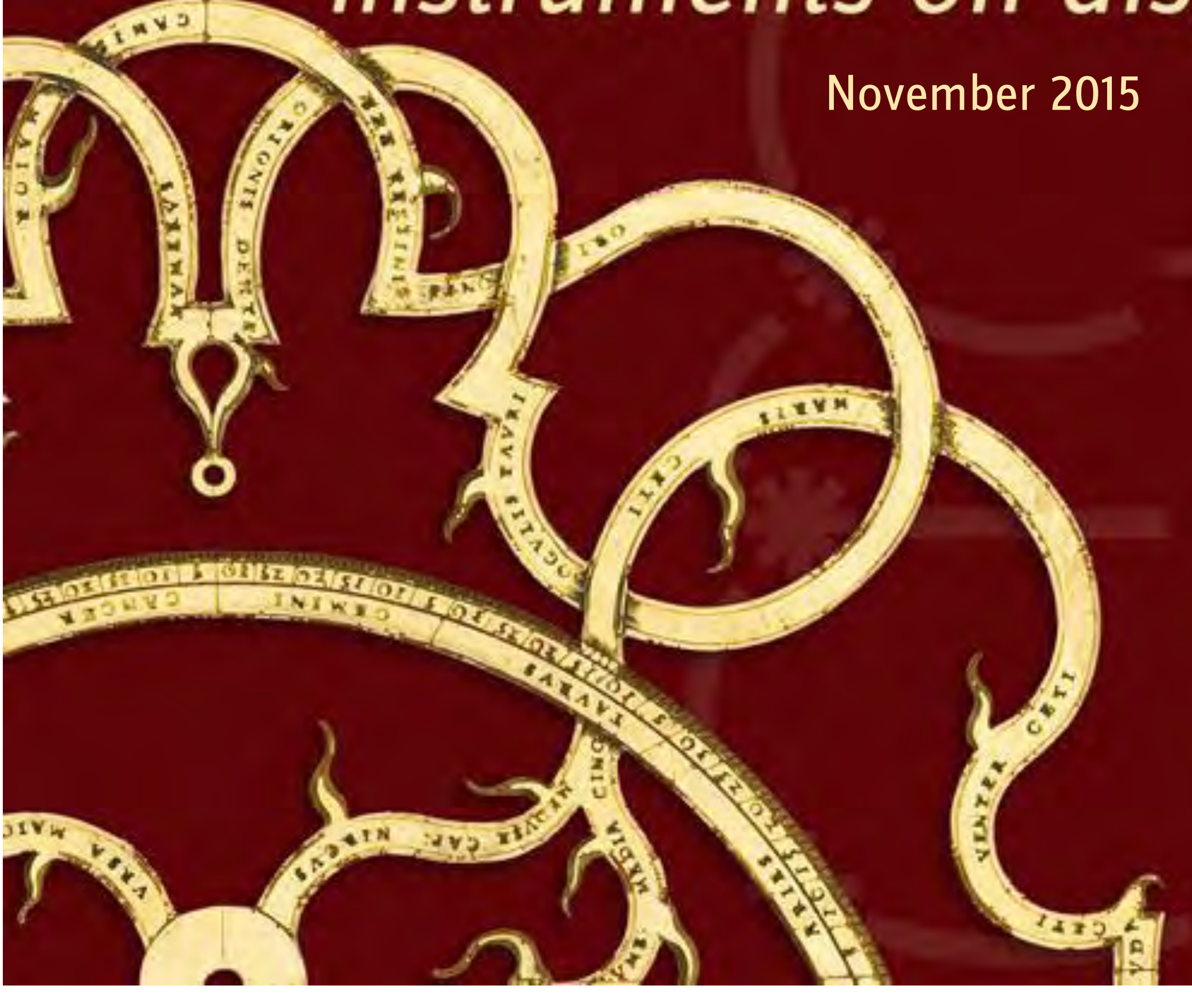
museo
galileo

Istituto e Museo
di Storia della Scienza

Catalogue of the Museo Galileo' s instruments on display

November 2015



Index of Rooms

ò-Room I

The Medici Collections

Filippo Camerota

Over the years the Medici Family, patrons of art and science, formed a superb collection of scientific instruments. Some elegant, refined pieces from this collection are displayed in this room. For nearly two centuries the instruments were kept in the Uffizi Gallery, alongside masterpieces of ancient and modern art. Begun by the founder of the Grand Duchy of Tuscany, Cosimo I de' Medici, the collection was further enriched by his sons and successors: Francesco I, interested mainly in natural-history collections and alchemy, and Ferdinando I, who bought numerous mathematical, nautical and cosmographical instruments. Cosimo II had the honour of adding Galileo's revolutionary instruments to the collection. Later, superbly original glass thermometers blown in the Palazzo Pitti glassworks were fabricated for the Accademia del Cimento, founded by Grand Duke Ferdinando II and Prince Leopoldo de' Medici. Memorable among the later Medici rulers is Cosimo III, patron of the mathematician Vincenzo Viviani, Galileo's last disciple.

Astrolabe

Setting:	Room I
Maker:	Egnazio Danti or Giovanni Battista Giusti [attr.]
Place:	Florence
Date:	16th cent.
Materials:	brass, wood
Dimensions:	diameter 840 mm, height 860 mm
Inventory:	3361

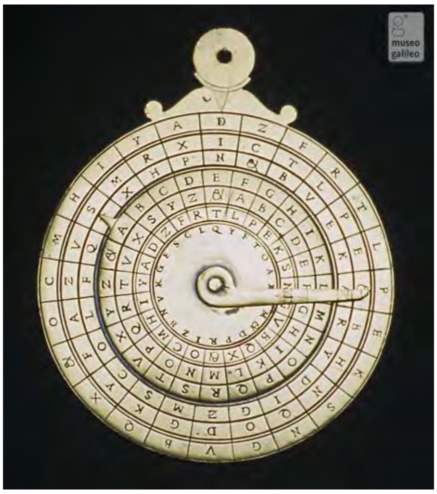
Astrolabe with a single tympanum for latitude 43°40' (Florence). It is placed on an octagonal table, whose inclination is adjustable. There are a rete and an alidade. The planisphere is surrounded by: the calendar with the names of the months; a shadow square engraved on an arc in an eccentric position; a zodiac circle; a Tychonic scale for dividing the degrees into twelve parts; a windrose; and a degree scale.
Originally attributed to Egnazio Danti, it is now regarded by G. L'E Turner—on account of the punch-marks and the engraving characteristics—to have been made in the Florentine workshop that produced the instruments signed by Giovanni Battista Giusti.
The instrument was preserved in the Uffizi Gallery, and Galileo himself used it for astronomical calculations. For this reason it is known as "Galileo's astrolabe."

Binocular telescope

Setting:	Room I
Maker:	Chérubin d'Orléans
Place:	French
Date:	ca. 1675
Materials:	wood, leather, grained leather
Dimensions:	length c. 1050 mm
Inventory:	2563

The instrument consists of four rectangular tubes containing two small telescopes: the eyepieces are at the larger end, the objectives at the smaller. All the tubes are made of wood and painted black on the inside. The largest tube is covered with black grained leather. The others are covered with green leather with gold tooling, and bear the Medici coat of arms in the center. On the edges is the image of a cherub, the maker's symbolic signature. The two inner tubes, in parchment, are now missing some parts. The compound eyepiece comprises three lenses. The magnification is 15. This binocular telescope was first described in the work by the Capuchin friar Chérubin d'Orléans, *La dioptrique oculaire* [Ocular dioptrics], (Paris, 1671). The presence of the Medici coat of arms indicates that Chérubin himself made the instrument for Cosimo III de' Medici, probably in the 1670s. Provenance: Medici collections.

Ciphering device



Setting:	Room I
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	diameter 100 mm
Inventory:	1312

Ciphering device comprising two superposed disks of different diameters. Each disk carries three concentric rings divided into twenty-four cells containing the letters of the alphabet. The larger, fixed disk carries a suspension ring; the smaller, revolving disk has a small index on its rim. At the center is hinged an index arm that can rotate on both disks. The instrument made it possible to develop coded languages through the coordinated substitution of the letters of the alphabet shown by the index arm and the index of the smaller disk. Provenance: Vincenzo Viviani bequest.

Clinometer

Setting:	Room I
Maker:	unknown
Place:	Italian
Date:	16th cent.
Materials:	gilt brass, iron
Dimensions:	length 760 mm, max. height 255 mm
Inventory:	148

Clinometer consisting of a long iron bar, fitted with sights at both ends, maintained in a horizontal position by a large weight placed on the lower half of the instrument. On the upper half are two opposing triangles. One side of each triangle carried finely engraved dolphins; the other two sides carried horizontal and vertical graduated slits for lodging holders for movable sights (now missing). The brass parts are finely worked.

Antonio Santucci, in his *Trattato di diversi strumenti matematici* [Treatise of various mathematical instruments] (a manuscript datable to 1593), illustrates the uses of the instrument, which included the measurement of heights and distances as well as leveling. Provenance: Medici collections.

Folding rule

Setting:	Room I
Maker:	Antonio Bianchini
Place:	Italian
Date:	1564
Materials:	gilt brass
Dimensions:	length 375 mm
Inventory:	2514

Folding rule consisting of two wide, flat legs engraved with: the degree scale, the shadow square, the windrose, a scale of equal parts, and a list of forty-two European cities with their respective latitudes. On the legs are four folding viewers. The leg joint holds a magnetic compass complete with glass cover and magnetic needle; the hours are inscribed on the rim. Around the compass mount is a motto recalling the brevity of life. The instrument is signed by its maker, Antonio Bianchini, and dedicated to Cosimo I de' Medici. It appears in the *Trattato di diversi istrumenti matematici* (a manuscript dated to 1593) by Antonio Santucci under the name of "Gran Regola di Tolomeo" [Great rule of Ptolemy]. The instrument was used to measure terrestrial and astronomical distances with the help of a ruler (now missing) hinged to one of the legs. The ruler served as the base of the many triangles formed by folding the instrument. The base represented a measure proportional to the distance to be calculated. Identical to item inv. 2511, apart from the material and the format of the maker's signature. Provenance: Medici collections.

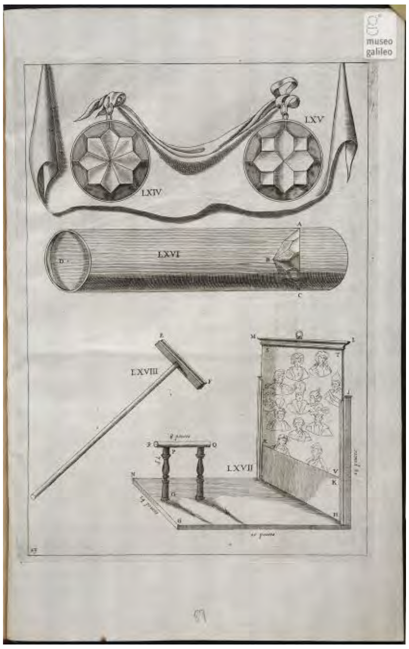
Instrument of the "Primum Mobile"

Setting:	Room I
Inventor:	Peter Apianus
Maker:	Egnazio Danti
Place:	Florence
Date:	1568
Materials:	brass
Dimensions:	height 279 mm

Inventory: 2643

The Instrument of the Primum Mobile is also called the quadrant of Petrus Apianus, because he invented it and described it in the treatise *Instrumentum primi mobilis* (Nuremberg, 1524). The instrument is used to find sines and cosines. It bears the initials "F.E.D.P.F." [Frater Egnatius Dantis Predicatorum Fecit]. Egnazio Danti dedicated it to Grand Duke Cosimo I de' Medici, as attested by the Medici coat of arms engraved on the front. The instrument was depicted on the ceiling of the Stanzino delle Matematiche in the Uffizi Gallery. Provenance: Medici collections.

La perspectiue curieuse…, Jean François Niceron (facsimile)



Setting: Room I
Author: Jean François Niceron
Place: Paris
Date: original 1638 / facsimile 2008
Dimensions: facsimile 35x24 cm
Inventory: Firenze, Museo Galileo, MED 2135

First book specifically dedicated to the perspective technique of "anamorphosis". A copy was donated by the author to Prince Leopoldo de' Medici in 1643. The plate on display illustrates the dioptric artifice allowing to see the hidden portrait of Ferdinando II.

Map of the Danube

Setting: Room I
Author: Carlo Gibertoni
Date: 1694
Materials: scagliola
Dimensions: 1465x793 mm
Inventory: 3715

The lower left corner of the scagliola table carries a dedication in French by the mapmaker, Carlo Gibertoni, to Grand Prince Ferdinand de' Medici, son of Cosimo III. The course of the Danube is shown against a white background. There is a fairly detailed description of the areas traversed by the river: towns, tributaries, physical features, etc. The Adriatic coast of Italy, the gulf of Venice, and a portion of the Dalmatian coast are outlined.

Optical toy

Setting: Room I
Inventor: Jean-François Niceron
Maker: Jean-François Niceron
Date: 1642
Materials: wood
Dimensions: 700x430x530 mm
Inventory: 3196

An optical toy designed and made by Jean-François Niceron. The apparatus consists of an oil painting on a wooden board, fixed vertically to a second horizontal board carrying a wooden support. The painting represents a series of turbaned heads with a flag display in their midst. The support originally carried a tube containing a polyhedral lens and a diaphragm (the tube was lost in the 1966 flood). If the painting was observed through the tube, the portrait of Ferdinand II de' Medici appeared. The portrait was actually composed of separate fragments assembled through the multiple refractions produced by the polyhedral lens. Thanks to the refractions of a prismatic lens, this toy generates an optical illusion similar to anamorphoses. On the horizontal table is a partially deleted inscription praising Ferdinand II.

Optical toy

Setting: Room I
Author: Ludovico Buti
Place: Italian
Date: 1593
Materials: wood, glass
Dimensions: 815x500x1120 mm
Inventory: 3197

The wooden frame carries a board holding wooden sticks of triangular section. If we view the board from the top toward the lower front, the row of visible sides of the painted sticks displays the portrait of Charles III, Duke of Lorraine; if, using the mirror placed in front, we observe the arrangement from the opposite side, we see the portrait of the Grand Duchess Christina of Lorraine, daughter of Charles III and wife of Ferdinand I de' Medici. A very similar apparatus was described by Egnazio Danti in his commentary on Jacopo Barozzi from Vignola's *Le due* *regole della prospettiva* [The two rules of perspective] (Rome, 1583) and, later, by Jean-François Niceron.

Polyhedral dial

Setting: Room I
Maker: Stefano Buonsignori
Place: Florence
Date: 1587
Materials: wood
Dimensions: height 195 mm
Inventory: 2456

Instrument in the shape of a regular dodecahedron, finely decorated with brilliant colors. Some characteristics resemble those of items inv. 2458 and inv. 2459. Each face of the polyhedron is engraved with a different type of sundial (scaphe - vertical - inclined) complete with gnomon. The hollow space on the top was a housing for a magnetic compass (now missing) to orient the instrument toward the local magnetic meridian. One face of the polyhedron also bears the Medici coat of arms. Made by Stefano Buonsignori, as can be deduced from the initials "D.S.F.F.," which stand for "Don Stephanus Florentinus [or Florentiae] Fecit."

Portrait of Ferdinand II de' Medici

Setting: Room I
Author: unknown
Date: 17th cent.
Materials: oil on canvas
Dimensions: 1540x2800 mm
Inventory: 3806

Portrait by an unknown artist of Grand Duke Ferdinand II, co-founder of the Accademia del Cimento with Prince Leopold de' Medici.
The Academy's members included: Lorenzo Magalotti - Vincenzo Viviani - Giovanni Alfonso Borelli - Carlo Renaldini - Francesco Redi - Alessandro Segni - Carlo Roberto Dati - the brothers Candido and Paolo del Buono - Alessandro Marsili - Antonio Oliva.
Some of the Academy's most famous correspondents were: Christiaan Huygens - Honoré Fabri - Robert Hooke - Gasparo Berti - Giovanni Domenico Cassini - Athanasius Kircher - Niels Steensen - Henry Oldenburg.

Quadrant

Setting: Room I
Maker: Giovanni Battista Giusti [attr.]
Place: Italian
Date: 1556
Materials: lignum vitae
Dimensions: radius 167 mm
Inventory: 2521

The quadrant has a degree scale, hour lines for Italian hours, a zodiacal calendar, and a shadow square on the front. The back is engraved with nine concentric circles forming a perpetual calendar. The instrument is set for latitude 43°45' (Florence). Dedicated to Cosimo I de' Medici, it is almost certainly the work of Giovanni Battista Giusti.

Quadrant

Setting: Room I
Maker: Carlo Renaldini
Place: Italian
Date: 1667
Materials: wood, brass
Dimensions: height 2660 mm
Inventory: 2544, 3187

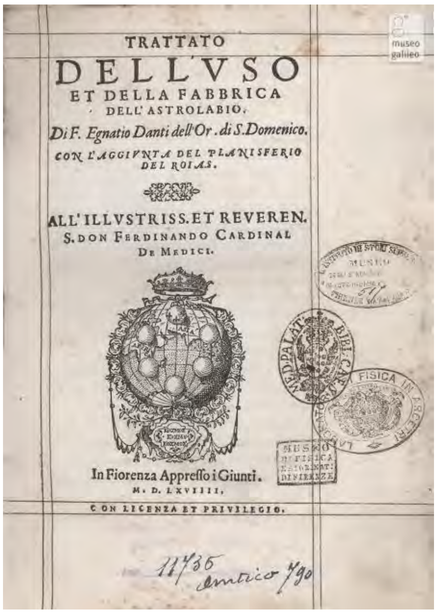
This quadrant was made by Carlo Renaldini, an active member of the Accademia del Cimento. The instrument was used for astronomical observations and measurements. Its wooden structure was built by Anton Francesco Tofani in 1667. The mathematical divisions were placed by Jacopo Mariani in 1684. The original index (rule) is now lost. There is a magnetic compass resting on a small head. The quadrant bears a dedication to Prince Leopold de' Medici.

Refraction dial

Setting:	Room I
Maker:	Simone Barocci [attr.]
Place:	Urbino
Date:	second half 16th cent.
Materials:	brass
Dimensions:	diameter 175, height 175 mm
Inventory:	241

Refraction dial already documented in the Medici inventories of 1574. Commissioned in Urbino by Guidobaldo del Monte from the workshop of Simone Barocci, a well-known maker of scientific instruments.
Consists of a cup whose inside is engraved with the hour lines and holds the gnomon. The upper rim carries a housing for a magnetic compass (missing), used to orient the dial. There is a lid.

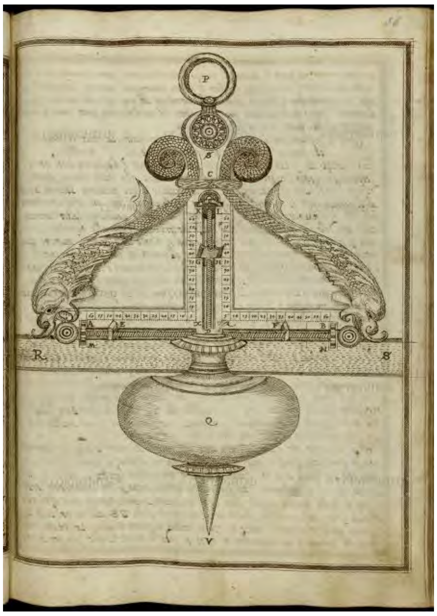
Trattato dell'uso et della fabbrica dell'astrolabio, Egnazio Danti (facsimile)



TRATTATO
DELL'VSO
ET DELLA FABBRICA
DELL'ASTROLABIO.
Di F. Egnatio Danti dell'Or. di S.Domenico.
CON L'AGGIVNTA DEL PLANISFERIO DEL ROIAS.
ALL' ILLVSTRISS.ET REVEREN.
S.DON FERDINANDO CARDINAL DE MEDICI.
In Fiorenza Appresso i Giunti.
M.D.LXVIIII.
CON LICENZA ET PRIVILEGIO.

Setting:	Room I
Author:	Egnazio Danti
Place:	Florence
Date:	originale 1569/ facsimile 2010
Dimensions:	facsimile 32,4x22,7 cm
Inventory:	Firenze, Museo Galileo, MED 1306

Dedicated to Cardinal Ferdinand de' Medici, the treatise contains the first complete description of the astrolabe printed in Italy. Danti describes the operations of the instrument and the method of its construction. For this purpose, he examines some of the most important models of his time, designed by Gemma Frisius, Juan de Rojas, and Oronce Finé.



Trattato di diuersi istrumenti matematici…, Antonio Santucci (facsimile)

Setting:	Room I
Author:	Antonio Santucci
Date:	original 1593-1594 / facsimile 2008
Dimensions:	facsimile: 32,5x22 cm
Inventory:	Firenze, Biblioteca Marucelliana, Ms. C 82, cc. 35v-36r

Anonymous, but most certainly a work by Antonio Santucci, the cosmographer or "Master of the sphere" of Ferdinando I, this treatise describes some of the most important astronomical and surveying instruments kept in the Grand Ducal Wardrobe. The folio on display illustrates the use of the clinometer.

Room II

Astronomy and Time

Giorgio Strano

This room contains a rich array of instruments designed to measure time: sundials, nocturnals and astrolabes that showed the hour by day or by night.
Without clarifying what time is, astronomy has always striven to define its units on the basis of celestial phenomena, and to develop precise timekeeping instruments.
Displayed here, along with commonly used scientific objects, are highly refined instruments fabricated in the artisans' shops that began to flourish in the 16th century. In the Germanic states, for instance, the members of the Schissler family were renowned, and many of their products entered the Medicean collections. Among the Italian instrument-makers, Giovanni Battista Giusti, Stefano Buonsignori and the Della Volpaia family were outstanding. Especially important in this room are the instruments from the legacy of Viviani, Galileo's last disciple. This collection includes objects of many kinds, revealing Viviani's specific interests in the field of the astronomy.

Aristotelian planetarium

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	ca. 1600
Materials:	painted wood
Dimensions:	980x1500x980 mm
Inventory:	2700

Large armillary sphere made of wood painted in bright colors, supported by a turned wooden stand. Of Ptolemaic design, with the Earth at the center, the sphere also displays the heaven of fixed stars. The horizon is octagonal. Provenance: Vincenzo Viviani bequest.

Armillary sphere

Setting:	Room II
Maker:	Carlo Plato
Place:	Rome
Date:	1578
Materials:	brass
Dimensions:	350x205x205 mm
Inventory:	1115

Armillary sphere showing the Ptolemaic system, mounted on a turned wooden base. On the horizon are engraved the place and year of construction, and the initials "Car. PL.," which suggest an attribution to Carlo Plato. The sphere was purchased in the second half of the nineteenth century by the director of the Museo di Fisica e Storia Naturale, Ferdinando Meucci.

Armillary sphere

Setting:	Room II
Maker:	Girolamo della Volpaia
Place:	Florence
Date:	1564
Materials:	brass, bronze, rock crystal
Dimensions:	490x775x490 mm
Inventory:	2711

This armillary sphere is signed by Girolamo della Volpaia. The rings surround a large rock crystal globe representing the Earth. The user would orient the instrument in the north-south direction by means of two magnetic compasses (now missing). The polar axis would be tilted to match the altitude of the celestial pole in the place of observation. Two sights could be oriented relative to two graduated scales, one a zodiac scale, the other a calendar scale. By rotating the central part of the instrument around the polar axis, one could make the shadow of the sight aimed at the Sun overlap the second sight exactly. The resulting configuration showed the precise arrangement of the main celestial circles. By reading the degree of the celestial equator that intersected the meridian, one could thus determine the hour of observation.
The entire sphere rests on a heavy brass pedestal painted in black, with feet in the shape of animal paws. The supports of the horizon circle are also shaped and pierced. Famous since its earliest days, the sphere has often been cited and illustrated, particularly in the characteristic nineteenth-century iconography celebrating past scientific glories. Provenance: Medici collections.

Astrological disk

Setting:	Room II
Maker:	unknown
Date:	17th cent.
Materials:	gilt copper
Dimensions:	diameter 210 mm
Inventory:	2505

This finely engraved astrological disk carries the names of twelve winds on its circumference. The symbols and names of the zodiac signs are also displayed. There is a suspension ring and a mobile alidade with a T-square attachment and two sights, one of which is damaged. Probable provenance: Medici collections.

Astronomical clock

Setting:	Room II
Maker:	Caspar Rauber [attr.]
Place:	German
Date:	ca. 1575
Materials:	gilt and silvered brass; case: glass, velvet
Dimensions:	214x323x151 mm; height 400 mm
Inventory:	3370

This table clock has a richly decorated pavilion-shaped case, with a fretworked dome surmounted by an armillary sphere. Each side of the clock carries dials with different functions, operated by gear mechanisms inside the case. Of the two larger dials, one is of the planispheric astrolabe type, with an external hour circle numbered from I to XII twice and a reversible tympanum for locating star positions and determining the planetary hours. It is preset for latitude 48° on one side and latitude 40° on the other. Above this dial, a pendulum was hooked on at a later date (17th C.). The other larger dial, also reversible, displays months, dates, major saints' days, the seasonally changing duration of light and darkness from dawn to sunset, and some hour computations. The armillary sphere, with the Earth placed at the center and a small magnetic compass in the base, is operated manually. The chime for the hours, quarter-hours, and minutes is under the dome. The alarm mechanism is missing. The iron movement has three trains driven by springs inside barrels with a fusee: one train is for timekeeping, one for the hours chime, and one for the minutes chime.
The back of the astrolabe dial is stamped twice with the initials CR joined inside a shield: the letters may stand for Caspar Rauber. The original leather case is lined on the inside and outside with red velvet. There are six openings protected by crystals. The globe-shaped top, also covered in leather, protects the armillary sphere. The case is divided into three parts: the base, with a drawer for the keys, and two façade covers.
Possibly the clock made in Florence for Maria Cristina of Lorraine, wife of Grand Duke Ferdinand I de' Medici. Remained in the possession of the Medici and was later exhibited in the Tribuna di Galileo. Restored to working order in 1878.

Astronomical compendium

Setting:	Room II
Maker:	unknown
Place:	German
Date:	late 16th cent.
Materials:	silvered and gilt brass
Dimensions:	closed: 86x86 mm
Inventory:	2478

Astronomical compendium consisting of a box with three compartments. In the first, there is an astrolabe and a lunar calendar. Between the first and second compartment is an hour circle. The second compartment houses a sundial and a magnetic compass for orientation. The third compartment contains the *Horae planetarum* table and an horary quadrant with a shadow square. The markings are in German. The finely engraved instrument is already recorded in the 1595 inventory of the belongings of Grand Duke Ferdinand I de' Medici.

Astronomical compendium

Setting:	Room II
Maker:	unknown
Place:	German
Date:	ca. 1600
Materials:	silvered and gilt brass
Dimensions:	closed: 63x49 mm
Inventory:	2481

This astronomical compendium, in the shape of a Missal, carries the coat of arms of the Company of Jesus ("IHS"). The outer face of the lid bears a lunar dial showing the phases of the moon; the inner face is engraved with the hour lines. Inside, there is a tilting gnomon mounted on a compass (now missing), that ensured the instrument's correct orientation and allowed its use as a dial. The back of the book displays the planetary hours.

Astronomical ring

Setting:	Room II
Maker:	unknown
Date:	mid-17th cent.
Materials:	brass
Dimensions:	diameter 86 mm
Inventory:	2452

This ring dial comprises four rings (armillae). One ring carries the symbols of the zodiacal constellations on the inner side; another is inscribed on both sides with a semi-circle divided into twelve parts. The rings can slide on cursors. There are hinges for closing the dial. Provenance: Medici collections.

Astronomical ring

Setting:	Room II
Maker:	unknown
Place:	German?
Date:	mid-17th cent.
Materials:	brass
Dimensions:	diameter 75 mm
Inventory:	2451

This ring dial comprises three rings (armillae). One ring carries the symbols of the zodiacal constellations on the inner side; another is inscribed on both sides with a semi-circle divided into twelve parts. There are hinges for closing the dial. Provenance: Medici collections.

Astronomical ring

Setting:	Room II
Maker:	Johannes Motter [attr.]
Place:	Flemish
Date:	ca. 1550
Materials:	brass
Dimensions:	diameter 127 mm
Inventory:	2453

This ring dial comprises three rings (armillae). One ring is engraved on the outside with the names of the stars, and on the inside with the zodiac belt subdivided from 1 to 20 for the hours. There are two sights. Another ring carries on both sides a semi-circle divided into 90 degrees. A throne can be positioned in different ways depending on the latitude. There are hinges for closing the dial. Some characteristics suggest the instrument may have been made by Johannes Motter. Provenance: Medici collections.

Box of mathematical instruments

Setting:	Room II
Maker:	Christoph Schissler
Place:	German
Date:	late 16th cent.
Materials:	instruments: gilt brass; box: black leather with gilt tooling
Dimensions:	390x340 mm
Inventory:	2532, 2541, 2542 (archipenzolo con busto di fanciullo), 2543, 3726

A typical example of a coordinated set of mathematical instruments. The box, made by Christoph Schissler, contains 25 brass parts for different uses, housed on two levels divided into compartments. Probably not all the instruments in the box today were part of the original set. On the first level there are a square, two magnetic compasses, three plumb levels, a Mordente compass (named after its inventor, Fabrizio Mordente), a graduated ruler, two smaller graduated rulers, a quadrant, a base for ellipse compasses, and several accessories. On the second level there are four graduated rulers, four magnetic compasses, two plumb levels, four small folding rods, and several accessories. A color drawing on paper shows the layout of the box. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Celestial globe

Setting:	Room II
Maker:	Mario Cartaro
Place:	Rome
Date:	1577
Materials:	wood
Dimensions:	sphere diameter 160 mm, height 390 mm
Inventory:	123

This celestial globe, made by Mario Cartaro, is one of the rare examples of printed globes produced in Italy in the sixteenth century. Manuscript globes, which could be made in much larger sizes, were more common. This globe is too small to be read easily. The wooden sphere is solid and the inscriptions are in Latin. A matching terrestrial globe is preserved at the Monte Mario Observatory in Rome. Provenance: Medici collections.

Celestial globe

Setting:	Room II
Maker:	Ibrâhim 'Ibn Saîd as Sahlì
Place:	Valencia
Date:	1085
Materials:	brass, wood
Dimensions:	sphere diameter 220 mm, height 435 mm
Inventory:	2712

Believed to be the oldest arab celestial globe in the world. Only the globe is original; the base with the horizon and the meridian are more recent. An Arabic inscription states that the globe was made in Valencia by Ibrâhim 'Ibn Saîd and his son Muhammad in year 478 of the Hegira (1085 of the Christian era). The instrument was acquired and studied in the second half of the nineteenth century by Ferdinando Meucci, director of the Museo di Fisica e Storia Naturale of Florence.

Cylinder dial

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	between 1574 and 1587
Materials:	gilt and painted wood
Dimensions:	height 337 mm
Inventory:	2457

Finely decorated cylinder dial. On the surface of the column are drawn the hour lines, at the top of which are the names of the months and of the zodiac signs. The movable top section has two gnomons of different length, to be used according to the time of the year of the observation. The gnomons can be folded into the instrument. There is a painted dedication to Francesco I de' Medici, suggesting a date of manufacture between 1574 and 1587, the years when the eldest son of Cosimo I assumed the title of Grand Duke of Tuscany.

Declinatory

Setting:	Room II
Maker:	Giovanni Battista Giusti [attr.]
Place:	Florence
Date:	second half 16th cent.
Materials:	brass
Dimensions:	170x170 mm
Inventory:	3822

Quadrant consisting of a square plate whose corners stand for the four cardinal points. The "south" corner holds a pivoting index that rotates on the degree scale and is fitted with a magnetic compass. To calculate the declination of a wall on which a vertical dial was to be installed, the instrument had to be placed horizontally with one side against the wall. The compass showed the index's direction relative to the magnetic meridian; with the degree scale, one could read the relative declination, east or west. If held vertical, with the index used as a plumb bob, the instrument could also be used to measure the slope of a plane on which an inclined dial was to be installed. The back of the quadrant is blank. The construction characteristics suggest an attribution to Giovanni Battista Giusti.

Declinatory

Setting: Room II
Maker: unknown
Place: Italian
Date: 1671
Materials: gilt brass
Dimensions: 228x229 mm
Inventory: 1300

The instrument is composed of two overlapping square plates. The top plate has a large round opening whose rim is engraved with a graduated scale. Inside the opening, pressed against the top plate, is a rotating disk with a central vertical gnomon, a line grid for Italian hours (24 equal hours from sundown), and markings for the cardinal points: T-ramontana [North], L-evante [East], O-stro [South], and P-onente [West].
The declination quadrant was used to find the orientation of a vertical surface such as a wall. The side of the instrument marked "Parte del declinatorio verso il muro" was placed against the wall. The central disk would then be turned until the gnomon's shadow showed the time at which the measurement was performed. The Tramontana-Ostro axis would thus be parallel to the north-south axis, and the angle between the wall and the meridian line could be read on the graduated scale.

Diptych dial

Setting: Room II
Maker: Hans Tucher
Place: German
Date: second half 16th cent.
Materials: ivory
Dimensions: 129x121 mm
Inventory: 2471

Square box in the form of a book, with a windrose on its lid and a moon dial on its back. Inside the lid are listed the places where the sundial can be used (from North Africa to Sweden). For each latitude indicated (42°, 45°, 48°, 51°, and 54°) there was a hole for inserting a string tied to the opposite end of the base. The string served as gnomon and its shadow, cast on the dial below, gave the hour on the corresponding circles. The dial carries the signature of the maker, Hans Tucher, and his snake-shaped trademark. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Diptych dial

Setting:	Room II
Maker:	unknown
Place:	German
Date:	late 17th cent. - early 18th cent.
Materials:	boxwood
Dimensions:	44x32 mm
Inventory:	2490

This dial, a miniature box decorated with floral motifs, is in the German style and was probably made in Nuremberg. A string stretched between the lid and the base serves as a Two gnomons cast their shadows on the hour lines. In the base is inserted a small compass for orienting the dial. The inside of the lid and the base are engraved with sundials. Provenance: Medici collections.

Diptych dial

Setting:	Room II
Maker:	unknown
Place:	French or Italian
Date:	late 16th cent. - early 17th cent.
Materials:	gilt brass
Dimensions:	35x26 mm
Inventory:	2464

Dial mounted in a small oval box with a hinged lid, which carries two embossed figures. In the base is inserted a compass for orienting the dial. Fitted with a suspension ring, the instrument could be worn as a pendent. Provenance: Medici collections.

Diptych dial

Setting:	Room II
Maker:	unknown
Place:	German
Date:	mid-17th cent.
Materials:	ivory
Dimensions:	52x35 mm
Inventory:	2469

A tiny rectangular box, probably made in Germany. A string connects the lid to the base, in which is inserted a compass for orienting the dial. The string's shadow, cast on the hour lines, shows the hours. Two sundials are marked on the inside of the lid and on the base. The compass is flanked by etchings of two faces. Provenance: Medici collections.

Diptych dial

Setting:	Room II
Maker:	unknown
Place:	French
Date:	1573
Materials:	ebony, ivory
Dimensions:	70x56 mm
Inventory:	2489

Dial consisting of an oval ebony box with a decorated and painted lid. Inside the lid are marked latitudes 43°, 45°, and 48°, with three corresponding holes. These latitude values suggest the instrument came from France. The base is fitted with a compass for orientating the dial and hour lines marked on three concentric bands. A string is stretched between the lid and the base. When the box is opened, the string, inserted in the hole corresponding to the selected latitude, casts its shadow on the hour lines. The instrument was already documented in the reign of Grand Duke Cosimo I de' Medici. Probable provenance: Medici collections.

Diptych dial

Setting:	Room II
Maker:	unknown
Place:	Nuremberg
Date:	1767
Materials:	boxwood
Dimensions:	97x67 mm
Inventory:	3173

Dial in the shape of a small box. A compass for orienting the instrument is fitted into the base (the magnetic needle is missing). The gnomon consists of a string that stretches into alignment with the celestial axis when the box lid is opened. The insides of the lids are inscribed with two horary quadrants, the date 1767, and the initials LM, from which the maker cannot be identified.

Dividers

Setting:	Room II
Maker:	Benvenuto della Volpaia
Place:	Florence
Date:	16th cent.
Materials:	steel, gold
Dimensions:	length 390 mm
Inventory:	2515

Dividers in the shape of a dagger made of blued steel with gold inlays. A very precious object, it was part of a set of instruments for military or cartographic use. Carries the inscription "Volentieri" [willingly] in gold, whose significance is unclear. When the dividers are open, they display the maker's initials, "B.V." (Benvenuto della Volpaia), also inlaid in gold. Provenance: Medici collections.

Equinoctial dial

Setting:	Room II
Maker:	Thomas Haye
Place:	Paris
Date:	ca. 1705
Materials:	brass; case: fishskin, velvet
Dimensions:	96x90 mm
Inventory:	2479

This octagonal equinoctial dial is universal, i.e., it functions at all latitudes. Complete with case lined in black velvet. Made by T. Haye, about whom we have no information.

Fragments of paper astrolabes

Setting:	Room II
Maker:	unknown
Place:	Florence?
Date:	17th cent.
Materials:	paper
Dimensions:	30x30 mm
Inventory:	1289bis

These rare fragments of a plane astrolabe and other astronomical instruments are an example of a product that enjoyed wide diffusion but was hard to preserve. Persons who could not afford to buy a high-quality metal instrument made one out of paper or cardboard, sometimes pasting together pages from old books. These fragments include: the back of an astrolabe mater made from the pages of a book on the battle of Lepanto; an astrolabe tympanum for latitude 43°; a Rojas planisphere; fragments of the rete of a cardboard astrolabe; an horary disk with index.

Geometrical square

Setting: Room II
Maker: unknown
Place: Italian?
Date: 16th cent.
Materials: brass
Dimensions: side 162 mm, height 220 mm
Inventory: 121

This geometrical square consists of a frame inscribed with the shadow square on two contiguous sides. At the corner opposite the one formed by the shadow square is a hinged shutter with sights. Inside the frame are a quarter-circle with the degree scale and a diagonal rod carrying a compass and magnetic needle at its center. A pillar attached to the back of the square allows the instrument to be installed on a wooden base and kept in a horizontal position during surveying work. This specimen resembles the model published by Georg von Peurbach in his treatise *Quadratum geometricum* (Nuremberg, 1516). Provenance: Medici collections.

Gimbaled compass

Setting: Room II
Maker: Christoph Schissler [attr.]
Place: German
Date: late 16th cent.
Materials: gilt brass, wood; case: black leather with gold stamps
Dimensions: diameter 90 mm, total height 180 mm
Inventory: 2535

Gimbaled compass attributed to Christoph Schissler. There is a hook for hanging the instrument from the saddle-bow and a gilt brass counterweight to hold it steady. Rests on a wooden stand and is fitted with a lid carrying an engraved and enameled color geographic map. Housed in a gold-stamped leather box. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Gunner's rule

Setting:	Room II
Maker:	Hans Christoph Schissler
Place:	Prague
Date:	1595
Materials:	brass
Dimensions:	length 180 mm
Inventory:	2517

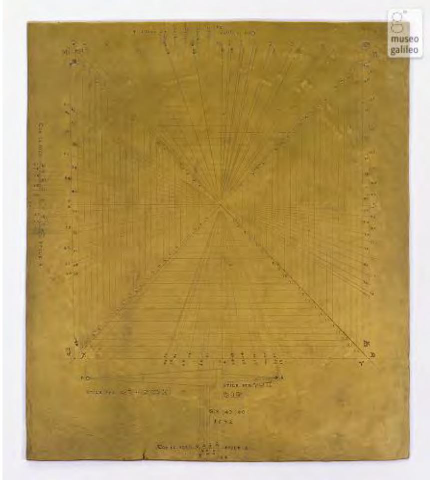
This rule, made by Hans Christoph Schissler, was used for military purposes (such as determining the calibers of stone and lead projectiles), land surveying, and time reckoning. Accordingly, there are a scale of weights for cannonballs, a linear measurement scale in Roman feet, a small magnetic compass in the leg joint, a viewer at the end of one leg, and a cross-arm with the scale of diurnal hours. A second cross-arm and plumb bob (missing) enabled the instrument to be used as a gunner's level for measuring inclinations and adjusting gun elevation. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Horary converter disk

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	second half 17th cent.
Materials:	brass
Dimensions:	diameter 117 mm
Inventory:	1287

This horary disk has a revolving index, but other parts are missing. Despite its rather crude manufacture, it could convert the various types of equal hours most commonly used in Europe: Italian hours, Babylonian hours, and astronomical hours. There are two opposing semi-circular appendices. The surface is engraved with three circles carrying the hour marks. Two sights are attached to the back. Provenance: Vincenzo Viviani bequest.

Horary disk for constructing sundials



Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	1672
Materials:	brass
Dimensions:	264x287 mm
Inventory:	1304

This horary disk is engraved on a rectangular plate bearing four zodiacal trigones as represented by Regiomontanus. The instrument is calibrated for latitude 43°45' (Florence). The markings are in Italian. Provenance: Vincenzo Viviani bequest.

Horary quadrant

Setting:	Room II
Maker:	Giovanni Battista Giusti
Place:	Florence
Date:	1565
Materials:	brass
Dimensions:	204x185 mm
Inventory:	2524

Quadrant signed by Giovanni Battista Giusti and set for latitude 43°40' (Florence). The front carries a degree scale, with markings for the tropics and the equator, hour lines for Italian hours, a shadow square and a "Tabula Solis motus" [Table of the motion of the Sun], indicating the Sun's entrance into the zodiac signs. On the back is engraved a windrose divided into eight 45° sectors with the names of the winds. In the center of the windrose was a magnetic compass (now missing). Provenance: Medici collections.

Horary quadrant

Setting:	Room II
Maker:	Joseph Pinam
Place:	Italian
Date:	17th cent.
Materials:	wood

Dimensions: 116x102 mm
Inventory: 1306

This small solar quadrant displays the hour lines, the months, the lines of the tropics and the equator, and the name of the firm Joseph Pinam painted on one side. The other side displays the windrose. Could be used to determine the hour from the altitude of the Sun. Provenance: Vincenzo Viviani bequest.

Horary quadrant

Setting: Room II
Maker: Christoph Schissler
Place: Augsburg
Date: 1599
Materials: gilt brass; case: black leather with gilt tooling; stand: oak, brass
Dimensions: side 350x371x371 mm
Inventory: 155, 156 (cavalletto)

This square-shaped instrument, made by Christoph Schissler, was used to measure time, distances, and heights. Calibrated for latitude 48°15' (corresponding to Augsburg). There are, in fact, two horary quadrants, one with curved lines for unequal hours, the other with straight lines. Two adjacent sides carry the shadow square with several graduations. The opposite corner holds a pivoting vane fitted with viewer. The quadrant is fixed to a wooden stand, whose parts telescope to allow the instrument to be placed in its gold-tooled black leather box. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Horary quadrant

Setting: Room II
Maker: Stefano Buonsignori
Place: Florence
Date: ca. 1580
Materials: ebony, brass
Dimensions: 131x118 mm
Inventory: 2499

The front of this finely decorated quadrant carries (1) a brass disk with markings for days, months, and zodiac signs, and (2) a moon dial. There is a magnetic compass for orientation. On the back of the instrument are a shadow square, a degree scale, and a sundial with unequal hour lines set for latitude 43°30' (Florence). Made by Stefano Buonsignori, as indicated by the initials "D.STEP. B.F.F." [Stefano Buonsignori Florentinus Fecit]. Provenance: Medici collections.

Horary quadrant

Setting:	Room II
Maker:	Girolamo della Volpaia
Place:	Florence
Date:	1570
Materials:	brass
Dimensions:	336x336 mm
Inventory:	239

The quadrant, fitted with sights, is set for latitude 43° (corresponding to the belt including Tuscany, Umbria, and the northern part of Lazio). The front carries a shadow square, hour lines and a "Tabula Solis motus" (Table of the motion of the Sun) indicating the Sun's entrance into the zodiac signs. The back carries a large tilting iron foot, used as a support. Signed by Girolamo della Volpaia. Provenance: Medici collections.

Horary quadrant

Setting:	Room II
Maker:	Giovanni Battista Giusti
Place:	Florence
Date:	1568
Materials:	brass
Dimensions:	radius 249x236 mm
Inventory:	2520

Quadrant signed by Giovanni Battista Giusti and set for latitude 43°40' (Florence). The front carries a degree scale, hour lines for Italian hours, a magic square, and the "Rota medii motus et quantitas diei" which indicates the zodiac signs, months, hours and the eight main winds. The back is engraved with a shadow square. Provenance: Medici collections.

Horary quadrant

Setting:	Room II
Maker:	Giovanni Battista Giusti
Place:	Florence
Date:	ca. 1575
Materials:	gilt brass; case; leather
Dimensions:	94x83 mm
Inventory:	2525

One side of this quadrant carries a degree scale, an horary quadrant set for latitude 42° (Rome) with hour lines for Italian hours, and a magic square at the apex.
On the other side are a windrose (inside of which is a magnetic compass complete with a magnetic needle) and a scaphe dial with cover. A relief mask is placed at the apex.
Stored in a red leather case with matching velvet lining.
The quadrant belonged to Gregory XIII and is signed by Giovanni Battista Giusti ("Ioannes Batis"). It is listed in the inventory of the "effects" of Grand Duke Ferdinand I de' Medici.

Horary quadrant

Setting:	Room II
Maker:	Camillo della Volpaia
Place:	Florence
Date:	mid-16th cent.
Materials:	brass
Dimensions:	190x185 mm
Inventory:	3628

This quadrant can be attributed to Camillo della Volpaia, both from the construction characteristics and from the initials engraved on the front, "CVFF," which stand for "Camillus Vulpaia Florentinus Fecit." The horary quadrant is set for latitude 43°30' (Florence). On the front are a degree scale, Italian hour lines, a disk showing the Sun's annual travel through the zodiac signs ("Tabula Solis motus"), and the Medici coat of arms. The back is engraved with a shadow square.

Horizontal cylinder dial

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	wood, iron, paper
Dimensions:	76x135x65 mm
Inventory:	2486

Cylinder dial to be read horizontally. The cylinder, divided into sections for the morning and afternoon, carries the hour lines and is fixed to a base on two supports that enable it to rotate and receive the gnomon's shadow in all seasons. Calibrated for latitude 45° (the Po plain). Provenance: Medici collections.

Horizontal dial

Setting:	Room II
Maker:	Nicolas Bion
Place:	Paris
Date:	ca. 1710
Materials:	brass; case: fishskin, velvet
Dimensions:	75x68 mm
Inventory:	2475

Octagonal horizontal dial with gnomon and magnetic compass for orientation. Complete with case lined in red velvet. The instrument is signed by Nicolas Bion.

Horizontal dial

Setting:	Room II
Maker:	unknown
Date:	17th cent.
Materials:	wood, brass
Dimensions:	side 140 mm
Inventory:	141

Dial consisting of a square inscribed with the horary disk formed by concentric colored circles. At the center is a compass for orienting the instrument correctly, complete with lid and magnetic needle. Provenance: Medici collections.

Horizontal dial

Setting:	Room II
Maker:	unknown
Place:	French or Italian
Date:	17th cent.
Materials:	ivory, brass
Dimensions:	diameter 40 mm, height 35 mm
Inventory:	134

Dial in the shape of a small spotted-ivory box, complete with a screw-on lid whose inside carries a disk showing the phases of the Moon and a converter for changing lunar hours into solar hours. At the bottom of the box is a compass for orienting the dial, with a windrose on colored paper. There is a glass and an hour circle fitted with a gnomon. The dial is calibrated for latitude 45°30'. Provenance: Medici collections.

Horizontal dial

Setting:	Room II
Maker:	unknown
Place:	German or Dutch
Date:	17th- early 18th cent.
Materials:	ivory
Dimensions:	diameter 73 mm, height 40 mm
Inventory:	2468

Dial housed in a round box with a screw-on lid carrying painted geographic hemispheres. The lower part of the box is fitted with a cross-bar and a sliding thread. Provenance: Medici collections.

Horizontal dial

Setting: Room II
Maker: unknown
Place: Italian
Date: ca. 1700
Materials: slate, wood
Dimensions: 323x325 mm
Inventory: 3191

Square sundial in a wooden frame. There is a capsule containing a compass for orientation, complete with glass and magnetic needle. The gnomon is missing. The scale for Italian hours is etched on the surface; the four cardinal points are marked in the corners. Lines are shown in white, Arabic numerals in red. Probable provenance: Medici collections.

Horizontal dial

Setting: Room II
Maker: Giovan Battista Magnelli
Place: Florence
Date: 1692
Materials: slate
Dimensions: diameter 292 mm
Inventory: 3189

Round sundial whose surface is marked with three dials: the first for astronomical hours, the second for Italian hours, the third for ancient or Jewish hours. The gnomon of the third dial is missing. Signed by Giovan Battista Magnelli, a maker on whom we have no information.

Horizontal dial

Setting: Room II
Maker: Giovan Battista Asini
Place: Italian
Date: 1722
Materials: slate
Dimensions: 286x286 mm
Inventory: 122

This nearly square sundial comprises four dials, one in each angle. At the center is engraved a large windrose. The markings are in Dutch, but the signature is in Latin (EQUES JO:BAP: ASINI FECIT 1522). The date 1522 should read 1722. We have no information about the maker, Giovan Battista Asini.

Horizontal dial

Setting: Room II
Maker: unknown
Place: Italian
Date: late 17th cent.
Materials: slate
Dimensions: 143x124 mm
Inventory: 1283

Elliptical sundial with gnomon. Displays a coat of arms similar to that of the Medici with a decoration above it. The quadrant carries the Italian hours. Below, there is a motto on the fleeting nature of life, "Fugit irrevocabile tempus" [Time flows irreversibly]. Provenance: Vincenzo Viviani bequest.

Horizontal dial

Setting: Room II
Maker: unknown
Place: Italian
Date: first half 17th cent.
Materials: boxwood
Dimensions: 295x130 mm
Inventory: 3702

Rectangular dial with compass (parts missing) for orienting the instrument, inserted in the center of a removable disk bearing the zodiac signs, and the windrose. The edges of the table are engraved with another dial complete with gnomon and a second windrose.

Horizontal dial (incomplete)

Setting: Room II
Maker: unknown
Place: Dutch?
Date: 18th cent.
Materials: ivory
Dimensions: diameter 43 mm, height 37 mm
Inventory: 2466

Dial in the shape of a box whose outer sides are decorated with ornamental motifs. The lid carries a female bust in relief. The dial has an horary disk with a gnomon, similar to item inv. 134. On the bottom is a compass for orienting the dial with the colored windrose, but the magnetic needle is missing. A second compass, smaller and also colored, is inserted in the base of the box.

Hourglass (sand)

Setting: Room II
Maker: unknown
Place: Italian?
Date: 17th cent.
Materials: ebony, boxwood, glass
Dimensions: height 110 mm
Inventory: 429

Powder hourglass housed in a circular iron frame with four small pillars. The glass capsules are joined at the center by paper disks. The time elapsed was measured by the quantity of powder falling from the upper compartment to the lower one.

Jacob's staff

Setting: Room II
Inventor: Jacob ben Machir Ibn Tibbon [attr.]
Maker: Christoph Schissler [attr.]
Place: German

Date: late 16th cent.
Materials: wood, gilt brass
Dimensions: length 915 mm
Inventory: 3167

This instrument is identical to item inv. 3167 and, like it, is attributed to Christoph Schissler. It is also called Jacob's staff, a reference to its presumed inventor, Jacob ben Machir. The original model consisted of a perpendicular vane sliding on a longer rod. In this version, the vane is fastened to the end of the rod. The latter has a hollow section containing a thinner rod that can be pulled out as an extension. The vane and rod, perpendicular to each other, respectively represent the base and height of a triangle whose sides are the observer's lines of sight. The instrument applies the properties of similar triangles to the measurement of terrestrial and celestial distances. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Jacob's staff

Setting: Room II
Inventor: Jacob ben Machir Ibn Tibbon [attr.]
Maker: Christoph Schissler [attr.]
Place: German
Date: late 16th cent.
Materials: wood, gilt brass
Dimensions: length 915 mm
Inventory: 3167

This instrument is identical to item inv. 3167 and, like it, is attributed to Christoph Schissler. It is also called Jacob's staff, a reference to its presumed inventor, Jacob ben Machir. The original model consisted of a perpendicular vane sliding on a longer rod. In this version, the vane is fastened to the end of the longer rod. The latter has a hollow section containing a thinner rod that can be pulled out as an extension. The vane and rod, perpendicular to each other, respectively represent the base and height of a triangle whose sides are the observer's lines of sight. The instrument applies the properties of similar triangles to the measurement of terrestrial and celestial distances. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Lunar converter

Setting: Room II
Maker: unknown
Place: Italian
Date: 17th cent.
Materials: wood, brass
Dimensions: 250x160 mm
Inventory: 3701

This nocturnal and sundial consists of a rectangular wooden table whose top side carries two concentric brass disks of different diameters, with indexes. The reverse carries a compass (now missing) for orienting the instrument and several dials, with Italian inscriptions. Provenance: Medici collections.

Mathematical compendium

Setting: Room II
Maker: Hans Christoph Schissler
Place: German
Date: late 16th cent.
Materials: gilt brass, silver; case: leather with gilt tooling
Dimensions: 198x200x90 mm
Inventory: 2467

A fairly complex, multi-purpose instrument. The front compartment contains an astrolabe and a geographic mirror engraved with the name of the maker, Hans Christoph Schissler. The back compartment has a magnetic compass that can be oriented horizontally, with a calendar on the outer side of the compass base. There are also a diopter with a graduated scale for measuring heights and a plumb bob for measuring slopes. All these items fitted into a gold-tooled leather box. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Model of the lunar orb

Setting: Room II
Maker: Girolamo della Volpaia
Place: Florence
Date: 1557
Materials: gilt brass
Dimensions: 145x145x246 mm
Inventory: 118

This model of the lunar sphere, made by Girolamo della Volpaia, shows the system of four partial spheres in which the Moon was set, according to Georg von Peurbach. Three partial spheres, designed to resemble three spheres of the Sun, move the small lunar epicycle on an eccentric path around the Earth. A fourth partial sphere lies in a more external position. Its axis is tilted slightly away from that of the first three. The fourth sphere introduces into the model the retrograde motion of the lunar nodes. These are the points of intersection between the monthly path of the Moon and the annual path of the Sun—points at which eclipses can occur. This model broadly reflects the lunar theory expounded in Ptolemy's *Almagest*.

Model of the solar orb

Setting: Room II
Maker: unknown
Date: ca. 1575
Materials: gilt brass
Dimensions: 190x190x490 mm
Inventory: 1290

This model of the solar orb shows the Sun lodged in a system of three partial orbs. The third—which lies between the external and internal ones—carries the Sun around the Earth on an eccentric path relative to the Earth. This is the physical equivalent of the geometrical-mathematical theory expounded by Ptolemy in the *Almagest*. The model is carried by a brass satyr on a turned wooden stand. Provenance: Vincenzo Viviani bequest.

Navicula de Venetiis

Setting:	Room II
Maker:	unknown
Place:	English
Date:	15th cent.
Materials:	brass
Dimensions:	180x92 mm
Inventory:	3163

This dial is known as a naviculum dial because is shaped like a small boat. Of this type of instrument, documented from the fourteenth century, only a small number of specimens have survived. The dial consists of two engraved brass plates joined together. The front displays the lines of the diurnal and average hours, and a zodiacal scale (lower center). The rod hinged at the center can describe an arc of about 45° and is partly covered by the two plates, while the lower protruding end can serve as an index. The rod has a cursor to which is attached a string with a small weight (now missing). The back carries the shadow square, the lines of unequal hours, and a 90° scale. The months shown by the index are displayed at the bottom. Provenance: Medici collections.

Nocturnal

Setting:	Room II
Maker:	unknown
Place:	French
Date:	1554
Materials:	gilt brass
Dimensions:	diameter 54 mm
Inventory:	2501

The instrument consists of two superposed disks of different diameters. Part of the circumference of the smaller disk is toothed and fitted with a short index. On the disks is mounted a long, finely decorated index. The front of the instrument served as a nocturnal for determining the time from the positions of the stars. The front also carries the zodiac signs, the initials of the names of the months, and the hour markings. On the back is the sundial, complete with a folding gnomon, for telling time during the day. The back also displays the date (1554).

Nocturnal

Setting:	Room II
Maker:	Simon Keill
Date:	1647
Materials:	brass
Dimensions:	diameter 99 mm
Inventory:	1294

This horary disk is used to determine the hour by day and also serves as a lunar-solar calendar. The recto comprises three superposed disks, of which two have an index. The verso carries the hour lines, the shadow square, and an alidade with sights. It also bears the name of the maker, Simon Keill—on whom we have no information—and the date 1647. The instrument is engraved with the zodiac signs. Provenance: Vincenzo Viviani bequest.

Nocturnal

Setting:	Room II
Maker:	Pineau [attr.]
Place:	French
Date:	ca. 1600
Materials:	gilt brass
Dimensions:	diameter 54 mm
Inventory:	2502

Dial consisting of a disk engraved on both sides. The recto bears markings for the zodiac signs, months, and days. On it rotates a circle divided into 29 parts and carrying two indexes; on this circle is a small rotating disk fitted with a gnomon, a compass, and an index with the French inscription "Ligne de foy" [line of trust]. On this side the instrument could be used either as a sundial or a nocturnal. The verso carries the hour lines and a small tilting gnomon. There is a suspension ring. The inscriptions in French and the word "Pign" engraved on the index suggest the instrument was made by a craftsman named Pineau, on whom we have no information. Probable provenance: Medici collections.

Nocturnal

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	mid-17th cent.
Materials:	brass, bronze
Dimensions:	186x88 mm
Inventory:	2493

Nocturnal comprising two superposed brass disks of different diameter. The larger carries the markings of the months, the other the markings of the hours. Around the central opening is mounted the index. The instrument rests vertically on a molded bronze handle. Provenance: Medici collections.

Nocturnal

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	late 16th cent. - early 17th cent.
Materials:	brass
Dimensions:	201x112 mm
Inventory:	2494

This nocturnal comprises two superposed disks. The lower one indicates the days, months, and zodiac signs; the molded upper disk carries division marks from 1 to 16. Around the central opening is the revolving index. The instrument is fitted with a flat engraved handle. Provenance: Medici collections.

Nocturnal

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	first half 17th cent.
Materials:	brass
Dimensions:	106x57 mm
Inventory:	1313

Nocturnal comprising two superposed disks. The first is a fixed disk, attached to the molded handle and bearing the initials of the months. The second is a rotating disk, superposed on the first. It is divided into 24 hours and carries an oval opening for reading the months on the disk underneath. An index, hinged to the center, rotates freely around both disks. Provenance: Vincenzo Viviani bequest.

Nocturnal

Setting:	Room II
Maker:	unknown
Place:	French
Date:	1560
Materials:	gilt brass
Dimensions:	212x129
Inventory:	2504

Combination nocturnal and sundial. Several parts are missing. Comprises a disk with a hole at the center and fitted with a finely tooled handle. On both sides are 27 matching holes. A T-shaped brass strip is placed across the opening. The circumference carries protruding triangular tips. Engraved with the date (1560) and the word "Paschas," which is hard to interpret. Provenance: Medici collections.

Nocturnal and sundial

Setting:	Room II
Maker:	Lorenzo della Volpaia
Place:	Florence
Date:	1511
Materials:	brass
Dimensions:	diameter 77 mm
Inventory:	1305

The work of Lorenzo della Volpaia, this small nocturnal consists of overlapping disks showing the days and months of the year. It is fitted with indexes and set for latitude 43° (approximately that of Tuscany). The verso is engraved with a horary quadrant carrying the "Tabula Solis motus" [Table of the motion of the Sun], indicating the Sun's entrance into the zodiac signs. Provenance: Vincenzo Viviani bequest.

Nocturnal and sundial

Setting:	Room II
Maker:	Girolamo della Volpaia
Place:	Florence
Date:	1567
Materials:	brass
Dimensions:	diameter 97 mm
Inventory:	3811

This nocturnal consists of three overlapping disks of different diameters: the largest shows the zodiacal calendar; the middle one carries the hours and the rotating index; the smallest—a toothed disk—has a long index arm and the inscription "Horologium nocturnum." On the back are the signature of Girolamo della Volpaia and the date (1567), the solar quadrant, and the disk for determining the Sun's position in the zodiac signs. The instrument is set for latitude 43°44' (Florence). Similar to items inv. 2503 and inv. 1286.

Nocturnal and sundial

Setting:	Room II
Maker:	Girolamo della Volpaia [attr.]
Place:	Florence
Date:	16th cent.
Materials:	brass
Dimensions:	diameter 133 mm
Inventory:	1286

This nocturnal consists of three overlapping disks of different diameters: the largest shows the zodiacal calendar; the middle one carries the hours and the index; the smallest—a toothed disk—has a long index arm and the inscription "Horologium nocturnum." On the back are engraved a sundial and a shadow square. The instrument closely resembles items inv. 2503 and inv. 3811, and was probably made by Girolamo della Volpaia. Provenance: Vincenzo Viviani bequest.

Nocturnal and sundial

Setting:	Room II
Maker:	Girolamo della Volpaia
Place:	Florence
Date:	1568
Materials:	brass
Dimensions:	diameter 147 mm
Inventory:	2503

This nocturnal consists of three overlapping disks of different diameters: the largest shows the zodiacal calendar; the middle one carries the hours and the index; the smallest—a toothed disk—has a long index arm and the inscription "Horologium nocturnum." On the back are engraved two altitude quadrants, hour lines for the sundial, a shadow square and, in the center a "Tabula Solis motus" (Table of the motion of the Sun) indicating the Sun's entrance into the zodiac signs. Signed by Girolamo della Volpaia and set for latitude 43°30' (Florence). Similar to items inv. 1286 and 3811. Provenance: Medici collections.

Nocturnal and sundial

Setting:	Room II
Maker:	Eufrosino della Volpaia
Place:	Florence
Date:	1520
Materials:	brass
Dimensions:	104x187 mm
Inventory:	3264

The instrument consists of two disks connected by an arm. On one side of the larger disk is engraved a nocturnal (incomplete); on the other side is a quadrant, set for latitude 43°44' (Florence), with hour lines for Italian hours and a shadow square. The surface of the smaller disk is engraved with many astronomical scales. Made by Eufrosino della Volpaia. Provenance: Vincenzo Viviani bequest.

"Noon cannon"

Setting:	Room II
Maker:	Rousseau
Place:	French
Date:	early 19th cent.
Materials:	marble, brass, glass
Dimensions:	diameter 302 mm
Inventory:	3575

This dial, made by Rousseau, consists of a round marble slab engraved with a sundial and carrying a brass gnomon. A small brass cannon holding a tilting lens is attached to the slab. At noon, the Sun's rays, focused by the lens, ignite the gunpowder and thus cause the cannon to fire. For this reason the instrument is called a *noon cannon.*

Octant

Setting:	Room II
Maker:	unknown
Place:	Italian?
Date:	16th cent.
Materials:	brass
Dimensions:	radius 180 mm, height 170 mm
Inventory:	120

Octant consisting of a circular brass 45° sector fixed to a wooden base. The sector plate is inscribed with the sine scale. The rim displays the degree scale with cross-divisions (Tychonic scale). The alidade is complete with sights. There are two other sights on the rims of the plate at the ends of the sine scale. This type of instrument is depicted on the frame of Galileo's objective lens. Provenance: Medici collections.

Oil clock

Setting:	Room II
Maker:	unknown
Date:	18th cent.
Materials:	pewter, glass
Dimensions:	height 325 mm
Inventory:	3570

Designed for night use, this oil clock consists of a glass phial inserted in a pewter lamp. Time was measured by the amount of oil left in the phial. The instrument is incomplete—the graduated hour scale is missing—and thus inoperative.

Perpetual calendar

Setting:	Room II
Maker:	Christian Boyling
Place:	Dresden
Date:	second half 17th cent.
Materials:	gilt brass
Dimensions:	366x576 mm
Inventory:	Dep. MA, Firenze

This instrument, made by Christian Boyling, consists of two superposed brass plates. The top plate is finely perforated and adorned with the coat of arms of the House of Saxony. We can glimpse a red silk backing. At the center of the plate is a circle divided into twenty-four hours containing three horary disks: a nocturnal based on the phases of the Moon, a perpetual calendar, and a zodiacal calendar showing the length of day and night throughout the year. Between the two plates is a rotating disk carrying twelve smaller enameled disks depicting the months (one missing). These appear one at a time through the small circular window below the three horary disks.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	1568
Materials:	brass
Dimensions:	diameter 250 mm
Inventory:	1285

This astrolabe has three tympanums, two of which are made for latitudes 41° and 43° (Naples, Pisa) and 45° and 48° (Piacenza, Bavaria, and Vienna) respectively. The third tympanum carries: (1) on the front, a geographic planisphere, with equator, the tropics, and the names of the continents; (2) on the back, a degree scale, a zodiacal circle, a calendar, a diagram for converting equal hours into unequal hours, and a shadow square. A small magnetic compass is lodged in the throne, on which the year of construction is indicated. The back has a celestial planisphere with the orthographic projection of Juan de Rojas. The rule with an orthographic projection of the meridians lacks a cursor. Provenance: Vincenzo Viviani bequest.

Plane astrolabe

Setting:	Room II
Maker:	Christoph Schissler
Place:	Augsburg
Date:	1560
Materials:	gilt brass
Dimensions:	diameter 215 mm
Inventory:	1114

This elaborate astrolabe was made by the German craftsman Christoph Schissler. His signature, with the place and date of manufacture, is engraved on the back. Carries a single tympanum for latitudes 45° and 48° (corresponding to the Po Plain and Bavaria). There is a rule. The back displays the alidade, shadow square, degree scale, and hour lines. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Plane astrolabe

Setting:	Room II
Maker:	Muhammad 'Ibn Abi'l Qasim 'Ibn Bakran
Place:	Arab
Date:	1102-1103
Materials:	brass
Dimensions:	diameter 122 mm
Inventory:	1105

This small astrolabe carries four tympanums for latitudes 24°/30°, 31°/35°, and 32°/36° (corresponding to Persia), and for latitude 0° (i.e., the circle of the equator) and 66°. There is an alidade and a rete. The back of the mater displays a lunar calendar, in accordance with Islamic use, a shadow square, and a quadrant. The instrument is dated 496 of the Hegira (1102-1103 of the Christian era) and is signed by its maker, Muhammad 'Ibn Abi'l Qasim 'Ibn Bakran, on whom we have no information. Donated to the Museo di Storia della Scienza by the Florentine Prince Tommaso Corsini.

Plane astrolabe

Setting:	Room II
Maker:	Hans Dorn [attr.]
Place:	German
Date:	1483
Materials:	gilt brass
Dimensions:	diameter 460 mm, height 490 mm
Inventory:	1096

Unlike on most astrolabes, the mater of this instrument, attributed to Hans Dorn, does not have a raised limb; in other words, it lacks housings for interchangeable tympanums on the front. The planispheric plate is fixed, and built for latitude 48° (Munich). On the plate rotate the rete and the rule, engraved with the northern and southern latitudes and the date 1483. On the back are the alidade with folding sights, the zodiacal calendar, the degree scale, and a housing for a small tympanum inscribed on both sides with the divisions of the days and months, a zodiacal division, and a zodiacal planisphere. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	German?
Date:	16th cent.
Materials:	gilt copper
Dimensions:	diameter 88 mm
Inventory:	1106

This small astrolabe comprises three tympanums for latitudes 40°/45°, 42°/36°, and 50° (corresponding to Spain, Italy, and France). There is a rete (extensively damaged) and an alidade. The limb of the mater is graduated and divided into 24 parts. The back is inscribed with the zodiacal calendar and the shadow square for surveying. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	French?
Date:	13th cent.
Materials:	gilt copper, silver
Dimensions:	diameter 98 mm
Inventory:	1107

This small astrolabe comprises three tympanums: two are for latitudes 41°/42°, and 43°/44° (corresponding to the regions between Castille and Provence); the third is ungraduated. There is a rete and an alidade. The rete bears twenty-two silver studs representing the fixed stars. The limb of the mater is divided into 360°. On the connection point coinciding with 115° is a crack that extends along the back. The numbers and words are in Gothic characters. Although undated, the instrument's characteristics suggest it dates from the thirteenth century. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	Arab
Date:	14th cent. (?)
Materials:	gilt brass
Dimensions:	diameter 170 mm
Inventory:	1109

This astrolabe comprises five tympanums, of which four are for latitudes 0°/18°, 21°/24°, 30°/32°, and 34° (corresponding to the regions between Ethiopia and Syria). The inside of the mater carries the meridians and parallels. There is a rete: the zodiacal circle bears the names of the constellations in Latin. The back is inscribed with the names of the zodiac constellations in Latin and a shadow square. Dates from at least the fourteenth century, but may be older. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	Arab
Date:	10th cent.
Materials:	gilt brass; case: parchment, leather
Dimensions:	diameter 165 mm
Inventory:	1113

This astrolabe presently comprises two tympanums, for latitudes 30° and 33°, the other for latitudes 36° and 42° (corresponding to the regions between Persia and the Black Sea). There is an alidade, a rule, and a rete. The back carries a double shadow square and the zodiacal calendar.
The instrument comes with a tooled black leather case (cover missing) containing a sixteenth-century manuscript note stating that the astrolabe was brought from Spain and dates from 1252. The astronomical data inscribed on the astrolabe suggest it may have been built before 1000. According to tradition, the instrument dates from the period of Charlemagne (9th C.). A very similar Arab astrolabe is documented in a drawing by Antonio da Sangallo il Giovane [the

Younger] (c. 1520?) at the Gabinetto dei Disegni e delle Stampe (Department of Drawings and Prints) of the Uffizi. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	German
Date:	16th cent.
Materials:	copper
Dimensions:	diameter 385 mm
Inventory:	1282

German astrolabe with rete and rule, but lacking tympanums. The back displays a shadow square and alidade. Calibrated for latitude 48°2' (corresponding to Munich). Provenance: Vincenzo Viviani bequest.

Plane astrolabe

Setting:	Room II
Maker:	unknown
Place:	Tuscany?
Date:	17th cent.
Materials:	gilt brass
Dimensions:	diameter 405 mm
Inventory:	660, 1092

This astrolabe has only one tympanum. There is a rete and a degree scale on the limb. The tympanum is engraved on both sides with two different planispheric projections: a polar stereographic projection for latitude 43° (Pisa) on the front; and an equatorial stereographic projection on the back. The rete carries a rotating index. On the back of the astrolabe are a degree scale with a Tychonic scale, a zodiacal band, a calendar with the months in Latin and Greek, a sundial, a shadow square, and an alidade with sights. Provenance: Medici collections.

Plane astrolabe

Setting:	Room II
Maker:	Vincenzo Viviani [attr.]
Place:	Italian
Date:	1645
Materials:	copper, wood, cardboard
Dimensions:	diameter 228 mm
Inventory:	1289

This astrolabe, from the Vincenzo Viviani bequest, seems to have been made for teaching purposes, perhaps by the scientist himself. The wooden, copper-edged mater carries: a tympanum with the celestial vault; a tympanum with the main stars; a copper tympanum for latitudes 38° and 43° (from Sicily to Pisa); a cardboard tympanum for latitude 43° (Pisa); a rete; and a cardboard disk with a shadow square. The limb, rete, and index are made of copper, as is the back, which features an alidade, a disk with shadow square, a windrose, and a table for ecclesiastical dates.

Plane astrolabe (open)

Setting:	Room II
Maker:	Georg Hartmann
Place:	Nuremberg
Date:	1545
Materials:	gilt copper
Dimensions:	diameter 145 mm
Inventory:	1111

Astrolabe made by Georg Hartmann. Composed of three tympanums for latitudes 39° and 42°, 45° and 48°, 51° and 54° (corresponding to the regions between North Africa and all of Germany). The back carries the alidade, shadow square, and unequal-hour lines.

Polyhedral dial

Setting:	Room II
Maker:	Girolamo della Volpaia
Place:	Florence
Date:	1590
Materials:	boxwood
Dimensions:	height 109 mm
Inventory:	2460

Instrument in the shape of a pentagonal prism on which are marked a horizontal dial and four vertical dials, with gnomons. The base also holds a magnetic compass for orientation. All the sundials are set for latitude 43°30' (Florence). Resembles item inv. 3193. Signed by Girolamo della Volpaia. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	Girolamo della Volpaia [attr.]
Place:	Florence
Date:	late 16th cent.
Materials:	boxwood
Dimensions:	height 124 mm
Inventory:	3193

Sundial in the shape of a pentagonal prism (like the similar item inv. 2460). Comprises a scaphe dial on the upper face and two vertical dials. It is fitted with gnomons and set for latitude 42° (Rome). The base holds a magnetic compass for orientation. Its construction characteristics suggest an attribution to Girolamo della Volpaia. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	Stefano Buonsignori [attr.]
Place:	Florence
Date:	late 16th cent.
Materials:	wood
Dimensions:	height 176 mm
Inventory:	2459

Polyhedral sundial with hexagonal and square faces, similar to items inv. 2456 and inv. 2458. Each face is painted with a different type of sundial (horizontal - vertical - inclined) complete with gnomon. The top holds a magnetic compass—complete with a glass cover but missing the magnetic needle—to orient the instrument toward the local magnetic meridian. Made by Stefano Buonsignori. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	unknown
Date:	17th cent.
Materials:	painted stone
Dimensions:	height 294 mm, base 142x201 mm
Inventory:	2495

Various types of dials are etched on a complex stone polyhedron. Some traces of gilding remain. Only one gnomon survives. The instrument does not seem of Italian origin. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	unknown
Place:	German
Date:	late 16th cent.
Materials:	gilt and silvered brass
Dimensions:	base 76x50x47 mm
Inventory:	2477

Instrument in the shape of a trapezoidal solid whose faces carry different types of dials (vertical - horizontal - polar). This finely engraved and decorated instrument is still fitted with tilting gnomons. The upper part has a small compass for orienting the dials. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	David Beringer, G.P. Seyfried
Place:	Nuremberg
Date:	between 1777 and 1821
Materials:	wood, brass, painted paper
Dimensions:	height 170 mm, base 90x78 mm
Inventory:	126

Cube-shaped sundial with a magnetic compass for orientation. Each side displays a sundial with gnomon. The cube rests on a folding leg attached to the rectangular base. Signed by David Beringer and G.P. Seyfried. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	mid-17th cent.
Materials:	wood
Dimensions:	height 164 mm
Inventory:	3261

Sundial in the shape of a truncated tetrahedron generating seven finely decorated faces. Each carries a sundial (horizontal or inclined) complete with a gnomon. There is a magnetic compass to orient the instrument toward the local magnetic meridian. The base is damaged. Provenance: Medici collections.

Polyhedral dial

Setting:	Room II
Maker:	Stefano Buonsignori
Place:	Florence
Date:	late 16th cent.
Materials:	wood
Dimensions:	height 203 mm
Inventory:	2458

Polyhedral sundial with hexagonal and square faces, similar to items inv. 2456 and inv. 2459. Each face is painted with a different type of sundial (horizontal -vertical - inclined) complete with gnomon. The top holds a magnetic compass to orient the instrument toward the local magnetic meridian. Made by Stefano Buonsignori. Provenance: Medici collections.

Portable quadrant

Setting: Room II
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: radius 183 mm
Inventory: 2513

This quadrant, which closely resembles item also corresponding to inv. 2513, consists of a thin plate on which are roughly inscribed a few lines radiating from the vertex to the arc. The rim carries several scales. The instrument was used to plot and design dials. Provenance: Medici collections.

Portable quadrant

Setting: Room II
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: radius 129 mm
Inventory: 2513

This quadrant, which closely resembles item also corresponding to inv. 2513, consists of a thin plate on which are roughly inscribed a few lines radiating from the vertex to the arc. The rim carries several scales. The instrument was used to plot and design dials. Provenance: Medici collections.

Quadrans vetus

Setting: Room II
Maker: unknown
Place: German?
Date: late 14th cent. - early 15th cent.
Materials: brass
Dimensions: 102x102 mm
Inventory: 662

Known as the *quadrans vetus* [old quadrant], this is one of the three surviving medieval quadrants of its kind (the second is in the Museum of the History of Science in Oxford, the other at the British Museum in London). There are two sights on one of the straight sides. The front carries the shadow square, the hour lines, and a mobile zodiacal cursor in its guide, to be positioned for the desired latitude. The back is inscribed with the zodiacal calendar. The instrument displays Gothic characters. Designed to measure heights, distances, and depths, the instrument could also be used as a universal dial. A very similar quadrant is documented in a drawing by Antonio da Sangallo il Giovane [the Younger] (c. 1520?) at the Gabinetto dei Disegni e delle Stampe (Department of Drawings and Prints) of the Uffizi. Provenance: Medici collections.

Quadrant

Setting:	Room II
Maker:	unknown
Place:	Naples
Date:	1553
Materials:	brass
Dimensions:	side 172 mm
Inventory:	2522

This elegant quadrant features an unusual scalloped rim. On the front, the letters "A.D." are engraved at the center of the band. The rim carries three graduated scales: the degree scale, identified by the letter G, and other two scales divided into 48 equal parts and 48 decreasing parts respectively, identified by the letters A and L. The middle of the plate is engraved with a zodiacal calendar, a small index pivoting at its center. The back displays the declinations of many stars, some hour markings, and a motto on the brevity of life signed "T.R." Provenance: Medici collections.

Quadrant

Setting:	Room II
Maker:	Jean Giamin
Place:	Rome
Date:	late 16th cent.
Materials:	iron
Dimensions:	283x279 mm
Inventory:	2523

Iron quadrant with lines, numbers, and digits inlaid in gold and silver. The front carries a curved cursor with the zodiacal band and the signature of the maker, Johannes Giamin (OPUS. IOANIS.

GIAMIN. GALLI. BURDEGALLENSIS. ROMAE). On the back is the index arm and an astrolabe quadrant modeled on Oronce Finé's design. Provenance: Medici collections.

Quadrant

Setting:	Room II
Maker:	Tobias Volckmer
Place:	Braunschweig
Date:	1608
Materials:	gilt brass
Dimensions:	side 357x357 mm
Inventory:	1495, 2465

"Universal" quadrant, i.e., suitable for performing mathematical, astronomical, astrological, and military operations. Made by Tobias Volckmer. Consists of a square engraved on both sides. Not only is the ornamentation refined, but the lines are etched with high precision, yielding reliable results within a modest margin of error. The main feature of the front side is the sine grid or reduction quadrant for determining sines and cosines. The graduated arc displays a nonius for dividing each degree into five minutes. On the upper corner are hinged two graduated vanes in the manner of compasses. One is fitted with sights. In the opposite corner is a removable magnetic compass showing the difference between the geographic north and the magnetic north. The back of the compass carries an astrolabe tympanum. The compass lid bears a sundial on one side and a moon dial on the other. The windrose is engraved on the instrument plate under the compass. The back of the instrument carries two Stöffler quadrants (named after their inventor, Johann Stöffler), a band of markings for military use, another for astronomical use, the degree scale, a plumb bob, and a disk with an index, called *Signore dell'hore ineguali* [Lord of the unequal hours], constituting the astrological calendar. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Quadrant

Setting:	Room II
Maker:	Bernardo Facini
Place:	Venice
Date:	1701
Materials:	brass
Dimensions:	368x374 mm
Inventory:	3812

Mariner's quadrant signed by Bernardo Facini. The front carries a large circle with a sine quadrant or reduction quadrant. The circle is centered on two perpendicular axes indicating the four cardinal points. An arc concentric with the sine quadrant displays a crescent-shaped degree scale. On the back is a Tychonic scale for dividing degrees into 60 minutes. The mobile accessories are missing.

Quadrant with Easter scale

Setting:	Room II
Maker:	Josua Habermel [attr.]
Place:	German
Date:	ca. 1600
Materials:	gilt copper; box: wood, leather
Dimensions:	radius 145 mm
Inventory:	2518

Small quadrant with case, attributed to the maker Josua Habermel. The limb carries a double graduation for measuring heights and distances. The front is engraved with two open compasses. The sights are fixed, while the index arm is mobile, with a steel spring serving as guide. On the back is a table for computing Easter and the inscription *iuxta Kalendarii reformationem* [after the calendar reform]. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Scaphe dial

Setting:	Room II
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	345x108x108 mm
Inventory:	2533

Scaphe dial consisting of a squat base holding a cup in which the hour lines are inscribed. The cup has three parallel slits representing the main parallel circles of the celestial sphere (the equator and the tropics of Cancer and Capricorn). There is a gnomon and a long arm for suspending the instrument. Provenance: Medici collections.

Scaphe multiple dial

Setting:	Room II
Maker:	Stefano Buonsignori
Place:	Florence
Date:	1584
Materials:	wood
Dimensions:	diameter 130 mm
Inventory:	2485

This fully painted and gilt instrument was made by Stefano Buonsignori. It consists of a disk carrying four cup-shaped hollows, with a scaphe dial carved in each. In the center is a small magnetic compass for orientation. Provenance: Medici collections.

Sundial

Setting:	Room II
Maker:	Carlo Plato [attr.]
Place:	Rome
Date:	1578
Materials:	gilt brass
Dimensions:	diameter 126 mm
Inventory:	246

The instrument consists of a disk engraved with four horizontal dials on each side, complete with gnomons (only one gnomon is missing). Each dial is marked for a different latitude and displays a different arrangement of the hours. In the center of the disk is inserted a gimbaled compass for orienting the instrument. Attributed to Carlo Plato. Provenance: Medici collections.

Sundial

Setting:	Room II
Maker:	Camillo della Volpaia
Place:	Florence
Date:	1542
Materials:	boxwood

Dimensions: 152x94 mm
Inventory: 2488

Horizontal sundial engraved on a boxwood table. It is fitted with a magnetic compass for orientation and is set for latitude 43°44' (Florence). The gnomon consists of a folding brass wind vane. Signed by Camillo della Volpaia. Provenance: Medici collections.

Sundial

Setting: Room II
Maker: Camillo della Volpaia [attr.]
Place: Italian
Date: 1542
Materials: boxwood
Dimensions: 177x84 mm
Inventory: 2487

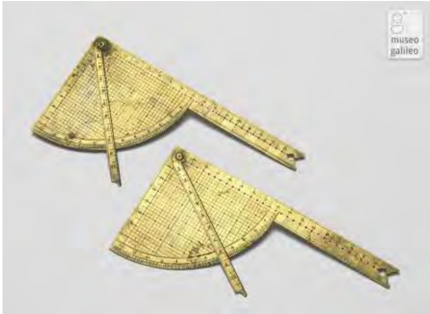
Horizontal dial engraved on a rectangular boxwood table. It is fitted with a magnetic compass for orientation. Underneath the compass is painted a map of Italy. The folding brass gnomon is in the shape of a angel. Along the rim of the table is inscribed a motto, in Italian, referring to the flight of time and to the truth of faith. The construction characteristics suggest its attribution to Camillo della Volpaia.

Sundial

Setting: Room II
Maker: unknown
Place: German
Date: ca. 1625-1630
Materials: silvered and gilt copper and brass, paper, glass
Dimensions: closed: 247x257 mm
Inventory: 1291, 1302

This box-shaped, finely chiseled German dial carries on the outer side of the lid a geographic mirror of the northern hemisphere. The inner side carries a revolving disk giving the Sun's position over a division corresponding to the lunar month. Inside the box are the equinoctial circle for the daytime hours with an index, an index arm, and an arc graduated for different latitudes. At the bottom of the box are a windrose, an opening with a compass for orienting the instrument (the magnetic needle is missing), and another revolving windrose. The outer side of the bottom carries a geographic mirror of the southern hemisphere, a circumference divided into degrees and days of the year, and a revolving disk with index arm and index for the positions of the Moon. Provenance: Vincenzo Viviani bequest.

Trigonometric quadrants



Setting: Room II
Maker: Christoph Schissler [attr.]
Place: German
Date: late 16th cent.
Materials: gilt brass
Dimensions: radius 120 mm
Inventory: 2529, 2637

Two identical German-made quadrants, possibly the work of Christoph Schissler. Both carry the sine grid, known as the *reduction quadrant*. Served to compute sines and cosines. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Vertical cylinder dial

Setting: Room II
Maker: Paolo Contarini
Place: Noto (Sicily)
Date: 1844
Materials: bone, wood; case: tin
Dimensions: height 137 mm, diameter 23 mm
Inventory: 127, 3252

Pillar dial formed by a bone cylinder engraved with the hour lines. The moving upper part carries the gnomon, which casts its shadow on the cylinder. The instrument fits into a tin case that also carries manuscript instructions for use on seven cards. The instrument, built by Paolo Contarini, is a replica of ancient pillar dials.

Vertical dial

Setting:	Room II
Maker:	unknown
Place:	German
Date:	ca. 1600
Materials:	gilt and silvered brass
Dimensions:	base 23x23 mm; total height 98 mm
Inventory:	2534

This dial consists of a square-section pillar fitted with a cupola lid that opens to show a small compass. The pillar has a plumb line to check the vertical. Calibrated for latitude 48° (Munich and Vienna), suggesting a German maker. Provenance: Medici collections.

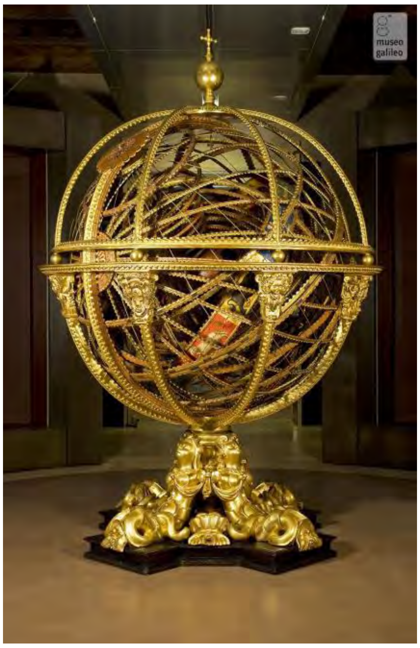
Rooms III and IV

The Representation of the World

Filippo Camerota

A singular form of assimilation and updating of Ptolemy's *Geography*, one of the founding texts of modern geographical studies, was the ambitious project for the Guardaroba Nuova in Palazzo Vecchio, conceived by Cosimo de' Medici as a grandiose *theatrum mundi*. This project was then emulated by Ferdinando I in the Uffizi Gallery, with a Cosmographic Room containing representations of the Medicean domains and a great Ptolemaic model of the universe designed by the cosmographer Antonio Santucci. It is the great armillary sphere that dominates this room, surrounded by terretrial and celestial globes of the finest workmanship.
In the adjacent room are four globes by the Venetian cosmographer Vincenzo Maria Coronelli. Famous for the great size of his creations, he built enormous globes, nearly four meters in diameter, for Louis XIV, King of France,.
As Coronelli explained in his *Epitome cosmografica* published in 1693, these globes are formed of many hand-written or printed sheets of paper, called gores, glued onto a large ball made of wood and papier-mâché coated with plaster.

Armillary sphere



Setting:	Room III
Maker:	Antonio Santucci
Place:	Florence
Date:	1588-1593
Materials:	wood, metal
Dimensions:	sphere diameter c. 2000 mm, height 3700 mm, width c. 2450 mm
Inventory:	714

Begun on March 4, 1588, and completed on May 6, 1593, this large armillary sphere was built under the supervision of Antonio Santucci at the request of Ferdinand I de' Medici. The sphere represents the "universal machine" of the world according to the concepts developed by Aristotle and perfected by Ptolemy. The terrestrial globe is placed at the center. Surprisingly, it even displays territories that were still relatively little known at the time.
Restored in the nineteenth century by Ferdinando Meucci, the device is now incomplete and some of its parts are mismatched. The wooden parts of the sphere are elaborately painted and covered with fine gold leaf. The sphere rests on a stand with four sirens, heavily restored in the nineteenth century.
This model is similar to a smaller one built by Santucci in 1582 for King Philip II of Spain, now in the Escorial library. Provenance: Medici collections.

Armillary sphere

Setting:	Room III
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	sphere diameter 70 mm, height 150 mm, width 95 mm
Inventory:	119

Small brass armillary sphere on a turned wooden stand. The sphere is geocentric and the Earth is represented by a small boxwood sphere. The horizon circle and the meridian are graduated. The sphere also carries the zodiac signs.

Armillary sphere

Setting:	Room III
Maker:	unknown
Date:	17th cent.
Materials:	varnished brass
Dimensions:	sphere diameter 170 mm, height 340 mm, width 210 mm
Inventory:	1101

Ptolemaic armillary sphere acquired and restored in the second half of the nineteenth century by Ferdinando Meucci, director of the Museo di Fisica e Storia Naturale of Florence. The Earth is represented by a brass sphere at the center. Two circles carry the Moon and Sun respectively. The sphere also carries the zodiac signs with their Latin names.

Armillary sphere

Setting:	Room III
Maker:	unknown
Date:	17th cent.
Materials:	gilt brass
Dimensions:	sphere diameter 185 mm, height 340 mm, width 225 mm
Inventory:	1117

This Ptolemaic armillary sphere rests on a stand made of turned and partly ornamented wood. The Earth is represented by a brass sphere at the center. The names of the zodiac signs are shown in Latin and Greek. Acquired and restored in the second half of the nineteenth century by Ferdinando Meucci, director of the Museo di Fisica e Storia Naturale of Florence.

Armillary sphere

Setting:	Room III
Maker:	unknown
Date:	ca. 1575
Materials:	brass
Dimensions:	sphere diameter 170 mm, height 340 mm, width 230 mm
Inventory:	1104

On this brass armillary sphere the zodiac signs are represented by the animals and figures after which they are named, with no other markings. The horizon circle carries a small magnetic compass. The Earth is not shown. Provenance: Medici collections.

Armillary sphere

Setting:	Room III
Maker:	unknown
Date:	17th cent.
Materials:	varnished brass
Dimensions:	sphere diameter 150 mm, height 305 mm, width 180 mm
Inventory:	1102

Varnished brass Ptolemaic armillary sphere acquired and restored in the second half of the nineteenth century by Ferdinando Meucci, director of the Museo di Fisica e Storia Naturale of Florence. The Earth is represented by a small brass sphere at the center. Two embossed brass circles carry the Moon and Sun. The names and zodiac signs are in Latin. The initials S.A.C.—in all likelihood the maker's—have not been identified.

Armillary sphere

Setting: Room III
Author: Maison Delamarche
Place: Paris
Date: 1858
Materials: paper, wood
Dimensions: sphere diameter 150 mm, height 330 mm, width 200 mm
Inventory: 3620

The armillary sphere, mounted on a turned wooden stand, is made of wood covered with printed paper. It holds a small colored and well-delineated terrestrial globe. It was published by the Maison Delamarche of Paris.

Celestial globe

Setting: Room III
Author: Matthäus Greuter
Place: Rome
Date: 1636
Materials: paper, wood
Dimensions: sphere diameter 490 mm, height 1520 mm, width 830 mm
Inventory: 2702

Celestial globe, complete with cover. Made by Matthäus Greuter, who claims to have used a globe (inv. Dep. OAA, Firenze) by Willem Jansz Blaeu as his model. In reality, he also drew on other authors such as Jodocus Hondius and Plancius. The star names are in Latin and Arabic. Also shown are the twelve southern constellations observed during a voyage by the Dutchman Frederick de Houtman to the southern hemisphere, 1595-1597. The English-type stand is very special, with the three curved legs supporting the circular horizon. Paired with the terrestrial globe inv. 2701.

Celestial globe

Setting: Room III
Author: Jodocus Hondius Jr, Adrianus Veen
Date: 1613
Materials: paper, wood
Dimensions: sphere diameter 535 mm, height 970 mm, width 780 mm
Inventory: 2696

This colored celestial globe is mounted on a support with four turned wooden legs. Its makers, Adrian Veen and Jodocus Hondius Junior (son of Jodocus Hondius Senior), dedicated it to the "Lords of the United Provinces of Belgium." The dedication is framed in a rectangular cartouche. Another cartouche states that the globe depicts not only the stars observed by Tycho Brahe, but also those in the sky of the southern hemisphere recorded by Frederick de Houtman. Most constellation names are in Latin. The globe also displays a portrait of Tycho Brahe.

Celestial globe

Setting: Room III
Author: Willem Jansz Blaeu
Date: 1622
Materials: paper, wood
Dimensions: sphere diameter 680 mm, height 1340 mm, width 980 mm
Inventory: Dep. OAA, Firenze

This celestial globe is signed Guljelmus Caesius, a name used by Willem Jansz Blaeu until 1621. It rests on four straight black pillars. The round stand is adorned with three lilies. Blaeu states that he used information provided by Tycho Brahe for star positions and observations by Frederik de Houtman for the constellations of the southern hemisphere. The constellations are shown with their figures; their names appear in Latin, Greek, and Arabic. Paired with the terrestrial globe inv. Dep. OAA.

Celestial globe

Setting: Room III
Author: Willem Jansz Blaeu
Date: published by Joan Blaeu after 1630
Materials: paper, wood
Dimensions: sphere diameter 680 mm, height 1110 mm, width 920 mm
Inventory: 2697

This celestial globe is part of the undated series derived from the 1616 prototype. There is a portrait of the great cosmographer Tycho Brahe, Willem Jansz Blaeu's master. The star positions are shown for the year 1640. They include more than 300 for the southern hemisphere, added thanks to the observations by Frederik de Houtman. The constellations are depicted with the classical figures from which they derive their names. The languages used are Latin, Greek, and Arabic. The author also mentions three new stars that appeared in his day. Bears the production serial number 11. Paired with the terrestrial globe inv. 2698. Provenance: Medici collections.

Celestial globe

Setting: Room IV
Author: Vincenzo Coronelli, Arnold Deuvez, Jean-Baptiste Nolin
Place: Paris
Date: 1693
Materials: paper, wood
Dimensions: sphere diameter 1080 mm, height 1950 mm, width 1400 mm
Inventory: 2364

This celestial globe by Vincenzo Coronelli reproduces the Paris reissue of the globe dated 1688. The copy was designed by the painter Arnold Deuvez, of the Académie Royale de Peinture et de Sculpture, and was engraved by the chalcographer Jean-Baptiste Nolin. Although published in

Paris, the captions are in Italian. The constellation names, reproduced with extreme accuracy, are in Italian, French, Latin, and Greek. Paired with the terrestrial globe inv. 2363. Provenance: Medici collections; in 1775, added to the Lorraine collections, which were incorporated into the Museo di Fisica e Storia Naturale of Florence.

Celestial globe

Setting: Room IV
Author: Vincenzo Coronelli
Date: 1696
Materials: paper, wood
Dimensions: sphere diameter 470 mm, height 680 mm, width 680 mm
Inventory: Dep. SBAS, Firenze

Like the matching terrestrial globe (Dep. SBAS, Firenze), this splendidly colored celestial globe is dedicated to King William III of England. It comprises 12 printed paper gores divided at the equator. Vincenzo Coronelli listed more stars than other globe-makers. Among others, he added the stars observed in the southern hemisphere by the English astronomer Edmond Halley. The globe also indicates the orbits of many comets. The names of the celestial bodies are in Italian, Latin, and Greek.

Celestial globe

Setting: Room III
Author: John Cary, William Cary
Date: 1816
Materials: paper, wood
Dimensions: sphere diameter 460 mm, height 1140 mm, width 630 mm
Inventory: 3842

Nineteenth-century celestial globe covered by 18 gores. Mounted on an English-type wooden tripod stand with a magnetic compass on the base. There are inscriptions in Latin and English. The constellations are depicted by elegant figures. Paired with the terrestrial globe inv. 3841.

Celestial globe

Setting:	Room III
Author:	Johann Georg Klinger
Place:	Nuremberg
Date:	1790
Materials:	paper, wood
Dimensions:	sphere diameter 320 mm, height 530 mm, width 455 mm
Inventory:	Dep. SBAS, Firenze

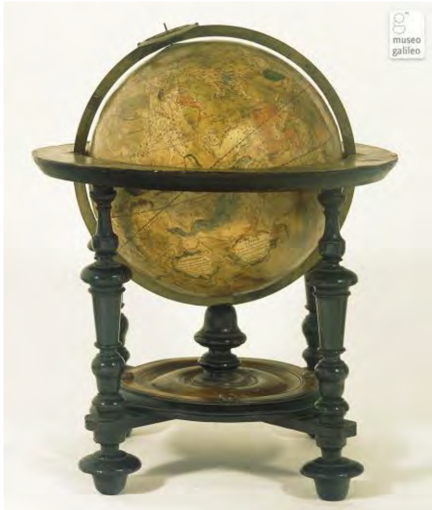
This celestial globe was made by Johann Georg Klinger, while the star positions were recorded for 1800 by Charles Messier. In addition to the Ptolemaic constellations, the globe displays those observed by Hevelius (1743), Nicolas-Louis de Lacaille (1776), and Maximilian Hell (1789). The names are in Latin.

Celestial globe

Setting:	Room III
Author:	Maison Delamarche
Place:	Paris
Date:	after 1805
Materials:	paper, wood
Dimensions:	sphere diameter 325 mm, height 590 mm, width 460 mm
Inventory:	Dep. OAA, Firenze

This celestial globe, mounted on a black wooden tripod, is covered with 12 printed gores. In addition to the Ptolemaic constellations, the globe displays those observed by Frederik de Houtman (1595-1597) and Hevelius (1648). Also shown is a constellation introduced by Joseph-Jérôme de Lalande in 1779 in honor of Charles Messier (Custos Messium). The globe is undated and the star positions correspond to 1800. The address listed for the workshop of Charles-François Delamarche indicates that the globe dates from after 1805, the year in which Delamarche moved to 13 Rue du Jardinet in Paris. Paired with the terrestrial globe inv. 3369.

Celestial globe



Setting: Room III
Author: Guillaume Delisle
Place: Paris
Date: 1700
Materials: paper, wood
Dimensions: sphere diameter 325 mm, height 600 mm, width 455 mm
Inventory: 974

Like the matching terrestrial globe inv. 2699, this celestial globe, made by Guillaume Delisle, is dedicated to the Duc de Chartres Louis-Philippe-Joseph d'Orléans. The northern and southern constellations comprise some additions to the Ptolemaic group, while those of the zodiac are the conventional ones. Provenance (identical to that of item inv. 2699): Medici collections; donated by Grand Duke Peter Leopold to the Museo di Fisica e Storia Naturale of Florence at its foundation in 1775.

Celestial globe

Setting: Room IV
Author: Vincenzo Coronelli
Place: Venice
Date: 1692
Materials: paper, wood
Dimensions: sphere diameter 1080 mm, height c. 1500 mm, width c. 1500 mm
Inventory: 2366

This celestial globe is a reprint of the 1688 Venice edition. It is dedicated by Vincenzo Coronelli to the Most Serene Republic of Venice and the Doge Francesco Morosini. Another inscription recalls that Coronelli was cosmographer to the Venetian Republic and founder of the Accademia degli Argonauti. The star positions are shown for the year 1700; there are 38 northern constellations, the 12 zodiacal constellations, and 33 southern constellations. Their names are in Italian, Greek, and Arabic. Coronelli lists 1,902 stars, as against Ptolemy's 1,022. Paired with the terrestrial globe inv. 2365. Provenance: Medici collections; in 1753, added to the collections of the Osservatorio Ximeniano. Displayed at the first History of Science Exhibition held in Florence in 1929.

Celestial globe

Setting: Room III
Author: Willem Jansz Blaeu
Date: published by Joan Blaeu after 1630
Materials: paper, wood
Dimensions: sphere diameter 680 mm, height 1100 mm, width 920 mm
Inventory: 347

This colored specimen is one of the undated editions sold by Willem Jansz Blaeu after his globes achieved a major commercial success. Unlike the terrestrial globes in the undated group, which differ in their dedications and their representations of land masses, this celestial globe is substantially identical to the others in the same group (inv. 348 - inv. 2697). It shows the stars identified by Tycho Brahe and Frederik de Houtmann. Paired with the terrestrial globe inv. 353. Provenance: Medici collections.

Celestial globe

Setting: Room III
Author: Willem Jansz Blaeu
Date: published by Joan Blaeu after 1630
Materials: paper, wood
Dimensions: sphere diameter 680 mm, height 1120 mm, width 920 mm
Inventory: 348

This celestial globe is one of the undated models produced by Willem Jansz Blaeu. Displays a ranking of stars by brightness. The constellations are represented by the animals and figures from which they derive their names. There is a portrait of Tycho Brahe. The stand is fitted with a magnetic compass. Bears the production serial number 13. Paired with the celestial globe inv. 354. Provenance: Medici collections.

Copernican sphere

Setting:	Room III
Maker:	Jean Pigeon [attr.]
Place:	Paris?
Date:	ca. 1725
Materials:	wood
Dimensions:	sphere diameter 280 mm, height 455 mm, width 280 mm
Inventory:	3263

Armillary sphere illustrating the heliocentric system of Copernicus: the Earth is represented by a small circle carrying a smaller one representing the Moon. The golden globe of the Sun is placed at the center. The inscriptions are in French. The likely attribution to Jean Pigeon is deduced from the Lorraine inventory of 1776.

Model for the demonstration of precession of the equinoxes and nutation

Setting:	Room III
Maker:	unknown
Date:	ca. 1800
Materials:	brass
Dimensions:	height 360 mm, width 240 mm
Inventory:	1465

Model for explaining the very slow motion called precession of the equinoxes. The phenomenon—which sparked scientific and doctrinal controversies—was investigated for several centuries. It was one of the arguments cited by Copernicus in support of his astronomical system. The model, actuated by a series of hand-operated gears, also simulates the nutation of the Earth's axis.

Perpetual wheel

Setting:	Room III
Author:	Antonio Santucci
Date:	after 1582
Materials:	paper
Dimensions:	420x580 mm
Inventory:	3716

This perpetual wheel, made by Antonio Santucci, is dedicated to Christine of Lorraine, wife of Ferdinand I de' Medici—as evidenced by the Medici-Lorraine coat of arms. There is no precise date, but, as the dedication indicates, the engraving was made after the calendar reform promulgated by Pope Gregory XIII in 1582.
The engraving comprises five concentric wheels for finding sunrise, the phases of the Moon, mobile feasts, the Dominical letter, the golden number, and the epact at any given time of year. An armillary sphere is depicted at the center. Over the wheel, two male figures with compasses are measuring stellar and physical distances on a celestial globe and a terrestrial globe.

Reduction compass

Setting:	Room III
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 175 mm
Inventory:	655

Reduction compass with a moving center for reducing measurements by a factor ranging from 2 to 10. This is done by shifting the central hinge to one of the several points marked on the shorter section of the legs. The longer section is fitted with a micrometer screw for a precision adjustment of the compass opening. The instrument was used mainly to reproduce drawings. Very similar to item inv. 633. Provenance: Medici collections.

Terrestrial globe

Setting: Room III
Author: Matthäus Greuter
Place: Rome
Date: 1632
Materials: paper, wood
Dimensions: sphere diameter 490 mm, height 1520 mm, width 830 mm
Inventory: 2701

This terrestrial globe, made by Matthäus Greuter, is complete with cover. The circular horizon rests directly on the three roughly C-shaped legs, creating a rather unusual English-type stand. The three feet are made of chiseled gilt wood. Greuter dedicated the globe to Jacopo Boncompagni. The inscriptions are in several languages and the cartographic imagery is largely borrowed from that of Willem Jansz Blaeu. One novelty is the addition of the name "Nieun Nederland" [New Holland] along the coast of the present United States. The globe is covered with 24 printed paper half-gores and two polar caps cut off at latitudes 80° North and South. Paired with the celestial globe inv. 2702.

Terrestrial globe

Setting: Room III
Author: Maison Delamarche
Place: Paris
Date: 1858
Materials: paper, wood
Dimensions: sphere diameter 150 mm, height 330 mm, width 200 mm
Inventory: 3621

This terrestrial globe is mounted on a small turned wooden stand from which four arms protrude, holding up the horizon circle. The arms give the latitudes and longitudes for several cities. It was published by the Maison Delamarche of Paris.

Terrestrial globe

Setting: Room III
Author: John Cary, William Cary
Date: 1816 / after 1818
Materials: paper, wood
Dimensions: sphere diameter 460 mm, height 1140 mm, width 630 mm
Inventory: 3841

Nineteenth-century terrestrial globe covered by 18 gores. Mounted on an English-type wooden tripod support. Carries inscriptions in English, with basic facts about many voyages such the second and third scientific expeditions of James Cook. Paired with the celestial globe inv. 3842.

Terrestrial globe

Setting: Room III
Author: Klinger Kunsthandlung
Place: Nuremberg
Date: ca. 1900
Materials: paper, wood
Dimensions: sphere diameter 100 mm, height 190 mm, width 100 mm
Inventory: Dep. SBAS, Firenze

The markings on this terrestrial globe are in German. Parallels and meridians are marked at 10° intervals, and the continents are shown in different colors. Built by the firm founded by Johann Georg Klinger.

Terrestrial globe

Setting: Room III
Author: Maison Delamarche
Place: Paris
Date: 1850
Materials: paper, wood
Dimensions: sphere diameter 150 mm, height 340 mm, width 200 mm
Inventory: Dep. SBAS, Firenze

This finely colored terrestrial globe is mounted on a turned wooden stand from which four arms protrude, holding up the horizon circle. Each arm gives the latitude and longitude from the Paris meridian for several cities. According to the information on the globe itself, it was published by the Maison Delamarche when it was under the management of Felix Delamarche.

Terrestrial globe

Setting: Room III
Author: Félix Delamarche & Charles Dien
Place: Paris
Date: 1821
Materials: paper, wood
Dimensions: sphere diameter 325 mm, height 590 mm, width 460 mm
Inventory: 3369

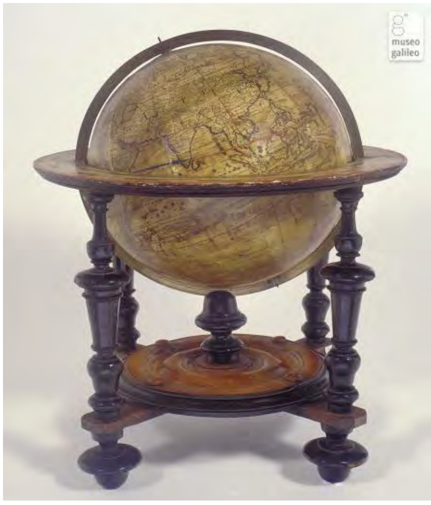
This terrestrial globe was published by Felix Delamarche in collaboration with Charles Dien. The sphere is covered with 12 printed gores. The inscription records the voyages of James Cook and Jean-François de La Pérouse. Paired with the celestial globe Dep. OAA, Firenze.

Terrestrial globe

Setting:	Room III
Author:	Charles-François Delamarche
Place:	Paris
Date:	1785
Materials:	paper, wood
Dimensions:	sphere diameter 325 mm, height 580 mm, width 470 mm
Inventory:	Dep. SBAS, Firenze

This terrestrial globe by Charles-François Delamarche, mounted on a Dutch-type stand 380 mm high, is covered with 12 printed gores. The horizon circle carries a small magnetic compass. A caption states that the globe describes the three voyages of Captain James Cook, his discoveries between April 1768 and his death, and the survivors' voyage home.

Terrestrial globe



Setting:	Room III
Author:	Guillaume Delisle
Place:	Paris
Date:	1700 / after 1708
Materials:	paper, wood
Dimensions:	sphere diameter 325 mm, altezza 580 mm, width 455 mm
Inventory:	2699

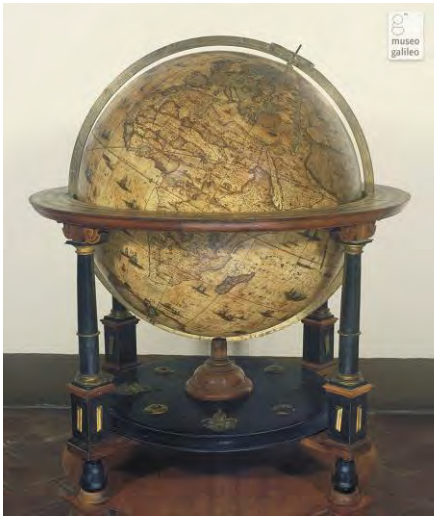
This terrestrial globe is dedicated to the Duc de Chartres Louis-Philippe-Joseph d'Orléans. Its maker, Guillaume Delisle, was a great cartographer who corrected many errors made by his predecessors. For example, he gave more accurate dimensions to Asia and the Mediterranean; he also used the latest observations by the Académie Royale des Sciences of Paris. The sphere of this specimen is covered with 12 printed gores, designed and etched by the French engraver Charles Simmoneau, member of the Académie Royale des Sciences. Paired with the celestial globe inv. 974. Provenance: Medici collections; donated by Grand Duke Peter Leopold to the Museo di Fisica e Storia Naturale of Florence at its foundation in 1775.

Terrestrial globe

Setting:	Room IV
Author:	Vincenzo Coronelli
Date:	1696
Materials:	paper, wood
Dimensions:	sphere diameter 470 mm, height 680 mm, width 680 mm
Inventory:	Dep. SBAS, Firenze

This terrestrial globe is dedicated to King William III of England. Despite its small size, it carries a wealth of details and information. Shows the discoveries made in numerous voyages of exploration, such as that of Jacob Le Maire. Vincenzo Coronelli regarded this as his most accomplished production. Indeed, the globe is very up-to-date and consistent with reality. It testifies to the care with which Coronelli compiled the latest geographic discoveries. Paired with the celestial globe (Dep. SBAS, Firenze), this brightly colored specimen is one of the finest known to survive. There is a Dutch-type stand. The six legs—rather than the usual four—are elaborately twisted.

Terrestrial globe



Setting:	Room III
Author:	Willem Jansz Blaeu
Date:	1622 / published ca. 1630
Materials:	paper, wood
Dimensions:	sphere diameter 680 mm, height 1340 mm, width 980 mm
Inventory:	Dep. OAA, Firenze

This terrestrial globe, mounted on a worked wooden stand decorated with brass lilies, is signed Guljelmus Blaeu and dedicated to Ferdinand II de' Medici. With the celestial globe inv. Dep. OAA, Firenze, it forms a very well preserved and richly painted pair. Even the paper ring covering the horizon plane is in excellent condition. The specimen belongs to the fifth—and best-known—type of globe made by Blaeu. Completed in 1617, the globe was not printed until 1622. The delay enabled Blaeu to incorporate the new discoveries by the Dutch travelers Le Maire and Schouten. In keeping with pre-1630 knowledge, California is depicted as an island. Australia is not shown. There is an outline of the northern coast of New Guinea.

Terrestrial globe

Setting:	Room III
Author:	Willem Jansz Blaeu
Date:	published by Joan Blaeu ca. 1645-1648
Materials:	paper, wood
Dimensions:	sphere diameter 680 mm, height 1140 mm, width 920 mm
Inventory:	353

This terrestrial globe is one in the series of Willem Jansz Blaeu's undated models, which often lack dedications as well. The difficulty of dating them is complicated by the fact that Joan Blaeu continued to reprint his father's globes. This specimen, which carries the date 1629 on the Australian coasts, was probably issued after 1645. California is still depicted as an island. A long text recounts the multiple attempts by Dutch travelers to discover the North-East passage. The globe is in excellent condition and richly adorned. The large letters are gilt and some scenes are painted. Paired with the celestial globe inv. 347. Provenance: Medici collections.

Terrestrial globe

Setting:	Room III
Author:	Willem Jansz Blaeu
Date:	published by Joan Blaeu ca. 1645-1648
Materials:	paper, wood
Dimensions:	sphere diameter 680 mm, height 1120 mm, width 920 mm
Inventory:	354

This terrestrial globe is one of the undated models produced by Willem Jansz Blaeu. It shows a rough outline of the coasts of Australia (New Holland), while California is still depicted as an island. Each region is displayed with its physical geographic features (mountains, rivers, etc.), typical animals and plants, and scenes of the everyday life of local inhabitants. Paired with the celestial globe inv. 348. Provenance: Medici collections.

Terrestrial globe

Setting:	Room IV
Author:	Vincenzo Coronelli
Place:	Venice
Date:	1688 / after 1691
Materials:	paper, wood
Dimensions:	sphere diameter 1080 mm, height c. 1950 mm, width c. 1400 mm
Inventory:	2363

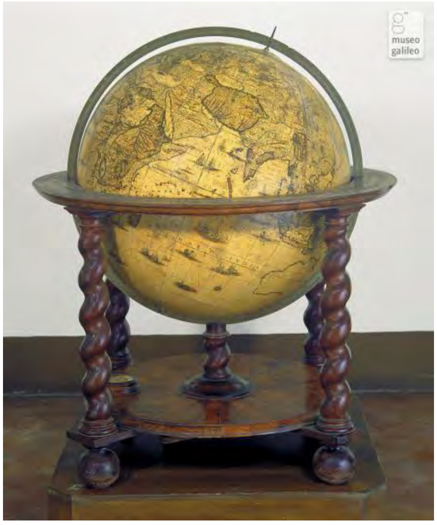
This terrestrial globe is dedicated by Vincenzo Coronelli to the Most Serene Republic of Venice and the Doge Francesco Morosini. The globe, made of papier-mâché, is very easy to handle despite its size. It is covered with 50 printed sheets containing an abundance of up-to-date historical information, such as a mention of the earthquake that destroyed Lima in 1688. There are pictures of animals and persons wearing local costumes. Paired with the celestial globe inv. 2364. Provenance: Medici collections; in 1775, added to the Lorraine collections, which were incorporated into the Museo di Fisica e Storia Naturale of Florence.

Terrestrial globe

Setting:	Room IV
Author:	Vincenzo Coronelli
Place:	Venice
Date:	1688 / after 1691
Materials:	paper, wood
Dimensions:	sphere diameter 1080 mm, height c. 1950 mm, width c. 1400 mm
Inventory:	2365

This terrestrial globe is dedicated by Vincenzo Coronelli to the Most Serene Republic of Venice and the Doge Francesco Morosini. The Dedicatory Epistle mentions Cardinal d'Estrées and the two large globes made by Coronelli for Louis XIV. This specimen, made of papier-mâché, is very easy to handle despite its size. It is covered with 50 printed sheets containing a wealth of up-to-date historical information, such as a mention of the earthquake that destroyed Lima in 1688. There are pictures of animals and persons in local costume. The English-type stand carries sculpted lions, like the stand of celestial globe inv. 2366, with which it is paired. Provenance: Medici collections; in 1753, added to the collections of the Osservatorio Ximeniano. Displayed at the first History of Science Exhibition held in Florence in 1929.

Terrestrial globe



Setting: Room III
Author: Willem Jansz Blaeu
Date: published by Joan Blaeu ca. 1645-1648
Materials: paper, wood
Dimensions: sphere diameter 680 mm, height 1110 mm, width 920 mm
Inventory: 2698

This terrestrial globe, made by Willem Jansz Blaeu, lacks a date and dedication but is probably later than 1645. On the roughly outlined coasts of Australia (New Holland), there is a mention of the year 1629 and a reference to the discoveries by the traveler Van Nuyts. California, still depicted as an island, contains a caption listing the various attempts to find a passage from Europe to Asia via the northern part of the American/Asian continent. Bears the production serial number 9. Paired with the celestial globe inv. 2697. Provenance: Medici collections.

Three-legged compass

Setting: Room III
Maker: unknown
Place: Italian
Date: 17th cent.
Materials: brass
Dimensions: length 185 mm
Inventory: 1480

Three-legged compass, with one leg missing. The steel-tipped legs are graduated and bear the inscription "Piede romano partito in onci 12 e deti 16" [Roman foot divided into 12 inches and 16 *deti*]. The notebook of Benvenuto della Volpaia contains an illustration of a variant of the three-leg compass attributed to Michelangelo Buonarroti and used for drawing different kinds of curves. Provenance: Medici collections.

Trattato sopra la nuova inventione della sfera armillare…, Antonio Santucci (facsimile)

Setting: Room III
Author: Antonio Santucci
Date: original ca. 1582/ facsimile 2008
Dimensions: facsimile 33x22,5 cm
Inventory: Genova, Biblioteca Universitaria, Ms. F.VII.6

This short treatise describes the making of an armillary sphere and its demonstrative and astrological purposes. The folio on display illustrates the rotation of the model's internal parts.

World map (facsimile)

Setting: Room IV
Author: Fra' Mauro
Place: original Murano / facsimile Florence
Date: original 1457-1459 / facsimile 1942
Materials: paper
Dimensions: side 2230 mm
Inventory: Dep. BNC, Firenze

This world map is drawn "upside down"—the lower part of the Italian boot is at the top, while Asia is placed on the left. This profusely detailed map gives the first known representation of several lands still unexplored at the time, drawing mainly on travel narratives such as Marco Polo's. The figures are enhanced by numerous and sometimes lengthy captions. The copy held by the Istituto e Museo di Storia della Scienza is a facsimile produced by Alinari, the Florentine photography firm. The original, made in Murano between 1457 and 1459 by Fra' Mauro, is in the Biblioteca Marciana of Venice.

Room V

The Science of Navigation

Filippo Camerota

Having consolidated their power over Tuscany, the Medici turned their gaze toward the sea, hoping to win a place in oceanic navigation and develop trade with the East and West Indies. These ambitions favoured the development of maritime science in Tuscany, making Leghorn a major centre in the Mediterranean, equipped with arsenals, naval shipyards, nautical schools and workshops for the production of nautical instruments and geographical charts, destined mainly for the captains of the Medicean fleet, the Knights of St. Stephen. The entry of the English Admiral, Sir Robert Dudley, into the service of Ferdinando I marked the consolidation of nautical science at the Medicean court. His important collection of nautical instruments, displayed in this room, along with his imposing treatise on the art of navigation, *Dell'arcano del mare* (The Secrets of the Sea), published in Florence in 1646-1647, became part of the Medicean collection.

Astrolabe

Setting:	Room V
Maker:	Charles Whitwell [attr.]
Place:	English
Date:	late 16th cent.
Materials:	brass
Dimensions:	diameter 673 mm
Inventory:	1123, 1124, 1127

Although unsigned, this astrolabe can be attributed, because of its characteristics, to the maker Charles Whitwell. There are two semicircular sectors that can be attached to the center of the astrolabe, a graduated rule, and a ruler with circle. The instrument was designed for nautical use. Provenance: Robert Dudley bequest to the Medici collections.

Astrolabe

Setting:	Room V
Maker:	Charles Whitwell
Place:	English
Date:	1595
Materials:	brass
Dimensions:	diameter 388 mm
Inventory:	1095

This universal astrolabe, made by Charles Whitwell, lacks a rule and an alidade. The mater carries a planisphere with an equinoctial stereographic projection. The back of the instrument is just barely roughed out. Provenance: Robert Dudley bequest to the Medici collections.

Astrolabe

Setting:	Room V
Maker:	unknown
Place:	English?
Date:	late 16th cent.
Materials:	brass
Dimensions:	diameter 290 mm
Inventory:	1100

All that survives of this astrolabe is the mater, whose back displays an orthographic-projection planisphere based on the model introduced by Juan de Rojas. Probable provenance: Robert Dudley bequest to the Medici collections.

Astrolabe

Setting:	Room V
Maker:	Johann Richter (Praetorius)
Place:	Altdorf
Date:	1591
Materials:	brass
Dimensions:	diameter 500 mm
Inventory:	1097

This astrolabe, made by Johann Richter, is missing its rete, an alidade, a rule, and several tympanums (there is only one for latitudes 53° and 57°, corresponding to Great Britain). On the back, at the center, are marked the main religious feasts, the zodiacal calendar, and the leading saints. The shadow square frames a finely etched rural scene. Provenance: Medici collections.

Astrolabe

Setting:	Room V
Maker:	Thomas Gemini
Place:	English
Date:	1550-1559
Materials:	brass
Dimensions:	diameter 355 mm
Inventory:	1093

This astrolabe was made by Thomas Gemini. On the front are the rete and the alidade. The mater carries the mariner's quadrant and the names of the winds in English, Greek, and Latin. The date is incomplete, but the three engraved digits (155) narrow the time frame for the instrument's construction to 1550-1559. On the back is a universal planisphere with another alidade fitted with a mobile perpendicular arm and a jointed index. The tympanums are missing. Provenance: Robert Dudley bequest to the Medici collections.

Astrolabe

Setting:	Room V
Maker:	Gerard Mercator [attr.]
Place:	Duisburg
Date:	ca. 1570
Materials:	gilt brass
Dimensions:	diameter 316 mm
Inventory:	1098

This astrolabe, attributed to Gerard Mercator, contains six tympanums for latitudes 43°, 36°, 39° and 42°, 45° and 48°, 51° and 54°, and 57° and 60° (corresponding to the regions between North Africa and Sweden); a seventh tympanum carries the geographic mirror for the northern and southern hemispheres. Probable provenance: Robert Dudley bequest to the Medici collections.

Astrolabe

Setting:	Room V
Maker:	Gualterus Arsenius
Place:	Louvain
Date:	1572
Materials:	brass
Dimensions:	diameter 341 mm
Inventory:	1103

Made by Gualterus Arsenius, nephew of Gemma Frisius, this astrolabe has ten tympanums for different latitudes. There is a rete and an alidade. The suspension ring contains a magnetic compass complete with magnetic needle, held up by two small graceful sculptures of a man and a woman. Provenance: Medici collections.

Astrolabe

Setting:	Room V
Maker:	Gualterus Arsenius [attr.]
Place:	Flemish
Date:	ca. 1570
Materials:	brass
Dimensions:	diameter 297 mm
Inventory:	1094

Astrolabe complete with rete and alidade, comprising eight tympanums for different latitudes. On the back, there is a zodiac belt, a calendar, the shadow square, the horary quadrant, and, on the alidade, markings for the ante- and post-meridian hours. Its structural characteristics suggest that it was made by Gualterus Arsenius in c. 1570. Provenance: Medici collections.

Atlante nautico, Anonymous (facsimile)

Setting:	Room V
Author:	unknown
Date:	original after 1670 / facsimile 2010
Dimensions:	facsimile 56x62 cm
Inventory:	Firenze, Museo Galileo, MED GF028

Dedicated to Cosimo III, Grand Duke of Tuscany, the atlas comprises nine tables showing the Mediterranean, the Atlantic coasts of Europe, the Atlantic coasts of Africa, Central and North America, South America, the coasts of southern Africa, the coasts of India and the Indonesian archipelago, and the coasts of northern Europe.

Atlante nautico, Giovanni Oliva (facsimile)

Setting:	Room V
Author:	Giovanni Oliva
Date:	original 1616 / facsimile 2010
Dimensions:	facsimile 51,5x33,5 cm
Inventory:	Firenze, Museo Galileo, MED GF032

This refined atlas is the work of Giovanni Oliva, a captain and mapmaker from Messina who headed the Livorno cartographic workshop from 1618 to 1650. The volume was probably produced in Marseille for Maria de' Medici. It comprises eighteen finely decorated maps showing the Mediterranean, Europe, the East Indies, and the New World, as well as an oval planisphere inspired by Abraham Ortelius's prototype.

Bust of Amerigo Vespucci

Setting:	Room V
Author:	Giovan Battista Foggini
Date:	17th cent.
Materials:	marble
Inventory:	3903

Amerigo Vespucci was born and educated in Florence, but soon moved to Seville, where he began a career in trade and finance. In the wake of Portuguese and Spanish navigators, he sailed to the New World, exploring the South American coast. An expert cartographer, he was the first to realize that the land he had reached was a new continent, not a hitherto unknown part of Asia.
The white marble bust is the work of Giovanni Battista Foggini, sculptor and architect at the court of Grand Duke Cosimo III de' Medici.

Dell'arcano del mare, Robert Dudley (facsimile)

DELL'ARCANO
DEL MARE,
DI D. RVBERTO DVDLEO DVCA DI NORTVMBRIA,
E CONTE DI VVARVICH,
LIBRO TERZO, E QVARTO;
Nel Terzo, si contiene la Disciplina Marittima, e Militare dell'Autore,
E nel Quarto, l'Architettura sua Nautica di Vascelli da guerra.
AL SERENISSIMO
FERDINANDO SECONDO
GRAN DVCA DI TOSCANA
suo Signore.

In FIRENZE, Nella Stamperia di Francesco Onofri. 1646.
Con licenza de' SS. Superiori.

Setting:	Room V
Author:	Robert Dudley
Place:	Florence
Date:	original 1646 / facsimile 2008
Dimensions:	facsimile 70x47 cm
Inventory:	Firenze, Biblioteca Nazionale Centrale, Magl. 5._.270

Famous and fundamental work by Robert Dudley (1573-1649), in which the author demonstrated his wide-ranging expertise in mapmaking and navigation science. Dedicated to Ferdinand II de' Medici (1610-1670) and first printed in three volumes in Florence in 1646-1647, the *Arcano del mare*, now exceedingly rare, was the first sea atlas of the entire known world. A monument also for its high typographic quality, the book contains sea charts and illustrations of innovative navigation instruments. There are also proposals for optimizing the profile of ship hulls.
The plate on display illustrates some of the ingenious instruments designed by Dudley.

Folding rule

Setting:	Room V
Maker:	James Kynvyn
Place:	London
Date:	1595
Materials:	brass
Dimensions:	length 660 mm
Inventory:	2516

Made by James Kynvyn, this rule consists of two legs graduated into 770 parts and a protractor at the swivel joint (180°). The grooved legs contain two flat arms that, when folded out and joined at a right angle, form the shadow square. The folding rule was used to measure angles, heights, and distances. Provenance: Robert Dudley bequest to the Medici collections.

Horary quadrant

Setting:	Room V
Maker:	Charles Whitwell
Place:	English
Date:	1595
Materials:	brass
Dimensions:	side 176 mm
Inventory:	2519

Quadrant made by Charles Whitwell, similar to item inv. 155. The shadow square occupies two adjacent sides; the opposite corner carries a pivoting vane with sights. In the center is engraved a Stöffler horary quadrant bounded by the arc of the degree scale. The back carries a zodiacal calendar and the windrose. Provenance: Robert Dudley bequest to the Medici collections.

Hourglass

Setting: Room V
Maker: unknown
Date: 17th cent.
Materials: iron, glass
Dimensions: height 130 mm
Inventory: 138

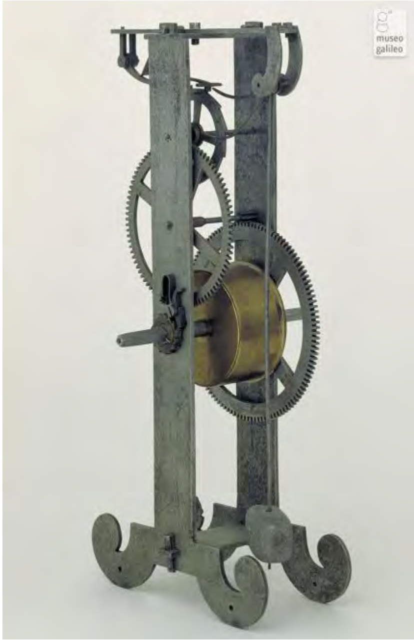
Powder hourglass housed in a hexagonal iron frame with six small pillars. The glass compartments are joined at the center by paper disks. The time elapsed was measured by the quantity of powder falling from the upper compartment to the lower one.

Mariner's astrolabe

Setting: Room V
Maker: Francisco de Goes
Place: Portuguese
Date: 1608
Materials: bronze
Dimensions: diameter 197 mm
Inventory: 1119

This mariner's astrolabe, made by Francisco de Goes, is fitted with a suspension ring, a degree scale (only half of which has been engraved), and an alidade. On the alidade are mounted two large square plates, one of which is perforated. The instrument served to measure the altitude of the Sun, which was indicated by the alidade on the degree scale when a ray passed through the front hole and struck the center of the back plate. Provenance: Robert Dudley bequest to the Medici collections.

Model of the application of the pendulum to the clock



Setting:	Room V
Inventor:	Galileo Galilei
Maker:	Eustachio Porcellotti
Date:	1860
Materials:	iron, brass
Dimensions:	160x350 mm
Inventory:	3450

This model, showing the application of the pendulum to the clock, revives the concept developed by Galileo as early as 1637. The iron frame holds brass gears. The train comprises two wheels and two pinions. The escapement is composed of: a wheel with 12 teeth along the rim and 12 pegs placed crosswise along the rim as well; a retaining lever powered by a thin spring; and two long upward-curved pallets, integral with the pendulum at its hinge point (the upper pallet is for release, the lower one receives the impulse). At the end of each oscillation the upper pallet meets the retaining lever and lifts it, freeing the escapement wheel. As the latter rotates, it meets the lower pallet and pushes it down, imparting the impulse needed to keep the pendulum moving. As the impulse pallet is pushed downward, it lowers the upper pallet as well, which consequently drops the retaining lever blocking the wheel. The pendulum is free to travel the remainder of its arc path, returning to the opposite end. There, it lifts the retaining lever, releasing the wheel and so starting a new cycle. Release and impulse occur in rapid succession at the end of every complete oscillation. One of the drawings (inv. 2433) by Vincenzo Viviani and Galileo's son Vincenzo Galilei was rediscovered in 1855: it illustrated the first application to the clock of the pendulum concept invented by Galileo. The discovery fostered the construction of countless models. This one, built in 1879 by Eustachio Porcellotti, was one of the first (the Museum has another copy by the same maker, dating from two years earlier).

Nautical circle

Setting: Room V
Inventor: Robert Dudley
Maker: Charles Whitwell
Place: English
Date: late 16th cent.
Materials: brass
Dimensions: diameter 730 mm
Inventory: 1116

Designed by Robert Dudley and made by Charles Whitwell, this large disk bears only a superficial resemblance to the astrolabe inv. 1123, 1124, 1127. In fact, it probably belonged to a more complex instrument described in Dudley's *Arcano del mare*. A ruler complete with circle also forms part of this navigation instrument. Provenance: Robert Dudley bequest to the Medici collections.

Nautical compass

Setting: Room V
Maker: unknown
Place: English
Date: late 16th cent.
Materials: brass
Dimensions: length and width 670 mm (open)
Inventory: 600

Large, incomplete English nautical compass with two sights for each leg and an arc graduated from 0° to 90°. Provenance: Robert Dudley bequest to the Medici collections.

Nautical compass

Setting: Room V
Maker: unknown
Place: English
Date: late 16th cent.
Materials: brass
Dimensions: length 425 mm, width 470 mm (open)
Inventory: 599

English nautical compass with an arc graduated from 0° to 90°. The sights are missing. Provenance: Robert Dudley bequest to the Medici collections.

Nautical hemisphere

Setting:	Room V
Inventor:	Michel Coignet
Maker:	Charles Whitwell
Place:	English
Date:	late 16th cent.
Materials:	brass
Dimensions:	diameter 280 mm
Inventory:	1099, 1122

The instrument, made by Charles Whitwell, consists of two superposed disks. On the front of the larger one is the maker's signature and a slit that may have served to fasten it to a support. On its rim are four diametrically opposing prominences carrying two right-angled semi-armillae. One of the prominences holds a suspension ring. Two other semi-armillae—one of which can be tilted—are attached to the four similar prominences on the smaller disk and rotate together with the latter around the center of the instrument. A diopter, pivoting on the center of the smaller disk, was used for sighting. This nautical hemisphere probably served to compute tides and is derived from a model invented by Michel Coignet c. 1580. Provenance: Robert Dudley bequest to the Medici collections.

Nautical instrument

Setting:	Room V
Maker:	James Kynvyn
Place:	London
Date:	1597
Materials:	brass
Dimensions:	diameter 310 mm
Inventory:	3174

Instrument made by James Kynvyn, comprising a round plate divided into four quadrants, two with the sine grid, known as the *reduction quadrant*, one with the shadow square, and one with the quadrant for determining the longitude. At the center is a rotating graduated alidade; the circumference is engraved with the degree scale. On the back is a cylindrical section for fitting the instrument on a support. Provenance: Robert Dudley bequest to the Medici collections.

Nocturnal

Setting:	Room V
Maker:	unknown
Place:	English
Date:	16th cent.
Materials:	brass
Dimensions:	diameter 77 mm, length 155 mm
Inventory:	2500

Nocturnal consisting of two concentric circles. The outer circle, divided into twenty-four hours, is fixed and joined to a straight arm serving as a handle. The inner circle rotates freely and carries two indexes pivoting at the center. The index pivot and the band of the rotating circle are connected via a small semi-hollow disk. Highly probable provenance: Robert Dudley bequest to the Medici collections.

Planisphere (facsimile)

Setting:	Room V
Author:	Lopo Homem
Place:	Lisbon
Date:	1554
Materials:	parchment
Dimensions:	2237x1425 mm
Inventory:	946

This planisphere, one of the oldest Portuguese maps extant, represents the coastal limits of the known world in the mid-sixteenth century. It is the first map to show Argentina, designated as "Terra Argentea." Dated and signed by the famous Portuguese cartographer Lopo Homem on the lower right.

Plate for nautical use

Setting:	Room V
Inventor:	Robert Dudley
Maker:	James Kynvyn
Place:	English
Date:	1595
Materials:	brass
Dimensions:	467x355 mm
Inventory:	663

Used for taking bearings at sea, this instrument, made by James Kynvyn, closely resembles a model illustrated in Robert Dudley's *Arcano del mare*. Consists of a rectangular brass plate carrying the shadow square and the quadrant for determining the longitude. On the upper right-hand corner was hinged a vane (missing). Provenance: Robert Dudley bequest to the Medici collections.

Protractor

Setting:	Room V
Maker:	unknown
Place:	English
Date:	late 16th cent.
Materials:	brass
Dimensions:	diameter 90 mm
Inventory:	613

Protractor consisting of a circle divided into 360°. Inside the upper half of the circle is a graduated semicircle; the lower half contains a rectangular plate with a double graduation into ten equal parts. The instrument was used to plot routes on sea charts and reproduce the bearings taken with the magnetic compass. Highly probable provenance: Robert Dudley bequest to the Medici collections.

Quadrant

Setting:	Room V
Inventor:	Robert Dudley
Maker:	unknown
Place:	English
Date:	1597
Materials:	brass
Dimensions:	radius 370 mm
Inventory:	3365

The front of this quadrant carries the windrose, the zodiacal calendar, and the shadow square. On the back are engraved the hour lines, the path of the Sun's diurnal arc, a zodiacal belt, and the degree scale. Provenance: Robert Dudley bequest to the Medici collections.

Quadrant

Setting:	Room V
Maker:	Thomas Gemini
Place:	English
Date:	mid-16th cent.
Materials:	brass, wood
Dimensions:	radius 270 mm
Inventory:	2509

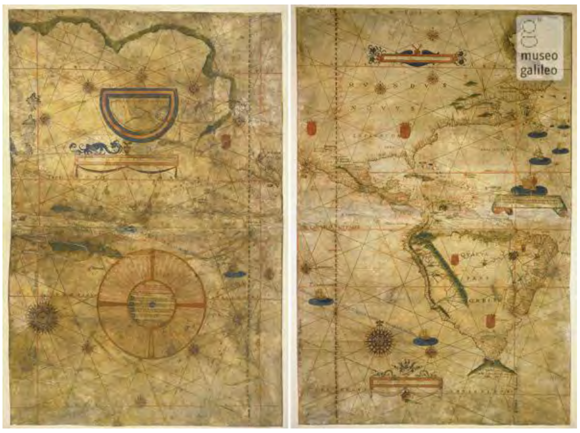
Double quadrant, comprising two brass plates and an identically shaped wooden tablet between them. The three plates rotate on one another around a single point located at the apex of the right angle. One quadrant displays on both sides the sine grid, known as the *reduction quadrant*, the degree scale, the shadow square, and the primum mobile quadrant designed by Petrus Apianus. The other quadrant carries an astrolabe quadrant based on the model developed by Oronce Finé, and a zodiacal quadrant with ecclesiastical calendar. The symbol "II" of the Gemini sign etched on the instrument reveals its maker, Thomas Gemini. Provenance: Robert Dudley bequest to the Medici collections.

Quadrant

Setting: Room V
Maker: James Kynvyn [attr.]
Place: English
Date: 1595 (?)
Materials: brass
Dimensions: 318x380 mm
Inventory: 242, 3362

The instrument, possibly made by James Kynvyn in 1595, is now incomplete. Of the horizontal circle with the degree scale only one half (from 180° to 360°) remains. However, it does still carry the base for the azimuth compass (missing). A quadrant with a nonius is fitted at right angles to the base. At right angles to this second plate pivoted a diopter (missing) for measuring heights, while the compass served to determine position angles. The instrument was thus used to calculate the coordinates of celestial bodies (altitude above the horizon and position relative to the magnetic meridian). Provenance: Robert Dudley bequest to the Medici collections.

Sea charts



Setting: Room V
Author: Bartolomeu Velho
Date: 1561
Materials: parchment
Dimensions: 800x1130, 813x1207, 810x1200, 830x1206 mm
Inventory: Dep. ABA, Firenze

These four sea charts, made of colored parchment, cover the Pacific, the New World, Europe and Africa, and Asia. The Pacific chart gives a highly detailed outline of the coasts, with a wealth of information. The "New World" chart uses the expression to denote North America only. South America is called the "Fourth part of the World." The author, Bartolomeu Velho, also shows the southern passage between the Atlantic and the Pacific discovered by Ferdinand Magellan in 1520. The map of Asia depicts, among other things, the 1497 voyage of Vasco da Gama.

Single-handed dividers

Setting: Room V
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 130 mm
Inventory: 1478

Single-handed dividers. The legs of the instrument comprise a semi-circular section and a straight section tapered to a point. The dividers could be opened with a single hand by applying finger pressure to the curved section. Used in navigation to plot routes on sea charts. This type of instrument is depicted on the frame of Galileo's objective lens. Provenance: Medici collections.

Single-handed dividers

Setting: Room V
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 120 mm
Inventory: 1479

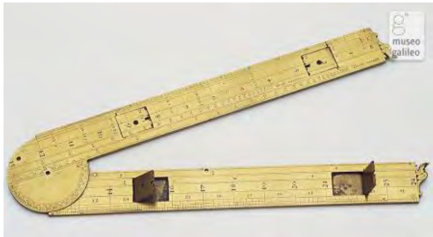
Single-handed dividers. The legs of the instrument comprise a semi-circular section and a straight section tapered to a point. The dividers could be opened with a single hand by applying finger pressure to the curved section. Used in navigation to plot routes on sea charts. This type of instrument is depicted on the frame of Galileo's objective lens. Provenance: Medici collections.

Spring-driven clock movement and dial

Setting: Room V
Maker: Johann Philipp Treffler
Place: Florence
Date: ca. 1659
Materials: brass, pewter
Dimensions: movement: 90x36x190 mm; dial: 258x304 mm
Inventory: 3557

The clock was originally housed in a wooden case, replaced by another destroyed in the 1966 flood. The brass dial displays the pewter hour circle and the seconds circle. The slim hour hand is elegantly designed and crafted. The minutes and seconds hands are missing. The brass going train has a large barrel for the mainspring and a gut fusee. The train comprises the fusee wheel, an intermediate wheel, a crown wheel, and a horizontal contrate wheel. The pendulum is missing. The back plate carries engraved ornamentation at the corners and on the rim; the center is engraved with the signature "Gio:Filipp Trefler Augosto" with flourishes. This instrument is traditionally believed to be one of the earliest applications of the pendulum to a clock in Italy. Appears to have belonged to Vincenzo Viviani.

Surveying compass



Setting:	Room V
Maker:	Humfrey Cole
Place:	London
Date:	1575
Materials:	brass
Dimensions:	length 350 mm
Inventory:	2527

Flat-legged surveying compass signed by Humphrey Cole. There are a degree scale (up to 180°), folding sights, and scales for measuring land plots and timber. The degree scale serves to measure position angles in surveying. The legs also fold out to 180°, enabling the instrument to be used as a ruler or alidade for a plane table. Provenance: Robert Dudley bequest to the Medici collections.

Table-clock movement

Setting:	Room V
Maker:	unknown
Place:	Italy
Date:	16th cent.
Materials:	iron, wood
Dimensions:	height 135 mm, max. diameter 160 mm
Inventory:	3821

Important Italian Renaissance clock movement, recently acquired. The spring mechanism is enclosed in a modern wooden case. The device reproduces a movement first illustrated in the manuscripts of Leonardo da Vinci.

Theodolite

Setting: Room V
Maker: unknown
Place: English
Date: late 16th cent.
Materials: brass
Dimensions: diameter 160 mm
Inventory: 2528

Incomplete theodolite. The semicircular sector carries a viewer on the diameter line, the degree scale on the arc of the circumference, and the shadow square at the center. Made in England, it is engraved on one side with the coat of arms of Queen Elizabeth I. Highly probable provenance: Robert Dudley bequest to the Medici collections.

Theodolite

Setting: Room V
Maker: Augustine Ryther
Place: English
Date: 1590
Materials: brass
Dimensions: max. diameter 235 mm
Inventory: 240

This instrument, made by Augustine Ryther, is one of the oldest models of theodolite extant. It comprises a horizontal circle with a degree scale on the circumference and an inscribed shadow square. At the center pivots a diopter with a magnetic compass. The compass carries a holder for a vertical semicircle with a degree scale, shadow square, and viewer. The plane of the vertical semicircle rotates jointly with the diopter underneath, allowing the simultaneous determination of the azimuth angle and zenith angle of a given point, i.e., its spatial coordinates. The instrument, used for surveying, matches the one introduced in the second half of the sixteenth century by Leonard and Thomas Digges. Highly probable provenance: Robert Dudley bequest to the Medici collections.

Windrose

Setting:	Room V
Inventor:	Robert Dudley
Maker:	unknown
Place:	English
Date:	1596
Materials:	copper
Dimensions:	diameter 340 mm
Inventory:	3372

This windrose probably belonged to a navigational magnetic compass. The back has a wooden base. Provenance: Robert Dudley bequest to the Medici collections.

Room VI

The Science of Warfare

Filippo Camerota

In this room, numerous instruments linked to the science of warfare and military architecture are displayed. In the Renaissance, the spread of firearms had transformed battlefields into the theatre of geometric studies. Powerful mortars had compelled modifying the geometry of fortresses. Moreover, suitable knowledge of the ratio between the weight and range of cannonballs was now required, calling for the greatest precision in measurement and computation. Men of arms were thus obliged to acquire the basic mathematical principles needed for the perfect management of military operations. The display cases at the centre of the room contain instruments designed by the military engineer Baldassarre Lanci, at the service of Cosimo I de' Medici from 1557. In the last display cases are the instruments bought in Germany by Prince Mattias while fighting in the Thirty Years' War as commander of the Medicean army.

Alidade

Setting: Room VI
Maker: Francesco Morelli
Place: Rome
Date: 1788
Materials: brass
Dimensions: length 670 mm
Inventory: 3603

Alidade consisting of a flat bar fitted with sights hinged at the ends. Probably intended for mounting on a plane table. Signed by Francesco Morelli, about whom we have no information.

"Archimetro"

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: steel
Dimensions: length 295 mm
Inventory: 629

Archimetro composed of four rods hinged together like compasses. Two of the rods carry thin folding sticks and optical sights at the ends and on the hinge. The instrument was used for surveying. Provenance: Medici collections.

Barrois compass

Setting: Room VI
Inventor: François Barrois
Maker: Franz Schwartz
Place: Brussels
Date: first half 18th cent.
Materials: brass
Dimensions: length 255 mm
Inventory: 656

This instrument was made by Franz Schwartz, about whom we have no information. It matches the model introduced by François Barrois in 1598 under the name of *Compas Barrois*. Consists of two intersecting graduated diopters that take the shape of double proportional compasses or a double folding square. On one leg slides a cursor to which is hinged a graduated perpendicular vane with sights. The instrument served to measure the internal and external angles of a building, construct regular polygons, measure heights and distances, and conduct surveying work. Provenance: Medici collections.

Beschreibung und underricht diesel frembden…, Wentzel Jamnitzer (facsimile)

Setting:	Room VI
Author:	Wentzel Jamnitzer
Date:	originale ca. 1575 / facsimile 2008
Dimensions:	facsimile 54x20 cm
Inventory:	Firenze, Accademia di Belle Arti, Ms. C.2.1.37

This booklet decribes some instruments housed in a mathematical box. It particularly illustrates the operations of the surveying instrument inv. 691. It was probably acquired in Germany by Giovanni Rucellai in 1632.

Box for mathematical instruments

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	box: red leather with gilt tooling; instruments: brass
Dimensions:	height (closed) 250 mm, width 100 mm
Inventory:	672

Set of instruments, housed in a square box, covered in red leather with gilt friezes and lined in red. The lid is connected to the box by a red tasseled cord running through two pairs of small brass rings. The inside is divided into nineteen compartments that now contain thirteen items, all made of brass: various drawing devices, a pair of small knives, and proportional compasses. Provenance: Medici collections.

Box for mathematical instruments

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: box: black leather with gilt tooling; instruments: brass
Dimensions: height (closed) 225 mm, width 75 mm
Inventory: 671

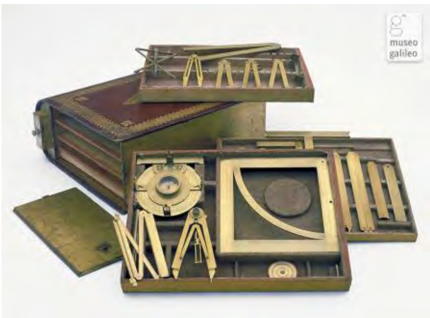
Box for mathematical instruments complete with lid and divided into eighteen compartments. Now contains only seven instruments: an ungraduated square; a file; a small instrument with a pointer at one end and a conical tip at the other; a rod; a reduction compass with an octagonal head and lacking one tip; an instrument with a double pen nib at one end and a sheathed tip at the other; and double dividers. Provenance: Medici collections.

Box for mathematical instruments

Setting: Room VI
Maker: unknown
Date: 18th cent.
Materials: box: wood; instruments: brass
Dimensions: 650x400x90 mm
Inventory: 597

This elegantly decorated box, complete with lock and key, is divided into sixteen compartments. It contains an instrument for drawing ellipses, with its components (tips, keys, steel screws, arms with sliding cursors, and X-shaped base); a gunner's quadrant with folding graduated rod; three rulers (two for plotting parallel lines and one plain ruler); an instrument for measuring angles; and some accessories (screws, pins, tips, and a molded head).

Box for mathematical instruments



Setting: Room VI
Maker: unknown
Date: 18th cent.
Materials: box: wood, leather; instruments: brass and gilt brass
Dimensions: 490x410x190 mm
Inventory: 677

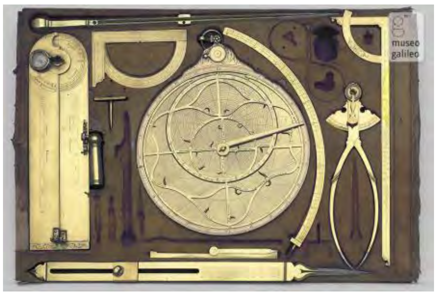
This large, book-shaped box has a red binding and gilt edges. The inside contains a drawer and three shelves carrying the instruments, some of which are missing. There are now several proportional compasses, reduction compasses and dividers; polymetric compasses (i.e., capable of multiple measurements); a plumb level; a few squares including a double square; a *radio latino*; several rulers; a quadrant; a surveying compass; a trigonometer, and a cylindrical weight tapering to a point and fitted with a ring.

Box for mining instruments

Setting: Room VI
Maker: unknown
Place: German
Date: 16th cent.
Materials: instruments: brass; box: wood
Dimensions: 270x190 mm
Inventory: 683

This German-made box comprises three levels containing instruments and accessories (some missing). On the first level are six wrought brass feet and four graduated brass rods. The second level carries a graduated disk with two small magnetic compasses forming the horizontal base of a mining theodolite. The third level contains the following: the vertical part of the mining theodolite, consisting of a graduated circle attached to a rod ending in a hook and fitted with an index, also hook-shaped; a clinometer, a plummet, a magnetic needle, and a plumb bob. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Box of mathematical instruments



Setting: Room VI
Maker: Giacomo Lusverg, Domenico Lusverg
Place: Rome
Date: second half 17th cent. - first half 18th cent.
Materials: brass, copper, glass, steel; case: wood
Dimensions: 530x365 mm
Inventory: 243, 244, 247

This box has three levels, each divided into compartments and containing mathematical instruments.

The first level has twenty-one compartments, some of them empty. It contains: a graduated square and clinometer signed "Iacobus Lusverg Roma 1688"; a compass with quadrant and plumb bob fixed to the hinge; a brass arc signed "Domenico Lusverg 1710 Roma"; an instrument that folds out to a T shape with a fixed bar, a mobile bar, and three steel points as a support; three different types of compasses: (1) proportional compasses, (2) military compasses signed "Dominicus Lusverg 1710 Roma," complete with a magnetic compass, three viewers in the shape of an eagle and monsters, and a stand fastened by means of two keys, (3) a pair of steel-tipped dividers; a semi-circle with a point; a protractor signed "Dominicus Lusverg 1707 Rome"; and an astrolabe for astrological use dated 1659.
The second level has forty-three compartments containing: three-point compasses signed Dominicus Lusverg; a goniometer signed "Dominicus Lusverg Roma 1710"; proportional compasses signed and dated as the previous one; three reduction compasses with polygonal heads, one of which has curved legs; a gunner's caliper and ruler; a rule; a ruler to trace parallel lines signed "Dominicus Lusverg Roma 1710"; a ruler for ellipses; a plumb bob; a square with graduated and folding bar signed "Dominicus Lusverg Roma 1710"; a ruler for ellipses with rotating key signed as the previous item; a case for measuring grains with eight pierced plates; a square signed "Dominicus Lusverg Roma"; six accessories and a finely engraved base to draw ellipses; a pair of dividers with legs jointed by a screw and a compass pencil-holder; a pair of scissors and a steel knife; and a complete magnetic compass signed "Dominicus Lusverg Roma 1710."
The third level, consisting of fourteen compartments, contains: a sundial complete with magnetic compass, graduated arc, and hour circle, with four feet under the base and signed "Dominicus Lusverg 1711 Roma"; a large proportional compass signed "Iacobus Lusverg Roma 16[..]"; a folding linear measure; a brass disk pierced at the center; a ruler to be mounted as an alidade; and a steel bar with two clamps and two sliding accessories for drawing. Provenance: Medici collections.

Box of mining instruments

Setting:	Room VI
Maker:	unknown
Place:	German
Date:	16th cent.
Materials:	instruments: gilt brass; box: leather with gilt tooling
Dimensions:	330x245 mm
Inventory:	2538

Typical set of mining instruments housed in a box with lid. The following items are fitted into special compartments: a mining theodolite consisting of a graduated horizontal disk with two small magnetic compasses, and a graduated circle inserted on a vertical rod and fitted with a hook-shaped index; a triangular clinometer; a protractor disk with an index; another disk fitted with a mobile quadrant at its center to compute slopes in mineshaft excavation; and two plummets. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Caliper compass

Setting:	Room VI
Maker:	Peugeot Frères
Place:	French
Date:	19th cent.
Materials:	steel
Dimensions:	length 185 mm
Inventory:	3693

Caliper compass consisting of two arched legs displaying small straight marks at the hinge point. The instrument is engraved with the name of its makers, the Peugeot brothers, on whom we have no information.

Caliper compass

Setting:	Room VI
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	length 220 mm
Inventory:	652, 3706

Caliper compass consisting of two arched legs displaying small straight marks at the hinge point. The straight marks move along a small graduated arc. Was used to measure the diameter of columns, and the caliber and weight of bronze, iron, lead, and stone shot: each substance had its own scale inscribed on the graduated arc. Provenance: Medici collections.

Carpenter's folding rule

Setting:	Room VI
Maker:	unknown
Place:	English
Date:	17th cent.
Materials:	wood, brass
Dimensions:	length 238 mm
Inventory:	608

Folding rule composed of three rods: two of wood, nine inches long, and one of brass, six inches long. The third is flat and slides into one of the first two. One side has three scales: the first numbered by 1 to 18; it continues to 24 on the brass leg. The other two scales are marked MH (Masthead) e YA (Yardarm) and were used for setting out the taper of ship's masts and yardarms. The opposite side has scales used for measuring areas and volumes.
This kind of instruments was used by carpenters in the building sites and shipyards. Provenance: Medici collections.

Case for military instruments

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	case: leather; instruments: iron, brass
Dimensions:	length 310 mm
Inventory:	620

Leather case shaped like a dagger sheath with gilt tooling. Divided into seven compartments, it now contains six iron and brass items: four rods for packing gunpowder into a harquebus or pushing shot into a gun; a gunner's level with a plumb bob; and a knife. Provenance: Medici collections.

Case of mathematical instruments

Setting:	Room VI
Maker:	Giacomo Lusverg, Domenico Lusverg
Place:	Rome
Date:	late 17th cent. - early 18th cent.
Materials:	brass; case: black leather lined with florentine paper
Dimensions:	case height 192 mm
Inventory:	639, 640, 673, 703

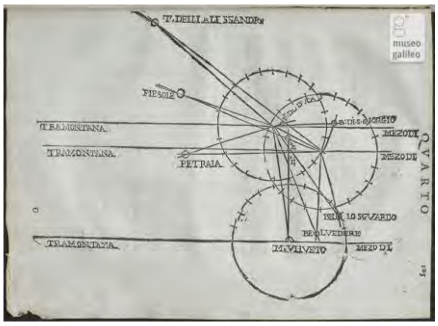
The case is divided into twenty-one compartments. It contains the following precision-made brass instruments: military compasses fitted with a magnetic compass whose cover is signed "Dominicus Lusverg Roma"; a square; a pair of dividers; an instrument to draw parallel lines; a folding linear measure; a bar to draw ellipses, with two points, one of which slides; a pair of dividers with octagonal head and curved legs; another bar to draw ellipses with two sliding points and pencil-holder, signed "Iacobus Lusverg Roma"; and a gunner's quadrant with five viewers and a fitting for a tripod, signed "Iacobus Lusverg Rome." Provenance: Medici collections.

Compass known as Michelangelo's compass

Setting:	Room VI
Maker:	unknown
Place:	Italian
Date:	16th cent.
Materials:	brass, steel; case: cardboard
Dimensions:	length 300 mm
Inventory:	1357

The compass is housed in a cylindrical cardboard case. There are the following steel accessories: two straight pointed rods for recording measurements (dividers), two curved rods for measuring diameters (spherical compass), tweezers, a pencil holder, a paper-cutter, and a small toothed wheel to perforate paper for pouncing. The accessories were attached to the molded brass legs by means of steel clamps. A note in the case stated that the instrument belonged to Michelangelo Buonarroti.

Del modo di misurare le distantie…, Cosimo Bartoli (facsimile)



Setting: Room VI
Author: Cosimo Bartoli
Place: Venice
Date: original 1564 / facsimile 2008
Dimensions: facsimile 45x33 cm
Inventory: Firenze, Museo Galileo, Rari 120

This treatise illustrates instruments and methods of measurement from the writings of many authors. In book IV a detailed topographic survey of Florence is illustrated

Discorso sopra alle misure che fa un pugnale, Anonymous (facsimile)

Setting: Room VI
Author: unknown
Date: original 16th cent. / facsimile 2010
Dimensions: facsimile 30x20,5 cm
Inventory: Firenze, Biblioteca Riccardiana, Ed. Rara 120

The treatise belonged to Bartolomeo Ammannati but may have been written by a captain of the Medici army. It illustrates the operations of an unusual dagger -shaped compass. The instrument could be used as a sundial, plumb level, drawing compass, geometric square, and magnetic surveying compass.

Dividers

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass, steel
Dimensions:	length 460 mm
Inventory:	1486/bis

Large dividers, typically used to record measurements on construction sites and in building surveys. Provenance: Medici collections.

Dividers

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	iron
Dimensions:	length 1090 mm
Inventory:	1000

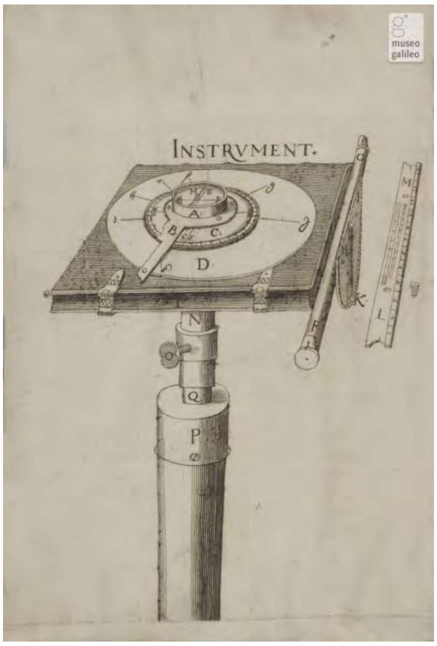
Dividers with two thin, chiseled legs that open by sliding along the arc of a circle. Their large size suggests they may have been used on construction sites. Provenance: Medici collections.

Drawing compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 210 mm
Inventory:	3684

Drawing compass with an octagonal head and two legs carrying a steel tip and a sheath respectively. The sheath contains a removable pencil holder. Provenance: Medici collections.

Eygendliche Beschreibung…, Andeas Albrecht (facsimile)



Setting:	Room VI
Author:	Andreas Albrecht
Place:	Nuremberg
Date:	original 1625 / facsimile 2010
Dimensions:	facsimile 30x19 cm
Inventory:	Firenze, Museo Galileo, Misc 282/ 31

The book is a companion to the theodolite built by Michael Bumel. It illustrates the operations of the instrument invented by the German mathematician and engineer Andreas Albrecht for measuring distances and for surveying work. The device also served to produce perspective drawings.

Folding rule

Setting: Room VI
Maker: Antonio Bianchini
Place: Italian
Date: 16th cent.
Materials: brass
Dimensions: length 380 mm
Inventory: 2511

Folding rule consisting of two wide, flat legs engraved with: the degree scale, the shadow square, the windrose, a scale of equal parts, and a list of forty-two European cities with their respective latitudes. Resembles item inv. 2514 except for the following points: different material (non-gilt brass); magnetic compass, now missing the glass cover and magnetic needle; different hour markings; lack of motto on brevity of life; full signature of maker, Antonio Bianchini. It appears in the *Trattato di diversi istrumenti matematici* (a manuscript dated to 1593) by Antonio Santucci under the name of "Gran Regola di Tolomeo" [Great rule of Ptolemy]. The instrument was used to measure terrestrial and astronomical distances with the help of a ruler (now missing) hinged to one of the legs. The ruler served as the base of the many triangles formed by folding the instrument. The base represented a measure proportional to the distance to be calculated. Provenance: Medici collections.

Folding rule

Setting: Room VI
Maker: Antoine La Motte
Place: Rome
Date: 1768
Materials: brass
Dimensions: length 175 mm
Inventory: 628

Folding rule consisting of two octagonal-section bars bearing measurement scales on their sides: the "mercantile" palm, the "architectural" palm, the Greek and Roman foot, and foot measures in use in various European locations (Vienna, Constantinople, Sweden, London, Amsterdam, Paris, Turin, Danzig [Gdansk], Genoa, Madrid and the Rhone region). One side is engraved with the signature of the maker, Antoine La Motte, about whom we have no information.

Folding square

Setting:	Room VI
Maker:	F. Rousselot
Place:	Paris
Date:	18th cent.
Materials:	brass
Dimensions:	length 145 mm
Inventory:	3629

Folding square signed by the Paris maker F. Rousselot, about whom we have no information. Housed in a boxwood case. On the inside of the lid there is a linear scale for reference. The legs pivot at the center of a small protractor that provides an instant reading of the angular aperture.

Four-point proportional compasses

Setting:	Room VI
Maker:	Giovanni Maccari
Place:	Rome
Date:	1666
Materials:	brass
Dimensions:	length 196 mm
Inventory:	3567

Four-point proportional compasses whose legs are fitted with steel tips and slots for sliding the clamp and pivot. The pivot divides each leg into two parts, whose length ratio determines the operations indicated on the proportional scales engraved on the slits. There is a polygon scale on the front. The back is engraved with scales for squaring the circle and dividing the circumference. The sides of each leg carry scales for line division and for regular bodies. The instrument is signed by Giovanni Maccari, who also made the Galilean sector inv. 3540.

Geometric and military compass

Setting: Room VI
Maker: Giovanni Maccari
Place: Italian
Date: 1676
Materials: brass
Dimensions: length 247 mm
Inventory: 3540

Finely engraved proportional compasses based on the model devised by Galileo (inv. 2430). The legs have various measurement scales: arithmetical scale, geometrical scale, stereometric scale, and metal scale. The instrument is designed to accommodate a quadrant arc (now missing) with a degree scale, a shadow square, and a scale of slopes. Signed by Giovanni Maccari, who also made item inv. 3567.

Graduated ruler

Setting: Room VI
Maker: unknown
Place: Urbino
Date: 1661
Materials: brass
Dimensions: length 291 mm
Inventory: 638, 3703

Ruler consisting of a brass plate engraved with different scales of proportion. On the front is an arithmetical scale divided into 60 equal parts, a geometrical scale divided into 200 decreasing parts, and a polygon scale. The back is engraved with a scale of chords, a scale of metals, a polyhedral scale, and a caliber scale for iron balls The instrument is probably related to the surveying instrument inv. 680, also made in Urbino. The front carries the Medici coat of arms.

Graphometer

Setting:	Room VI
Maker:	Domenico Lusverg
Place:	Rome
Date:	1710
Materials:	brass
Dimensions:	diameter 360 mm
Inventory:	245, 3699

Graphometer consisting of a semi-circle with a degree scale, and a magnetic compass and alidade at the center. In addition to the alidade viewers, there are two sights positioned at 0° and 180°. The back of the instrument carries a fitting for a tripod. Signed by Domenico Lusverg. Provenance: Medici collections.

Graphometer

Setting:	Room VI
Inventor:	Philippe Danfrie
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	diameter 167 mm, height 125 mm
Inventory:	151

Graphometer consisting of a horizontal semi-circle with a degree scale fitted on a rod with sights and mounted on a vertical support. At the center is the compass, around which a diopter rotates. This type of instrument was developed by the Frenchman Philippe Danfrie, who, in 1597, published a treatise illustrating the use of the graphometer. Provenance: Medici collections.

Graphometer

Setting:	Room VI
Maker:	"Ring"
Place:	Berlin
Date:	18th cent.
Materials:	brass
Dimensions:	length 290 mm
Inventory:	3630

Graphometer signed by Ring, a maker about whom we have no information. The base, which rests on an articulated foot, consists of a bar with viewers. The degree scale is fixed to both ends of the bar. A rotating diopter with a magnetic compass and level pivots at the center of the semicircle. The instrument, introduced by Philippe Danfrie in the late sixteenth century, was used to measure position angles in surveying.

Gunner's caliper

Setting:	Room VI
Maker:	unknown
Place:	German?
Date:	17th cent.
Materials:	gilt brass
Dimensions:	length 610 mm
Inventory:	699

Gunner's caliper housed in a leather case in the shape of a small sword sheath with gilt brass trimmings. The case is divided into four compartments, one of which is occupied by the square-shaped instrument. The caliber's four sides each carry a division into 24 equal parts, and decreasing divisions into 400, 1,300, and 2,100 parts. The "Munchen" inscription on one of the sides of the rule suggests a German origin. Provenance: Medici collections.

Gunner's caliper

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 940 mm
Inventory:	695

The square-section instrument is housed in a wooden case covered in red leather with gilt tooling, complete with a lid. The sides of the caliper are inscribed with several scales: a division into 90 decreasing parts (probably a degree scale), a division into 4,200 equal parts, and three metal scales for iron, lead, and stone. Provenance: Medici collections.

Gunner's calliper

Setting: Room VI
Maker: Lorenzo Batecin
Place: Venice
Date: 16th cent.
Materials: gilt brass
Dimensions: length 280 mm
Inventory: 3176

Gunner's caliper consisting of two straight legs curved near the ends. The curved parts carry a degree scale on one side and a gimbaled compass on the other. The compass is fitted with an equinoctial dial. The legs have perforations for the sights, now missing. The plumb bob is also missing. One of the legs carries a hinged graduated arc that slides on the other leg, measuring the angle of aperture. On the hinge is depicted the lion of Saint Mark. One leg is engraved with the name of the inventor, Lorenzo Batecin. Provenance: Medici collections.

Gunner's level

Setting: Room VI
Maker: Josua Habermel
Place: Prague
Date: late 16th cent.
Materials: silver, brass
Dimensions: height 180 mm
Inventory: 669 (arco), 2539

Gunner's level made by Josua Habermel. The curved base was set on the breech end of the barrel to measure the gun's elevation. On the level slides a plate carrying a magnetic compass, a graduated circle with an index, and a vertical graduated rod with a cursor index. The center of the graduated rod holds a laterally mounted clinometer. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Gunner's quadrant

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	max. length 420 mm
Inventory:	1303

This gunner's quadrant is composed of two flat legs of uneven length, joined at a right angle. A graduated arc enabled made it possible—presumably with the use of a plumb bob tied in the corner—to measure scarp-wall gradients and gun elevations. The model from which this example derives is described by Niccolò Tartaglia in *Nova scientia* (Venice, 1537). Provenance: Vincenzo Viviani bequest.

Gunner's quadrant

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 330 mm (lower side 130 mm), arc radius 75 mm
Inventory:	659

This gunner's quadrant is composed of two flat legs of different lengths, joined at a right angle and connected by a graduated arc. Thanks to a plumb line suspended from a hole in the corner, the arc enabled the gunner (1) to determine the ratio of the calibers of the iron and bronze shot to the required gun elevation, and (2) to measure the gradients of scarp walls in fortifications. Niccolò Tartaglia describes a similar gunner's quadrant in *Nova scientia* (Venice, 1537). Provenance: Medici collections.

Gunner's sight and level

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	gilt brass
Dimensions:	height 160 mm
Inventory:	3689

Gunner's level consisting of a small slit brass bar placed vertically on a curved base. There was a plumb bob, now missing. Was used to aim guns by placing the curved base on the cannon breech. Provenance: Medici collections.

Gunner's sight and level

Setting:	Room VI
Maker:	unknown
Date:	16th cent.
Materials:	gilt brass
Dimensions:	height 130 mm
Inventory:	670

Gunner's level consisting of two small slit brass bars placed vertically: between the bars slides a cursor with an index. The instrument, which had a plumb bob and a curved base, was used to aim guns by placing the base on the cannon breech. Provenance: Medici collections.

Gunner's sight and level

Setting:	Room VI
Maker:	unknown
Place:	German?
Date:	16th cent.
Materials:	brass, silver
Dimensions:	height 70 mm
Inventory:	2531

Gunner's level consisting of two thin parallel silver plates fastened to a curved brass base. In the slit between the strips runs a cursor with an index. The base is mobile. The instrument, which had a plumb bob, was used to aim guns by placing the base on the cannon breech. A comparison with similar but more elaborate instruments carrying engraved decorations suggests this specimen may have been used in battle. Provenance: Medici collections.

Horizontal dial

Setting:	Room VI
Maker:	Georg Zorn
Place:	Augsburg
Date:	1613
Materials:	gilt brass
Dimensions:	diameter 140 mm
Inventory:	2484

Horizontal dial consisting of a disk mounted on a wooden base and complete with gnomon and magnetic compass for orientation. Made by Georg Zorn, about whom we have no information. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Le due regole della prospettiua prattica…, Jacopo Barozzi da Vignola (facsimile)

Setting: Room VI
Author: Jacopo Barozzi da Vignola
Place: Rome
Date: original 1583 / facsimile 2010
Dimensions: facsimile 49x34,6 cm
Inventory: Firenze, Museo Galileo, MED G.F 006

First published in Rome in 1583 with commentaries by Father Egnazio Danti, Vignola's treatise is one of the main Renaissance sources on perspective. It illustrates the "two rules" of perspective drawing and selected instruments and optical games in the Medici collection, such as Baldassarre Lanci's distance meter and the catoptric double portrait (i.e., visible with a mirror) by Ludovico Buti.

Level

Setting: Room VI
Maker: Domenico Lusverg
Place: Rome
Date: 1710
Materials: brass, glass
Dimensions: 428x153 mm
Inventory: 701

Level consisting of a glass tube resting on a brass support. There is also a graduated arc and an engraved coat of arms representing an eagle and the image of a monster. The instrument has a fitting for a tripod and two sights. It was used for leveling and in the construction of aqueducts. Signed by Domenico Lusverg. Provenance: Medici collections.

Magnetic compass

Setting: Room VI
Maker: unknown
Place: German
Date: 16th cent.
Materials: gilt brass
Dimensions: diameter 65 mm
Inventory: 3182

Finely crafted magnetic compass complete with lid. Rotates on a graduated disk and displays a windrose. The straight base was probably attached to a rod that, when placed against the wall of a building, served to determine the wall's orientation relative to the magnetic north. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Measuring rule

Setting: Room VI
Maker: unknown
Place: English
Date: 16th cent.
Materials: wood, gilt brass
Dimensions: length 910 mm
Inventory: 694

Rule, complete with case, consisting of a square-section wooden rod with a gilt brass collar. One side carries divisions into inches and feet, the other a meridian line and a shutter concealing a housing for the sights and, perhaps, a plumb bob (now missing). There is a black wooden rod with brass sights and a short brass graduated rod made of two jointed sections. The instrument was used for measurements and ballistic computations. Provenance: Medici collections.

Military compass

Setting: Room VI
Maker: unknown
Date: 16th cent.
Materials: iron, brass
Dimensions: length 415 mm
Inventory: 1277

Dagger-shaped compass for geometrical, surveying, and military applications. The functions of the instrument are described in a manuscript in the possession of Bartolomeo Ammannati and, later, Vincenzo Viviani. The dagger blade comprises parts that open like compass legs. The handle knob contained a magnetic compass with a dial, now missing. Inside the blades were two small graduated rods, one of them folding. They served to take measurements in palms and Florentine *braccia*, and to use the compasses as a plumb level. The sheath also contained a square enabling the instrument to be used for measuring verticals, slopes, distances, heights, and depths. In artillery, the dagger served to set guns to the horizontal and to measure the caliber and weight of shot. Another device for military use was the goniometric circle divided into eight 45° sectors.

When attached to the handle, the circle enabled the user to measure the dimensions of fortresses and draw their plans. Provenance: Vincenzo Viviani bequest.

Military compass

Setting:	Room VI
Maker:	unknown
Place:	French
Date:	18th cent.
Materials:	brass
Dimensions:	length 170 mm
Inventory:	3692

Military compass consisting of two flat, graduated legs with markings in French. The front sides of the legs display a scale divided into equal parts; the values of gun calibers and the corresponding values of shot diameters are shown on the back. Possible provenance: Medici collections.

Military instrument

Setting:	Room VI
Maker:	Baldassarre Lanci
Place:	Italian
Date:	1557
Materials:	gilt brass
Dimensions:	diameter 150 mm
Inventory:	682

The instrument consists of a circular plate whose rim carries a degree scale divided into eight 45° sectors, the names of the winds, and, on a protruding portion, other two graduated scales. On the inner circle is the signature of the maker, Baldassarre Lanci, and the date, 1557 ("BALTHASSAR LANCÆVS URBINAS FACIEBAT A.N.D. MDLVII"). A magnetic compass is mounted at the center. Around it rotate the arched legs fitted with sights. One of the legs is fixed; the other is movable and has an adjustable viewfinder and a graduated clinometer with plumb bob. The clinometer carries the initials of the maker, "B.L." (Baldassarre Lanci). The instrument was used to measure the diameter of cannons and projectiles, distances, and heights, as well as for surveying. Provenance: Medici collections.

Military instrument

Setting: Room VI
Maker: Joost Bürgi [attr.]
Place: German
Date: late 16th cent.
Materials: gilt brass
Dimensions: length 300 mm
Inventory: 2530

Military instrument probably made by Joost Bürgi, as suggested by the initials I.B.F. [Iost Burgi Fecit]. Consists of a graduated central rod carrying a magnetic compass, a plumb bob, and a horizontal dial complete with gnomon. Along this rod slides a cursor, to which are hinged two graduated arms carrying two other small rods at the ends. As with item inv. 2510, this arrangement appears to be a variant of the *radio latino*, given the parallelogram shape formed by the jointed arms. The instrument was therefore used for measuring angles, heights, and distances and for surveying. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Military rule

Setting: Room VI
Maker: unknown
Place: Italian?
Date: 16th cent.
Materials: brass
Dimensions: length 290 mm
Inventory: 657

Square-section brass rule, graduated on one side only with decreasing scales up to 200 parts. Very similar to inv. 658, it was probably part of a more complex instrument such as a surveying compass. Provenance: Medici collections.

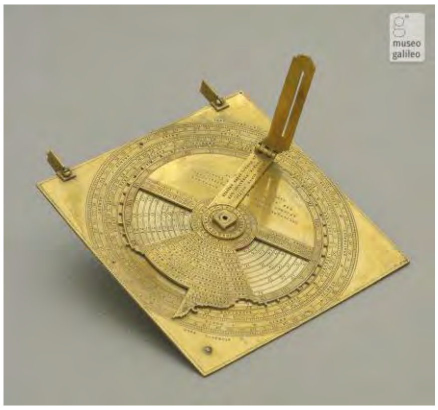
Military rule

Setting: Room VI
Maker: unknown
Place: Italian?
Date: 16th cent.
Materials: brass

Dimensions: length 280 mm
Inventory: 658

Square-section brass rule, graduated on one side only with decreasing scales up to 200 parts. Very similar to inv. 657, it was probably part of a more complex instrument such as a surveying compass. Provenance: Medici collections.

Nocturnal and sundial



Setting: Room VI
Maker: Georg Zorn
Place: Augsburg
Date: 1613
Materials: gilt brass
Dimensions: 126x126
Inventory: 2498

Disk with folding index arm rotating on a square plate carrying fixed sights for altitudes. The diurnal hours and night hours are marked for several latitudes. There are also markings for the climates. On the back are a nocturnal and sundial, a 90° quadrant with a shadow square, and the sine scale. Made by Georg Zorn, about whom we have no information. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Odometer

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: silvered brass
Dimensions: diameter 130 mm
Inventory: 648

Incomplete odometer comprising a disk with mobile indexes. The circumference is engraved with numbers. This is almost certainly the surviving counter of a lost mechanism for recording the revolutions of a vehicle wheel. Provenance: Medici collections.

"Organum Mathematicum"

Setting:	Room VI
Inventor:	Athanasius Kircher
Maker:	unknown
Place:	Italian
Date:	late 17th cent. - early 18th cent.
Materials:	wood
Dimensions:	445x310x250 mm
Inventory:	2741

Instrument composed of a veneered wooden chest with a hinged lid. On the lid and the front side are two rotating squares of painted copper. On the back, a small hinged shutter conceals a small empty chamber. The inside of the chest is divided into nine compartments, one for each of the following subjects: Arithmetic, Geometry, Art of fortifications, Chronology, Horography, Astronomy, Astrology, Steganography, and Music. Each compartment contains twenty-four small rods ending in a colored triangular tip. On each of the nine series of twenty-four small rods are inscribed definitions and information on the corresponding subject. At least one rod in each of the nine compartments has a black tip and constitutes the *application table*, which gives the rule for proper use. To multiply 74 x 8, for example, one removes the black-tipped rod from the Arithmetic compartment and places it next to the rods carrying the numbers 7 and 4 at the top. The eighth line on the black-tipped rod gives the desired product. This chest, was invented by Athanasius Kircher, who called it *Organum Mathematicum* or *Cista mathematica* or *Arca*. Described by Gaspar Schott in *Organum Mathematicum libris IX explicatum* (Herbipoli [Würzburg], 1668), it is a sort of portable encyclopedia, or comprehensive system for the classification of knowledge.

Organum mathematicum libris IX…, Gaspar Schott (facsimile)

Setting:	Room VI
Author:	Gaspar Schott
Place:	Herbipoli [Würzburg]
Date:	original 1668 / facsimile 2010
Dimensions:	facsimile 34x24 cm
Inventory:	Firenze, Museo Galileo, MED 0791

The Jesuit Gaspard Schott popularized the mathematical work of his teacher, Athanasius Kircher. In this text, he illustrates the functioning of the "Organum Mathematicum," a rod-based calculating machine invented by Kircher to easily perform the most complex arithmetical and geometrical operations.

Pantograph

Setting: Room VI
Maker: Joseph Meinicke
Place: Vienna
Date: 18th cent.
Materials: wood
Dimensions: box: 820x170 mm
Inventory: 596

Wooden pantograph with collars, brass tips and hinges, and small bone wheels. Housed in a wooden box with a hinged lid containing other accessories.

Plumb level

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: wood
Dimensions: radius 160 mm
Inventory: 3184

Plumb level comprising a painted and molded triangular wooden frame with two viewer and two brass hooks. The holder for the plumb bob (now missing) is fastened to the vertex. The legs are joined by two graduated arcs. Provenance: Medici collections.

Plumb level

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 160 mm
Inventory: 3690

Plumb level composed of two smooth, flat legs resting on feet. The legs are joined by a folding rod, graduated from 0° to 90°. From the perforated vertex hung a plumb bob, now missing. This type of instrument was widely used for leveling operations in building construction.

Plumb level

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 200 mm
Inventory: 654

Plumb level composed of two smooth, flat legs resting on feet. The legs are joined by a folding rod, graduated from 0° to 90°. From the perforated vertex hung a plumb bob (replica). This type of instrument was widely used for leveling operations in building construction. Provenance: Vincenzo Viviani bequest.

Plumb level

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 155 mm
Inventory: 3604

Small folding plumb level consisting of two legs hinged at a right angle. The legs rest on feet and carry two orthogonal arms that join like a hinge. There are a plumb bob and screws to lock the legs closed. The instrument was used to find the horizontal. Provenance: Medici collections.

Plumb level (gunner's level) and proportional compasses

Setting: Room VI
Maker: Pierre Galland
Date: 18th cent.
Materials: brass
Dimensions: length 180 mm
Inventory: 3695

This instrument was made by Pierre Galland, about whom we have no information. It is a plumb level that also functions as a set of proportional compasses. At the swivel joint there is a small square plate for opening the legs at a right angle. A small bar housed in one of the legs can be placed crosswise to intersect the plumb bob (missing). The bar carries a graduated scale whose values decrease toward the center, serving as a degree scale (with two 45° sectors). The flat legs are engraved with several proportional scales: arithmetical scale, volume scale, area scale, and polygon scale on the front; scale for squaring the circle and metal scale on the back.

Portrait of Nikolaus Kratzer

Setting: Room VI
Author: unknown
Date: unknown
Inventory: 3566

Portrait of the mathematician Nikolaus Kratzer surrounded by his working instruments: compasses - squares - sundials. An excellent copy of the original painting by Hans Holbein the Younger.

Proportional and surveying compasses

Setting: Room VI
Inventor: Leonard Zubler [attr.]
Maker: Georg Zorn
Place: Augsburg
Date: 1618
Materials: gilt brass
Dimensions: length 420 mm
Inventory: 2510

This instrument, apparently invented by Leonard Zubler, was made by Georg Zorn, about whom we have no information. It combines the characteristics of proportional compasses and the *radio* *latino*. The sides of the two main legs are engraved with several proportional scales. The central leg, which is fixed, ends in a ring that probably contained a gimbaled magnetic compass. The three legs are joined by two small jointed arms that slide on the central leg, indicating the angle formed by each of the main legs. The angle values up to 120° were shown on the central leg, which also displays the values of the sides of the polygons that can be drawn with different compass openings. Fitted with viewers (now missing), the instrument could be used for surveying. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Proportional compasses

Setting:	Room VI
Maker:	Antonio Costa
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	length 320 mm
Inventory:	Dep. GN, Roma

Proportional compasses with two flat legs, engraved with several proportional scales that give the limb its characteristic profile. The backs of the legs carry an arithmetical scale, a geometric scale, a scale of cubic roots, a polygon scale, and a metal scale. The front displays a chord scale, a tangent scale, the "added" scale (also found on the Galilean compass, inv. 2430), a polyhedral scale, and a scale of the ratios between volumes. Signed by Antonio Costa, about whom we have no information.

Proportional compasses

Setting:	Room VI
Maker:	Jacques Canivet
Place:	Paris
Date:	18th cent.
Materials:	brass
Dimensions:	length 143 mm
Inventory:	3647

Flat-legged proportional compasses made by Jacques Canivet. The front sides of the legs are engraved with the polygon scale and arithmetical scale. The back carries the scale of chords and the metal scale.

Proportional compasses

Setting: Room VI
Maker: Jost Miller
Place: Strasbourg
Date: 1616
Materials: brass
Dimensions: length 360 mm
Inventory: 2512

Like the compasses designed by Thomas Hood, these proportional compasses are fitted with a semicircular sector bearing the degree scale, the shadow square, and other measurement scales. Made by Jost Miller, about whom we have no information. Provenance: Medici collections.

Proportional compasses

Setting: Room VI
Maker: Pierre Le Maire
Place: Paris
Date: 18th cent.
Materials: brass
Dimensions: length 175 mm
Inventory: 3676

Flat-legged proportional compasses with the polygon scale, scale of chords, and scale of artillery-shot diameters on the front. The back carries the polyhedron scale, the metal scale, and the caliber scale. The instrument was clearly for geometrical and military use. Like item inv. 3677, signed by Pierre Le Maire.

Proportional compasses

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: length 170 mm
Inventory: 650

Proportional compasses consisting of flat legs folding over each other like scissors and fitted with steel tips. The legs are inscribed with decreasing graduations (from 2 to 12) to divide a line down to the twelfth part. The hinge has an index and graduated semi-circle (divided into 180°) to measure angular apertures. Provenance: Medici collections.

Protractor

Setting: Room VI
Maker: David Usslaub
Place: German
Date: 1599
Materials: gilt brass
Dimensions: diameter 90 mm
Inventory: 3182

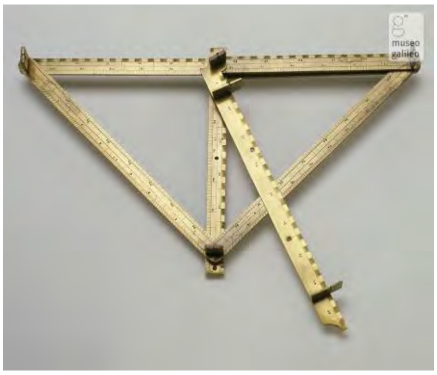
This protractor, made by David Usslaub, may have also formed part of a more complex instrument such as a surveying magnetic compass. In all likelihood, however, its only use was to reproduce on a sheet of drawing paper the position angles recorded in surveying work. The purpose of the process was to draw a topographic map. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Protractor

Setting:	Room VI
Maker:	unknown
Date:	16th cent.
Materials:	brass
Dimensions:	diameter 80 mm
Inventory:	683, 2526

Protractor consisting of a graduated circle and index. The central space, which is empty, is divided into four sections, one of which is occupied by a small quadrant. This part rotates inside the circle. Provenance: Medici collections.

"Radio latino"



Setting:	Room VI
Inventor:	Latino Orsini
Maker:	Carlo Doni
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	max. length 1460 mm
Inventory:	619

Radio latino (so called because it was invented by Latino Orsini) composed of eight hinged rods equipped with compass and viewers. On the rods are engraved various measurement scales: a scale of 190 equal parts, a geometrical quadrant, a degree scale, a scale for the division of circles and lines, a scale of polygons, a scale of weights and a linear measure in sub-multiples of the Florentine unit of length, the *braccio*. On the bars forming the central axis are several holes and different types of interchangeable steel points. The instrument is signed by Carlo Doni, about whom we have no certain information: he may have been either the client or the maker. The engravings and the structural characteristics resemble those found on instruments produced in Renaissance Florentine workshops. Provenance: Medici collections.

"Radio latino"

Setting:	Room VI
Inventor:	Latino Orsini
Maker:	unknown
Place:	Italian
Date:	late 16th cent.
Materials:	brass
Dimensions:	length 440 mm
Inventory:	647

The *radio latino* (named after its inventor, Latino Orsini) was used to measure distances, heights, and depths by means of rangefinding operations. For this purpose, it is fitted with four jointed rods forming a kite. The rods slide on the central rod and are inscribed with several measurement scales such as the shadow square and the degree scale. The viewer fitted on the joints for rangefinding operations are missing. The instrument, from the Medici collections, is portrayed on the ceiling of the Stanzino delle Matematiche in the Uffizi.

Reduction compass

Setting:	Room VI
Maker:	Agostino Rastrelli
Place:	Florence
Date:	1719
Materials:	brass, steel; case: wood, leather
Dimensions:	length 265 mm
Inventory:	688

Reduction compass with fixed center, signed by Agostino Rastrelli, a maker about whom we have no information. Contained in a black case. There are accessories with interchangeable points of different lengths according to the reduction ratios desired.

Reduction compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 150 mm
Inventory:	633

Reduction compass with a moving center for reducing measurements by a factor ranging from 2 to 10. This is done by shifting the central hinge to one of the several points marked on the shorter section of the legs. The longer section is fitted with a micrometer screw for a precision adjustment of the compass opening. The instrument was used mainly to reproduce drawings. Very similar to item inv. 655.

Reduction compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 210 mm
Inventory:	3686

Reduction compass with a moving center for reducing measurements by a factor ranging from 2 to 15. This is done by shifting the central hinge to one of the several points marked on the shorter section of the legs, numbered in sequence from 1/2 to 1/15. The instrument was used mainly to reproduce drawings. Provenance: Medici collections.

Reel

Setting:	Room VI
Maker:	unknown
Place:	German
Date:	16th cent.
Materials:	wood, rope, gilt brass
Dimensions:	length 195 mm
Inventory:	617

Instrument consisting of a small profiled rotating axle with a carved wooden handle. Wound on the axle is a cord carrying small bells at regular intervals, which serve as markers for measuring distances. Probably part of a set of mining instruments. Served to wind in coils a rope used for measurements and alignments in mineshaft excavation. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Ruler

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 174 mm
Inventory:	1322, 3683

Incomplete ruler composed of two flat legs carrying a series of unnumbered notches. Provenance: Vincenzo Viviani bequest.

Stands

Setting:	Room VI
Maker:	unknown
Place:	German
Date:	16th cent.
Materials:	wood, gilt brass
Dimensions:	length 240 mm

Inventory: 709

This support consists of eight turned wooden leg sections and a tip. The ornamentation suggests the item formed part of a box of mining instruments. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Surveying compass

Setting: Room VI
Maker: Matteo Botti, Giovanbattista Botti
Place: Italian
Date: 17th cent.
Materials: brass
Dimensions: diameter 180 mm
Inventory: 2506

Surveying compass consisting of a disk whose circumference is divided into eight 45° sectors carrying the names of the winds. On the lower half is engraved a double shadow square. In the upper part is a horizontal sundial with a gnomon on the alidade. The alidade, equipped with viewers, rotates around a magnetic compass complete with a glass cover and a magnetic needle. The magnetic declination, of 5° W, is indicated under the compass. At one end of the alidade is fixed a perpendicular bar, tangent to the circumference. The bar could be used for architectural surveying as a means of measuring the declination of the walls of a building. There are no markings on the back of the disk except the names of Matteo and Giovanbattista Botti. We have no information on Giovanbattista. Provenance: Medici collections.

Surveying compass

Setting: Room VI
Maker: Baldassarre Lanci
Place: Florence or Siena
Date: 16th cent.
Materials: gilt and enameled brass
Dimensions: length 480 mm, diameter 195 mm
Inventory: 144

Surveying compass built by Baldassarre Lanci, an engineer employed by the Medici. The maker's name, "INVENTVM ET OPVS BALDASSARRIS," is lightly etched on the outer rim of the circular plate. Only the letter "V" of "OPVS" is punched, clearly indicating an unfinished work. The instrument consists of a circular plate whose circumference is divided into eight 45° sectors, corresponding to the eight directions of the winds. The east-west axis carries two long rods with sights that are also fitted with two small cylindrical guides, in which a long brass stylus may have slided. Like Lanci's surveying instrument (inv. 152, 3165), this compass also probably served for making perspective drawings. The stylus was presumably used to plot the points of the sighted object on the sheet of drawing paper. Inside the circumference, along with the windrose, is the shadow square. A circular crown, hinged at the center, carries a diopter that housed a compass, now missing. The instrument was mainly used for surveying and for measuring distances and heights. The verso of the central round section folds along a hinge. One half contains a dial with gnomon; the other contains a toothed wheel with a moving index. The inscriptions are in Italian. This finely decorated instrument is illustrated in Antonio Santucci's *Trattato di diversi istrumenti matematici*, a manuscript datable to 1593. Provenance: Medici collections.

Surveying compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	diameter 95 mm
Inventory:	1279

Surveying compass consisting of a circular plate along whose edge are inscribed two degree scales: one divided into eight 45° sectors, in keeping with the traditional layout of the windrose, the other divided into four 90° sectors. At the center is the compass, but it lacks the magnetic needle and a lid. This richly ornamented instrument belonged to Vincenzo Viviani.

Surveying compass

Setting:	Room VI
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	side 209 mm
Inventory:	2508

Surveying compass consisting of a square plate divided into one hundred equal parts on each side. Inside the square is inscribed a circle with the names of the winds in Italian. Inside the circle is inscribed the shadow square and at the center is fitted the compass with magnetic needle.

There are a diopter with sights and a small bell for suspending the instrument. Provenance: Medici collections.

Surveying compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 160 mm
Inventory:	3687

Surveying compass with two flat steel-tipped legs. The hinge houses a magnetic compass (complete with lid) used to orient the instrument for measuring position angles in surveying work. Provenance: Medici collections.

Surveying compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	length 300 mm
Inventory:	1280

Surveying compass composed of two flat legs, one of which ends in a screw for fastening the instrument to a support. The legs have four mobile sights and two cursors fitted with long tips at right angles to each other. The legs carry a 190-part graduation on the front and several arithmetical scales on the back. In addition to measuring position angles in surveying work, the instrument could be used as a set of proportional compasses. Provenance: Vincenzo Viviani bequest.

Surveying compass

Setting:	Room VI
Maker:	unknown
Place:	Italian
Date:	17th cent.
Materials:	brass
Dimensions:	length 210 mm
Inventory:	1471

Surveying compass with two flat steel-tipped legs. The hinge houses a magnetic compass used to orient the instrument for measuring position angles in surveying work. The magnetic compass lacks a magnetic needle and is surrounded by a windrose. The graduated disk around the hinge bears the names of the winds in Italian. Provenance: Medici collections.

Surveying compass

Setting:	Room VI
Maker:	unknown
Date:	17th cent.
Materials:	brass
Dimensions:	diameter 265 mm
Inventory:	3371

Surveying compass consisting of a circular plate whose circumference carries a degree scale divided into eight 45° sectors. At the center is the windrose, containing a compass complete with glass and magnetic needle. Around the compass rotates the diopter with sights, at whose ends is attached a half-square circumscribing the main disk. There is a cardboard case, with iron reinforcements and a wooden lining, divided into three compartments. Provenance: Medici collections.

Surveying instrument

Setting:	Room VI
Maker:	Baldassarre Lanci
Place:	Italian
Date:	1557
Materials:	gilt brass
Dimensions:	diameter 300 mm, height on tripod 1390 mm
Inventory:	152, 3165

This surveying instrument consists of a circular plate whose rim carries a Latin inscription explaining its use "for operations of Geography, Corography and Cartography." The instrument's functions are finely illustrated in an engraving that fills the upper half of the plate, where some surveyors can be seen at work in front of a landscape. The lower half of the plate is occupied by a shadow square, a half windrose with a degree scale, and a geographic planisphere. The whole is contained in a square inscribed in the plate's circumference, and divided into 200 parts per side. The upper side of the square is inscribed with the maker's initials "BL" (Baldassarre Lanci), whose full name, together with the date 1557, appears on a rectangular block mounted on the base of the square. This element has a fixed lower part whose right end carries a folding arm with sights, divided into 400 parts, and an upper sliding part whose left end carries a folding arm identical to the previous one. Below the block was a small magnetic compass of which only the housing survives. At the center of the plate pivots a small column that bears a sliding needle surmounted by a tube sight that can be adjusted vertically as well as horizontally.
The instrument was used for measuring distances and heights, for surveying and—thanks to the central element—for making perspective drawings. These were made on a small curved table (now missing) lodged in the three holes visible along the rim of the disk. The instrument's use for the latter task is recorded by Daniele Barbaro in *La pratica della perspettiva* [The practice of perspective] (Venice, 1569) and by Egnazio Danti in his commentary on Jacopo Barozzi from Vignola's *Le due regole della prospettiva* [The two rules of perspective] (Rome, 1583). Provenance: Medici collections.

Surveying instrument

Setting:	Room VI
Inventor:	Wentzel Jamnitzer
Maker:	Wentzel Jamnitzer
Place:	Nuremberg
Date:	ca. 1575

Materials: yew wood, gilt brass
Dimensions: length 847 mm, disk diameter 141 mm
Inventory: 691

Surveying instrument invented by the Nuremberg goldsmith Wentzel Jamnitzer in 1575. Consists of a graduated brass disk hinged off-center on a long wooden alidade with brass sights. The disk carries two graduated scales: the double shadow square, engraved along the upper half-circumference of the inner circle, and the degree scale (180°), engraved on the lower section of the outer circle. Two brass indexes (one now missing) marked the alidade's inclination on the graduated scales during surveying work. A plumb level, now missing, enabled the user to keep the common diameter of the two circles vertical. This made it possible to determine the horizontal level of aqueducts and plots of land (with the alidade in horizontal position) and measure heights, distances, and depths (with the alidade tilted toward a distant point). During measurements, the alidade was blocked in the sighting position by means of the small steel clip placed on the back of the disk. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Surveying instrument

Setting: Room VI
Maker: Christoph Trechsler
Place: German
Date: 1572
Materials: gilt brass
Dimensions: side of square 63 mm, length of longest side of triangle 120 mm
Inventory: 643

Set of two small instruments of similar design: the first is a heavy square with a magnetic compass (missing its magnetic needle) with mobile indexes and two graduated circles; the second is a triangle, bearing on its side the initials of its maker, "C. T." (Christoph Trechsler), and a small arc with decreasing graduations that represent a linear scale. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Surveying rod

Setting: Room VI
Maker: unknown
Place: German
Date: 16th cent.
Materials: wood, gilt brass
Dimensions: length 745 mm
Inventory: 693

Circular-section wooden rod with brass reinforcements at both ends. The wood carries a linear scale with gold markings divided into 12 inches, corresponding to the Nuremberg foot (29.7 cm). The numbering runs from 1 to 12 and from 25 to 28. At the center is a German inscription: *This ruler is 2.5 feet long*. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Surveying rods

Setting: Room VI
Maker: unknown
Place: German
Date: 16th cent.
Materials: gilt brass
Dimensions: length 880 mm
Inventory: 2536, 2537

Two supports, each consisting of three sections and two caps. These were accessories for mining instruments. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Surveyor's square

Setting:	Room VI
Maker:	unknown
Place:	Urbino
Date:	1654
Materials:	brass
Dimensions:	150x60 mm
Inventory:	680

This surveyor's square consists of a hollow cylinder with eight vertical slits placed around its circumference at 0°, 30°, 90°, 135°, 180°, 210°, 270°, and 315°. The cylinder base has a central socket to fix the instrument onto a tripod (now missing). The upper part is closed by a disk with a graduated rim and a magnetic compass at its center. The compass has a cover and an alidade with viewers. The upper part was used for surveying, while the cylinder with the eight slits was used to establish alignments at right angles and at 30° and 45° angles. The instrument is probably related to the rule inv. 638, 3703, also made in Urbino. Provenance: Medici collections.

Surveyor's square

Setting:	Room VI
Maker:	Domenico Lusverg
Place:	Rome
Date:	1710
Materials:	brass
Dimensions:	diameter 83 mm, height 143 mm
Inventory:	681

Surveyors' square consisting of a hollow cylinder with eight vertical slits placed 45° apart from one another. The cylinder base has a central fitting to attach the instrument to a tripod (now missing). The upper part is closed by a disk with a graduated rim; there is a magnetic compass in the center, with a cover and an alidade with viewers. The upper part was used for surveying, while the cylinder with the eight slits was used to trace perpendicular alignments and 45° angles. Signed by Domenico Lusverg. Provenance: Medici collections.

Theodolite

Setting: Room VI
Maker: Erasmus Habermel
Place: Prague
Date: late 16th cent.
Materials: brass; box: leather with gilt tooling
Dimensions: diameter 250 mm
Inventory: 154

Theodolite built by Erasmus Habermel. The central disk carries four linear scales and the shadow square. At the center pivots a diopter with an index and a magnetic compass. Attached to the rim are a circular band with six concentric circumferences, a degree scale, and two diametrically opposing viewers. The instrument was used to measure heights and distances and to record position angles in surveying. There is a gold-tooled leather case. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Theodolite

Setting: Room VI
Maker: unknown
Date: 17th cent.
Materials: brass
Dimensions: compass diameter 130 mm, semicircle diameter 198 mm, height 219 mm
Inventory: 149

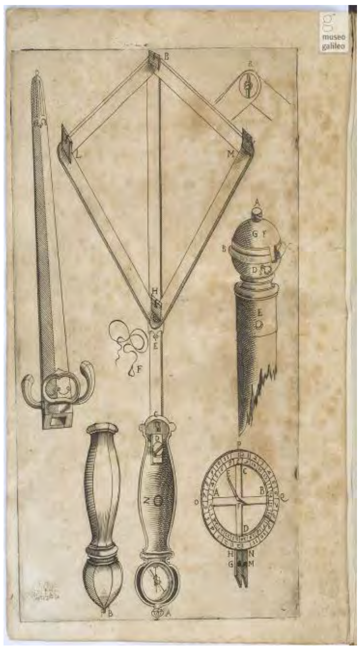
Theodolite with wooden support, consisting of a circular plane fitted onto a straight base. The plane carries a round sheet of paper with the compass and a diopter at its center. At the center of the straight base is hinged another diopter bearing a vertical semi-circle with a degree scale and plumb bob. In surveying work, the position angles of the points sighted would be marked on the sheet. Distances and heights were computed by reading the angle of inclination of the line of sight shown by the plumb bob on the vertical semi-circle. For building surveys, the straight base could be held against the wall to determine the wall's orientation relative to the magnetic north. Provenance: Medici collections.

Theodolite

Setting:	Room VI
Inventor:	Andreas Albrecht [attr.]
Maker:	Michael Bumel
Place:	Nuremberg
Date:	1625
Materials:	brass, wood
Dimensions:	compass diameter 100 mm, max. length 365 mm, height 210 mm
Inventory:	150

This unusual theodolite is joined to the book describing its construction and use. Placed at the horizontal on a pedestal, the book carries on its cover a magnetic compass with a sundial, and on its top edge a viewer, with a degree scale, a shadow square, and a plumb bob. The book was written in German and printed in Nuremberg in 1625. It explains that the purpose of the instrument was to measure distances, heights, and depths, to conduct surveying work, and to produce perspective drawings. The maker was Michael Bumel; the author of the book, and possible inventor of the instrument, was Andreas Albrecht, from Nuremberg. Provenance: Medici collections.

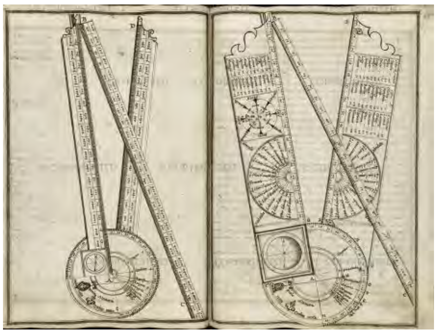
Trattato del Radio Latino…, Latino Orsini (facsimile)



Setting:	Room VI
Author:	Latino Orsini
Place:	Rome
Date:	original 1583 / facsimile 2008
Dimensions:	facsimile 35x24 cm
Inventory:	Firenze, Museo Galileo, Rari 099

Work edited and commented by Egnazio Danti, in which is described the astronomic and topographic military instrument designed by the author (inv. 647 and 619). The plate on display illustrates the different parts of the instrument.

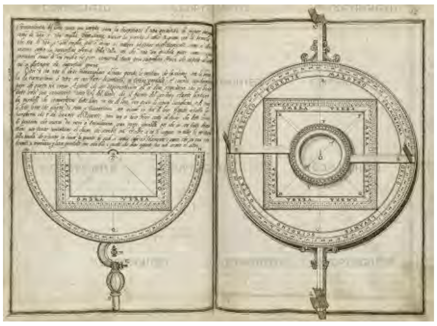
Trattato di diuersi istrumenti matematici…, Antonio Santucci (facsimile)



Setting:	Room VI
Author:	Antonio Santucci
Date:	original 1593-1594 / facsimile 2008
Dimensions:	facsimile 44x32,5 cm
Inventory:	Firenze, Biblioteca Marucelliana, Ms. C 82, cc. 44v-45r

Anonymous, but most certainly a work by Antonio Santucci, the cosmographer or "Master of the sphere" of Ferdinando I, this treatise describes some of the most important astronomical and surveying instruments kept in the Grand Ducal Wardrobe. The folio on display illustrates the folding rule inv. 2514.

Trattato di diuersi istrumenti matematici…, Antonio Santucci (facsimile)



Setting:	Room VI
Author:	Antonio Santucci
Date:	original 1593-1594 / facsimile 2008
Dimensions:	facsimile 44x32,5 cm
Inventory:	Firenze, Biblioteca Marucelliana, Ms. C 82, cc. 31v-32r

Anonymous, but most certainly a work by Antonio Santucci, the cosmographer or "Master of the sphere" of Ferdinando I, this treatise describes some of the most important astronomical and surveying instruments kept in the Grand Ducal Wardrobe. The folio on display illustrates the use of a surveying compass.

Triangulation compass

Setting: Room VI
Maker: Joost Bürgi
Place: Prague?
Date: ca. 1604
Materials: gilt brass, iron
Dimensions: length 385 mm
Inventory: 645

Known as *instrumentum triangulare*, this triangulation device for surveying work was made by Joost Bürgi, a well-known craftsman specializing in clocks and scientific instruments. Bürgi worked in Kassel (from 1579 on) for the Landgrave Wilhelm IV of Hesse-Kassel, and in Prague (starting in 1604) at the court of Rudolph II. The instrument is unsigned but entirely similar—apart from the slightly longer arms—to a copy in the Museum of the History of Science at Oxford, which is signed “Ioost Bürgi F.” The arms are divided into 300 parts each and display measurement scales for the Prague foot and for weights of stone (“STEIN”), cast iron (“GOSSEN EISSEN”), and lead (“BLEI”). The sights are present, but of the third cross-arm only a fragment survives, still hinged to the cursor. The instrument was used for surveying work and to measure heights and distances. Provenance: Medici collections.

Triangulation instrument

Setting: Room VI
Maker: Paolo Massucci
Place: Lucca
Date: 1604
Materials: brass; case: wood, leather
Dimensions: length 400 mm
Inventory: 668

Triangulation instrument consisting of two long rectangular-section legs with pointed ends and a graduated semicircle. The legs are inscribed on the front with the scale for dividing a line into as many as 12 equal parts, and with the polygon scale for constructing figures with up to 24 sides. The verso carries a scale divided into 360 equal parts. The semicircle has, on the front, a set of hour lines, and on the back, a scale of metals, a degree scale, and a shadow square divided into six parts per side. The instrument is kept in a case decorated with studs and mask figures. The accessories include: a gimbaled compass (incomplete), a small quadrant divided into 90 degrees and equipped with a cursor, a gunner's level with two quadrants and two plumb bobs, a brass plumb bob, a viewer, a pointed cursor, and a rectangular cover with a point. The instrument is signed by Paolo Massucci. Provenance: Medici collections.

Triangulation instrument

Setting: Room VI
Maker: Baldassarre Lanci [attr.]
Place: Florence
Date: 16th cent.
Materials: gilt brass
Dimensions: max. length 530 mm
Inventory: 3164

The Latin inscription—"INSTRVMENTVM PER CIPIENDI DISTANTIAM PER SVPERFICIEM"—indicates that the instrument is used "to find the distance by means of the surface." It consists of a 125° circular sector with a 90-mm radius. At the center is a fixed ruler divided into 44 parts and a mobile radius. A second ruler, also divided into 44 parts, is hinged to the end of the mobile radius. Each ruler is equipped with two sights. On the back of the instrument are three small brass tubes, perhaps to fasten the instrument to a support. The distance was measured presumably from two surveying stations whose distance was proportional to the length of the mobile arm; the lines formed a triangle with one side in a known proportion to the unknown distance. The construction characteristics and elaborate engravings suggest an attribution to Baldassarre Lanci. Provenance: Medici collections.

Tripod base

Setting: Room VI
Maker: unknown
Place: German
Date: 16th cent.
Materials: wood, gilt brass
Dimensions: diameter 175 mm, max. height 800 mm
Inventory: 2538

Horizontal base for holding one or more measuring instruments. There are holes for inserting the three extensible legs inv. 2538. There is also a large central opening in which two wooden circular sectors are fitted. Between them runs a cursor carrying a hook for a plumb line. The ornamentation suggests the item formed part of a box of mining instruments. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Tripod legs

Setting:	Room VI
Maker:	unknown
Place:	German
Date:	16th cent.
Materials:	wood, gilt brass
Dimensions:	length 420 mm
Inventory:	2538

Three extensible legs that, with the horizontal base inv. 2538, formed a tripod for holding one or more measuring instruments. Each leg consisted of two square-section rods and two moving and telescoping parts. They carry steel tips to be driven into the ground, and a threaded section for screwing into the corresponding openings in the horizontal base. The ornamentation suggests the item formed part of a box of mining instruments. Brought to Florence from Germany by Prince Mattias de' Medici in the first half of the seventeenth century.

Room VII

Galileo's New World

Paolo Galluzzi

The room dedicated to the great scientist is the heart of the Museo Galileo. Here are displayed the only two surviving telescopes, among the many built by Galileo; the objective lens of the telescope through which, in January 1610, he observed the satellites of Jupiter for the first time; the military and geometric compasses he developed during his years in Padua; other instruments of his invention and educational models illustrating the crucially important results attained by Galileo in his studies on mechanics. At the centre of the room is the marble bust commissioned of the sculptor Carlo Marcellini by Cosimo III de' Medici. Some relics of Galileo, the secular saint of science, are also exhibited here: his thumb, the index finger and middle finger from his right hand, and a tooth, removed from Galileo's corpse when it was translated to the monumental tomb in Santa Croce.

Apparatus for experiments on pendulums

Setting:	Room VII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, iron
Dimensions:	diameter 1150 mm, height 1650 mm
Inventory:	982

This apparatus serves to study the properties of the pendulum, to compare the fall times of bodies along the chords of a given circle, and to show that the distances traveled by a falling body are proportional to the squares of the fall times. Some of these experiments had already been described by Galileo in the early decades of the seventeenth century.
The device consists of a wooden circle fastened vertically to a large triangular base of veneered wood standing on turned legs. The rim of the circle carries two brass channels. By adjusting the clamps, the channels can be positioned so as to materialize any two chords of the circle. By simultaneously releasing two identical balls into the brass channels, we observe that they consistently travel down the channels in identical time, as demonstrated by the fact that the bells at the ends of the channels ring in unison.
The instrument can also be used to demonstrate that a pendulum swung from a given height always rises back to that height even if the pendulum's length is changed during the oscillation.
The tall bar, approximately 4.5 meters long, was placed vertically along the diameter of the circle. It served to conduct experiments on free-falling bodies, demonstrating the Galilean laws of uniformly accelerated motion.
This model is more sophisticated than the one described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748). Its presence in the Museo di Fisica e Storia Naturale is documented as early as 1776, indicating its provenance from the Lorraine collections.

Apparatus for showing the proprieties of the wedge

Setting: Room VII
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass, ivory
Dimensions: 490x240x630 mm
Inventory: 1385

This apparatus, now incomplete, was described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748) as a device for demonstrating the properties of the wedge; a similar instrument was also illustrated by Willem Jacob 's Gravesande and Theophilus Desaguliers. A rectangular wooden base supports a frame with a rectangular opening at the top. Two metal wires, stretched along the edges of the aperture, act as rails for two ivory rollers mounted on wheels. To separate the rollers, it is necessary to overcome a force proportional to their weight. The missing part of the apparatus consisted of three small hinged boards forming a variable-angle wedge inserted between the rollers and weighted down with a load. The apparatus demonstrates that the weight exerted on the wedge makes it possible to separate the rollers and lift another weight whose magnitude is inversely proportional to the angle formed by the wedge. Provenance: Lorraine collections.

Apparatus showing the composition of motion

Setting: Room VII
Maker: unknown
Date: late 18th cent.
Materials: wood, brass
Dimensions: 460x100x490 mm
Inventory: 963

The apparatus shows the effects of the composition of a horizontal motion and a vertical motion, a concept that lies at the heart of the Galilean theory of motion. A wooden base holds a vertical panel whose top carries two horizontal rails formed by a pair of metal wires. A small brass trolley can be pulled horizontally along the rails by means of a cord holding a weight and passing over a pulley. A second cord, also carrying a weight, is fastened to one end of the rails and passes over a pulley attached to the trolley. When the trolley is pulled, the shift in the pulley joined to it causes the weight to rise along the diagonal. This illustrates the fact that the composition of two perpendicular motions produces a diagonal path. The latter is also materialized by a groove of pale wood on the vertical panel. In *Leçons de physique expérimentale* (Paris, 1743-1748), Jean-Antoine Nollet described a similar instrument in which the trajectory resulting from the combination of the two perpendicular motions was plotted by a pencil on the panel. Provenance: Lorraine collections.

Apparatus to demonstrate the isochronism of falls along a spiral

Setting:	Room VII
Inventor:	Jean Truchet
Maker:	unknown
Date:	first half 18th cent.
Materials:	wood, brass, iron
Dimensions:	max. diameter 625 mm, machine height 780 mm, max. height 1700 mm
Inventory:	976

This apparatus is extremely rare: the only other known example, now at the University of Padua, originally belonged to Giovanni Poleni's Teatro di Filosofia Sperimentale. The device was invented in 1699 by Jean Truchet to demonstrate Galileo's law of falling bodies along an inclined plane. It provides an experimental demonstration of the acceleration of natural motion using an equivalent but different approach with respect to the inclined plane inv. 1041.
The apparatus consists of a hexagonal wooden base to which are fastened six curved brass bars that join in a common apex, forming a paraboloid. A pair of metal wires is wound in a spiral around the paraboloid, forming a track that rises from the base to the top of the device. At the apex of the paraboloid is a cup with a hole connecting it to the spiral track. A brass plumb line (now missing) ensured the perfect verticality of the device, a prerequisite for the experiment's success.
A ball is dropped down the track. When the ball has completed the first turn of the spiral, the second ball is released. We observe that each turn, whose length increases in the sequence of odd numbers beginning with 1, is covered by both balls in equal times, exactly as predicted by Galileo's law of natural motion. The base of the apparatus conceals a clockwork mechanism fitted with a spoon that reactivates the experiment by releasing the ball again. Provenance: Lorraine collections.

Apparatus to demonstrate the parabolic trajectory of projectiles

Setting: Room VII
Maker: unknown
Date: late 18th cent.
Materials: wood, brass
Dimensions: 1980x570x1250 mm
Inventory: 968

The apparatus was probably first described by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). It demonstrates experimentally that gravitational acceleration causes a body launched horizontally to describes a parabolic trajectory.
A wooden base, fitted with leveling screws, holds a stand with a quarter-circle track and vertical panel on which a series of four brass rings are fixed at equal distances along a parabola. A ball falling down the track experiences a constant acceleration. When no longer supported by the track, the ball's horizontal projection is combined with the natural motion of uniformly accelerated fall; the ball's path thus becomes parabolic, as evidenced by the fact that it goes through the entire series of rings. The experiment confirms Galileo's discovery of the parabolic trajectory of bodies as the result of the combination of horizontal projection and free fall, defined by the Pisan scientist in c. 1609 and first published in the Giornata Quarta [Fourth Day] of the *Discorsi and dimostrazioni matematiche intorno a due Nuove Scienze* (Leiden, 1638). Provenance: Lorraine collections.

Application of the pendulum to the clock

Setting: Room VII
Inventor: Galileo Galilei
Author: unknown
Date: 19th cent. (copy)
Materials: pencil on paper with frame
Dimensions: 460x770 mm
Inventory: 2433

The oval frame with feet and gilt friezes contains a copy of the original drawing made by Vincenzo Viviani and by Galileo's son, Vincenzo. It reproduces the apparatus illustrated by

Galileo in his letter of June 1637 to Laurens Reael, in which he explained his method of determining the longitude based on the observation of the periods of Jupiter's moons. This solution required a very precise time-keeping system. To this end, Galileo proposed a clock (inv. 2085) of his invention that made use of the isochronism of pendulums of equal length, a principle discovered by Galileo himself. A report by Vincenzo Viviani tells of that discovery and of Vincenzo Galilei's role in it. The discovery of the application of the pendulum to the clock was claimed in 1658 by Christiaan Huygens, whose assertions were vigorously challenged by Viviani.

Armed lodestone

Setting:	Room VII
Maker:	unknown
Date:	ca. 1608
Materials:	lodestone, brass, iron, wood
Dimensions:	magnet 38x30x55 mm; support: height 670 mm, 320x174x55 mm (base)
Inventory:	2431

Galileo presented this magnet to Ferdinand II, as witnessed by Benedetto Castelli: "I have seen a piece of lodestone of six ounces only armed with iron with exquisite care by Signor Galileo and donated to the Most Serene Grand Duke Ferdinand, which supports fifteen pounds of iron fashioned in the shape of a sepulchre" (*Discorso sopra la calamita,* Ms Galil. 111, c.203v. Biblioteca Nazionale Centrale, Florence).
Galileo's studies on magnetism intensified between 1600 and 1609. In particular, Galileo discussed magnets with Paolo Sarpi and Giovanfrancesco Sagredo, between Padua and Venice, during that decade. Their exchanges frequently refer to William Gilbert's *De Magnete* (London, 1600).

Armed lodestones

Setting:	Room VII
Maker:	unknown
Date:	first decade 17th cent.
Materials:	lodestone, iron, brass, silver
Dimensions:	59x65x25 mm; 34x36x29 mm; 73x45x74 mm; 46x16x60 mm; 58x32x55 mm; 40x60x60 mm

Inventory: 6, 7, 8, 9, 10, 11

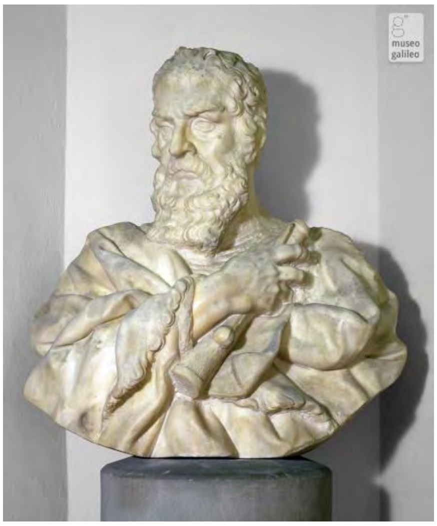
Set of armed lodestones used by Galileo for his studies on magnets, which intensified in 1600-1609. In particular, Galileo discussed magnets with Paolo Sarpi and Giovanfrancesco Sagredo, between Padua and Venice, during that decade. Their exchanges frequently refer to William Gilbert's *De Magnete* (London, 1600).

Brachistochronous fall

Setting: Room VII
Maker: Francesco Spighi
Place: Florence
Date: second half 18th cent.
Materials: wood, brass, ivory
Dimensions: 2395x420x910 mm
Inventory: 966

This apparatus demonstrates the observable effects of a physical principle discovered by Galileo on November 29, 1602, and communicated by him to Guidobaldo del Monte that day. Using geometrical methods, Galileo proved that a body takes less time to fall along the arc of a circumference than along the corresponding chord—even though the latter is a shorter path. Galileo, who viewed the arc as an infinite set of inclined planes, did not realize that the brachistochrone of a body falling between two points is the arc of a cycloid and not the arc of a circle. The mathematical demonstration of the brachistochronous property of the cycloid was provided by Jacques Bernoulli in 1697.
The device consists of a wooden frame with a cycloidal channel. A straight channel also pivots on the frame, and its inclination can be adjusted by means of pegs fixed in holes with brass rings under the cycloid. Dropping two balls simultaneously down the two channels, we observe that the ball falling down the arc of the cycloid reaches bottom well before the ball traveling down the inclined plane.
This experimental apparatus was built by Francesco Spighi.

Bust of Galileo Galilei



Setting:	Room VII
Author:	Carlo Marcellini
Date:	1674-1677
Materials:	marble
Dimensions:	height 780 mm
Inventory:	3902

Cosimo III de' Medici commissioned this striking sculpture from Carlo Marcellini, who was working at the Academy of Sculpture in Palazzo Madama in Rome. The artist shows Galileo with his head slightly turned toward the right with respect to the central axis of the bust. In his right hand, beneath the fold of his cloak, he holds two of the instruments that had most contributed to his renown: the geometric and military compass and the telescope.

Compound microscope, Galilean

Setting:	Room VII
Inventor:	Galileo Galilei
Maker:	Giuseppe Campani [attr.]
Place:	Italian
Date:	second half 17th cent.
Materials:	cardboard, leather, wood, iron
Dimensions:	height 200 mm, diameter 55 mm
Inventory:	3429

The compound microscope, made of cardboard, leather and wood, is inserted in an iron support with three curved legs. The outer tube is covered in vellum green decorated with gold tooling. There are three lenses (an objective, a field lens, and an eyepiece), all double-convex. The objective measures 11 mm in diameter and has a thickness of 3.5 mm. The glass is clear with few imperfections; the edge is ground and there are some fine chips. The field lens (diameter 30 mm, thickness 4.7 mm) is in a cell that pushes into the bottom of the inner tube. The glass is amber-green, with air bubbles, and has a ground edge that is chipped; the eyepiece, with an aperture of 24 mm, also has some bubbles; it is protected by a wooden cap that screws onto the mount. This very important instrument was said to have been built by Galileo, but is now more plausibly attributed to Giuseppe Campani. Johannes Faber, fellow of the Accademia dei Lincei, gave the name "microscope" (*microscopio*) to Galileo's "small eyeglass" (*occhialino*) in 1625.

Dialogo sopra i due massimi sistemi del mondo, Galileo Galilei (facsimile)

Setting:	Room VII
Author:	Galileo Galilei
Place:	Florence
Date:	original 1632 / facsimile 2010
Inventory:	Firenze, Museo Galileo, MED 1190

Galileo's scientific and literary masterpiece, arranged as a four-day dialogue between three participants. Their exchanges suggest to the reader that the Copernican model is distinctly superior. By comparison, the traditional hypotheses—including the one put forward shortly earlier by Tycho Brahe—suffer from insuperable limitations. The frontispiece by Stefano Della Bella depicts the imaginary conversation between Aristotle, Ptolemy, and Copernicus.

First-order lever with bent beam

Setting:	Room VII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, lead
Dimensions:	790x290x580 mm
Inventory:	1009/a

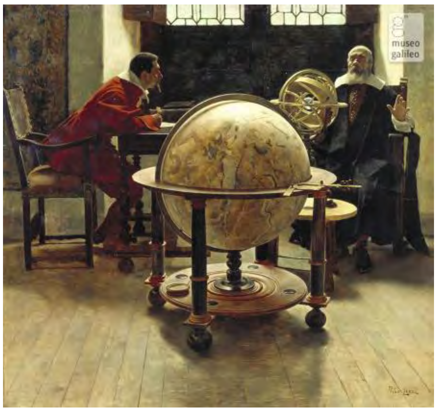
First-order lever in which the beam is not straight but bent to form an obtuse angle. Resting on a double base, it is of similar construction to levers inv. 1007 and inv. 1002. Each end carries a lead pan suspended by a cord. The apparatus served to demonstrate that a bent-beam lever functions exactly like a straight-beam lever.
The instrument is inspired by a model proposed by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). Provenance: Lorraine collections.

Galileo and Milton

Setting:	Room VII
Author:	Annibale Gatti
Date:	second half 19th cent.
Materials:	oil on canvas
Dimensions:	580x700 mm
Inventory:	3682

Annibale Gatti's painting shows the presumed meeting of the poet John Milton with Galileo confined in the villa Il Gioiello in Arcetri, where the scientist spent the last years of his life after the condemnation of 1633.

Galileo and Viviani



Setting:	Room VII
Author:	Tito Lessi
Date:	1892
Materials:	oil on board
Dimensions:	410x410 mm
Inventory:	Dep. OAA, Firenze

Tito Lessi's painting shows Galileo in old age with Vincenzo Viviani. After his condemnation in 1633, Galileo was confined to the villa Il Gioiello in Arcetri, where Viviani assisted him from 1639 until his death in 1642.

Galileo's objective lens

Setting: Room VII
Author: Vittorio Crosten (frame)
Date: lens: late 1609 - early 1610 / frame: 1677
Materials: lens: glass, gilt brass / frame: ivory, ebony
Dimensions: lens diameter 38 mm / frame 410x300 mm
Inventory: 2429

Objective lens used by Galileo for many observations in 1609-1610. In 1610, he was the first to observe Jupiter's moons, which he called the "Medicean Planets." He announced his great discovery in *Sidereus Nuncius* [The Starry Messenger], published in Venice the same year. Galileo donated the lens of the telescope with which he made the discovery to Grand Duke Ferdinand II. At a later date, the lens was accidentally cracked. After Galileo's death (1642) the lens was kept in the Guardaroba [Wardrobe] of Prince (later Cardinal) Leopold de' Medici. When Leopold died (1675), the lens was added to the Medici collection in the Uffizi Gallery. The collection remained there until 1793, when it was transferred to the Museo di Fisica e Storia Naturale. In the mid-nineteenth century, the lens was displayed in the Tribuna di Galileo with other Galilean memorabilia.
In 1677, the Medici commissioned Vittorio Crosten to build the ebony frame in which the lens has since been preserved.

Galileo's telescope

Setting: Room VII
Inventor: Galileo Galilei
Maker: Galileo Galilei
Place: Italian
Date: ca. 1610
Materials: wood, paper, copper
Dimensions: length 1273 mm
Inventory: 2427

Original telescope made by Galileo consisting of a main tube and two smaller housings in which the objective and the eyepiece are mounted. The main tube consists of two semicircular tubes held together with copper wire. It is covered with paper. The objective measures 51 mm in diameter, and is biconvex, but the radii of curvature of the surfaces of the two faces are not equal;

the focal length is 1,330 mm, the thickness at the center 2.5 mm. The eyepiece is plano-concave and measures 26 mm in diameter; the concave side, facing the eye, has a radius of curvature of 48.5 mm; the thickness at the center is 3.0 mm, the focal length -94 mm (the negative focal length means that the lens is diverging). The instrument's magnification is 14 and its field of view 15'. In 1611, Prince Federico Cesi, founder of the Accademia dei Lincei, suggested calling this instrument *telescopio* [from the Greek *tēle* ("far") and *scopeo* ("I see")].
Galileo designed ingenious accessories for the telescope's various applications. One of the most important was the micrometer, an indispensable device for measuring distances between Jupiter and its moons. Another was the helioscope, which made it possible to observe sunspots through the telescope without risking eye damage.

Galileo's telescope

Setting: Room VII
Inventor: Galileo Galilei
Maker: Galileo Galilei
Place: Italian
Date: late 1609 - early 1610
Materials: wood, leather
Dimensions: length 927 mm
Inventory: 2428

Original telescope made by Galileo consisting of a main tube with separate housings at either end for the objective and the eyepiece. The tube is formed by strips of wood joined together. It is covered with red leather (which has become brown with the passage of time) with gold tooling. The plano-convex objective, with the convex side facing outward, has a diameter of 37 mm, an aperture of 15 mm, a focal length of 980 mm, and a thickness at the center of 2.0 mm. The original eyepiece was lost and was replaced in the nineteenth century by a biconcave eyepiece with a diameter of 22 mm, a thickness at the center of 1.8 mm, and a focal length of -47.5 mm (the negative focal length means that the lens is diverging). The instrument's magnification is 21 and its field of view 15'. It is registered in the 1704 inventory of the Uffizi Gallery as "A telescope of Galileo 1 2/3 *braccia* [973 mm] long in two pieces to lengthen it, covered with leather of several colors and gold tooling, with two lenses, of which the eyepiece is at an angle": the eyepiece was thus still present, but loose in its housing. By the end of the eighteenth century, it was missing. In 1611, Prince Federico Cesi, founder of the Accademia dei Lincei, suggested calling this instrument *telescopio* [from the Greek *tēle* ("far") and *scopeo* ("I see")].
Galileo designed ingenious accessories for the telescope's various applications. One of the most important was the micrometer, an indispensable device for measuring distances between Jupiter and its moons. Another was the helioscope, which made it possible to observe sunspots through the telescope without risking eye damage.

Geometric and military compass

Setting:	Room VII
Inventor:	Galileo Galilei
Maker:	Galileo Galilei
Date:	ca. 1606
Materials:	brass
Dimensions:	length 256 mm, width (open) 360 mm
Inventory:	2430

One of the many compasses built by Galileo starting in 1597. Possibly the model presented by Galileo to Cosimo II together with a copy of *Le operazioni del compasso geometrico et militare* [Operations of the geometric and military compass] (Padua, 1606). The Galilean compass—not to be confused with drawing compasses—is a sophisticated and versatile calculating instrument for performing a wide variety of geometrical and arithmetical operations, making use of the proportionality between the corresponding sides of two similar triangles. It comprises three parts:
- the two legs, held together by a round disk (pivot), whose faces (front and back) are engraved with numerous scales;
- the quadrant, graduated with various scales, which is fixed by means of wing nuts to the holes in the compass legs;
- the clamp, a cursor inserted into one of the compass legs; keeps the instrument vertical and can serve as an extension for the leg holding it.

The priority for the instrument's invention was claimed by the Milanese Baldassarre Capra in a work published in Padua in 1607. Galileo replied effectively to Capra's claims with a peremptory *Difesa* [Defense].
The compass, initially kept in the Uffizi Gallery, was transferred in the mid-nineteenth century to the Tribuna di Galileo.

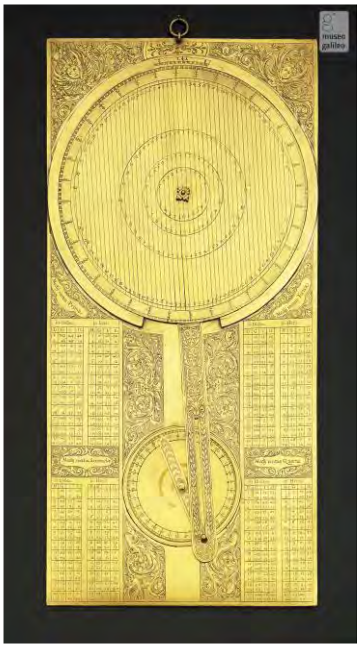
Inclined plane

Setting:	Room VII
Maker:	unknown
Place:	Florence
Date:	early 19th cent.
Materials:	wood, iron, brass
Dimensions:	5440x390x1240 mm
Inventory:	1041

This inclined plane, with five small bells and a pendulum, was devised to provide an experimental demonstration of the Galilean law of falling bodies. The apparatus makes use of

another important physical principle discovered by Galileo: the isochronism of pendulums of equal length. This principle is demonstrated by the pendulum connected to the plane, which completes its oscillations in equal times. The experiment consists in releasing a small ball from the top end of the plane at the same time as the pendulum is swung. At each successive complete oscillation of the pendulum, the ball strikes one of the small bells placed along the inclined plane at increasing distances, arranged in the sequence of odd numbers. The experiment not only makes it possible to measure the increase in the distances traveled by a body in natural fall in successive and equal time intervals starting from the rest position; it also provides—thanks to the bell rings—an acoustic perception of the ball's constant acceleration during its fall.
No documents survive proving that Galileo performed this specific experiment. In the mid-nineteenth century, Giuseppe Bezzuoli—following the instructions of Vincenzio Antinori, director of the Museo di Fisica e Storia Naturale—represented in a fresco of the Tribuna di Galileo the Pisan scientist conducting an experiment to demonstrate the law of falling bodies by means of an inclined plane.

Jovilabe



Setting:	Room VII
Inventor:	Galileo Galilei
Maker:	unknown
Date:	second half 17th cent.
Materials:	brass
Dimensions:	400x195 mm
Inventory:	3178

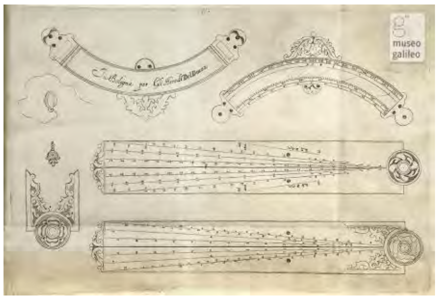
Brass instrument, undated and of unknown maker. The Jovilabe is certainly connected to Galileo's efforts to determine the periods of Jupiter's moons—whose discovery he announced in 1610 in *Sidereus Nuncius*—and to compute the times of their eclipses. Galileo immediately realized that eclipses of Jupiter's moons could provide a precise method to determine the longitude. The instrument is engraved with tables showing the mean motions of each of the four moons. Two connected disks of different diameters are rotated by means of a movable rod. They are used to create a "view from the Sun" of the movements of Jupiter's moons observed from the Earth (movements that seem irregular because of the heliocentric motions of the Earth and Jupiter). Galileo began the systematic study of the periods of Jupiter's moons in 1611, developing a micrometer for the purpose. The Pisan scientist compiled tables of the periods that he offered, with his telescopes, first to the King of Spain (1611, 1612, 1616, and 1627-1628), then to the States General of Holland (1637-1641). To convince his Spanish interlocutors that Jupiter and its moons could be observed on unstable ground, such as a ship's deck, Galileo designed a special helmet carrying a small telescope on a hinged mount. The device was named *celatone* (*celata* = "helmet" in Italian). In this second proposal, he also described the advantages of applying the pendulum to the clock. Despite the interest they aroused, neither of his proposals was accepted. Provenance: estate of Leopold de' Medici.

Large armed lodestone

Setting: Room VII
Maker: unknown
Date: first decade 17th cent.
Materials: lodestone, brass, iron, wood
Dimensions: 350x150x515 mm
Inventory: 542

Long kept in the Uffizi Gallery, where it was observed and described by Cornelis Mejjer, this lodestone was re-armed by Mejjer to restore its original power. Mejjer also recalled that exceptional magnets such as this fetched exorbitant prices. Indeed, in 1609, Cosimo II had paid 100 *doppie* (i.e., 200 gold *scudi*) to buy—on Galileo's advice—an extremely powerful lodestone owned by Giovanfrancesco Sagredo in Venice. That magnet has been lost.

Le operazioni del compasso geometrico e militare, Galileo Galilei (facsimile)



Setting: Room VII
Author: Galileo Galilei
Place: Padua
Date: original 1606 / facsimile 2010
Inventory: Firenze, Museo Galileo, MED 2023

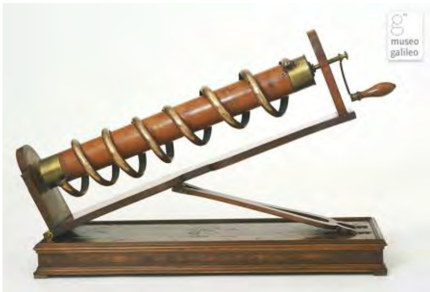
This work by Galileo (1564-1642) [The operations of the geometric and military compass] was published in Padua in 1606 and dedicated to Prince Cosimo de' Medici. It illustrates, with many figures, the operations that can be performed with the Galilean compass alone or in combination with the quadrant. The booklet was probably sold or given with a copy of the instrument. This explains why it contains no images of the instrument itself: these first appeared in the Latin translation (*Galilaei de Galileis* [...] *de proportionum instrumento* [...], Strasbourg, 1612), edited by Matthias Bernegger (1582-1640).

Middle finger of Galileo's right hand

Setting: Room VII
Author: unknown
Date: Stand, case, and inscription: ca. 1737
Materials: marble, glass
Dimensions: 150x150x445 mm
Inventory: 2432

This item exemplifies the celebration of Galileo as a hero and martyr of science. The finger was detached from the body by Anton Francesco Gori on March 12, 1737, when Galileo's remains were moved from the original grave to the monumental tomb built on the initiative of Vincenzo Viviani. The finger became the property of Angelo Maria Bandini and was long exhibited at the Biblioteca Laurenziana. In 1841, the relic was transferred to the just-opened Tribuna di Galileo in the Museo di Fisica e Storia Naturale. Together with the Medici-Lorraine instruments, it was eventually moved to the Museo di Storia della Scienza in 1927. On the marble base is carved a commemorative inscription by Tommaso Perelli.

Model of Archimedean screw or cochlea



Setting: Room VII
Inventor: Archimedes
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass, copper
Dimensions: height 600 mm, base 800x210 mm
Inventory: 998

Model of a water-lifting device called *Archimedean screw* or *cochlea*. The wooden base carries a hinged frame whose slope can be adjusted by resting it against one of the notches carved into the base. The frame carries a wooden cylinder fitted with a handle and a helical copper channel on the outside. Turning the handle raises a ball placed at the lower end of the channel. It is now believed that a similar contrivance, albeit with different construction features, was invented by Archimedes. The cochleas used in antiquity were effectively composed of a wooden tube containing a concentric axle. Between the axle and the tube, several partitions were attached in a helical, parallel sequence, resembling that of a helical staircase. Archimedean screws are still used today, particularly for raising liquids carrying suspended matter and debris. Resembles item inv. 999. Provenance: Lorraine collections.

Model of the application of the pendulum to the clock

Setting:	Room VII
Inventor:	Galileo Galilei
Maker:	Eustachio Porcellotti
Place:	Florence
Date:	1877
Materials:	iron, brass
Dimensions:	height 325 mm
Inventory:	2085

Built in 1877 by the Florentine clockmaker Eustachio Porcellotti, this working model is based on the drawing (inv. 2433) of the Galilean invention by Vincenzo Viviani and Vincenzo Galilei.

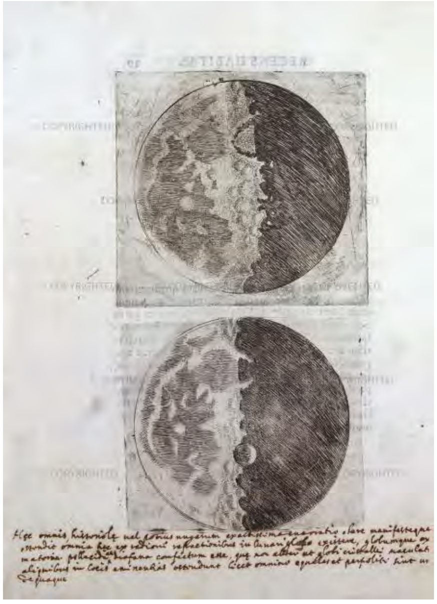
Second-order lever

Setting:	Room VII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, lead
Dimensions:	570x150x650 mm
Inventory:	1006

Second-order lever inspired by a model proposed by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742).
A turned column fixed to a profiled base carries the beam with a counterweight and two notches for shifting the fulcrum's position. A second column carries a pulley on which runs a cord

connected to a weight serving as the effort. Two lead pans hanging from the lever act as the load. Fifteen nails dividing the beam into equal segments serve to vary the application of the load. Provenance: Lorraine collections.

Sidereus Nuncius, Galileo Galilei (facsimile)



Setting:	Room VII
Author:	Galileo Galilei
Place:	Padua
Date:	original 1610 / facsimile 2010
Inventory:	Firenze, Biblioteca nazionale centrale, Post. 110

The *Sidereus Nuncius* is the work in which Galileo announced the discovery of Jupiter's moons. Using drawings and illustrations, he analyzed the new celestial phenomena observed with the telescope in Padua in early 1610. The work initiated a process that would lead, in a few decades, to the acceptance of the Copernican system despite opposition from ecclesiastical authorities. The work's publication and its dedication to the Medici of Jupiter's moons (which Galileo named the "Medicean Stars") opened the path for the return of Galileo to Tuscany, Cosimo II having appointed him Granducal Mathematician and Philosopher. A few months after the *Sidereus Nuncius* appeared, the Pisan scientist observed "three-bodied Saturn," sunspots, and the phases of Venus, which provided further evidence against the Aristotelian-Ptolemaic system.

Stand with tackle and polyspaston

Setting:	Room VII
Inventor:	Willem Jacob 's Gravesande
Maker:	unknown
Date:	second half 18th cent.
Materials:	ivory, wood, brass
Dimensions:	550x550x1200 mm
Inventory:	539, 1401

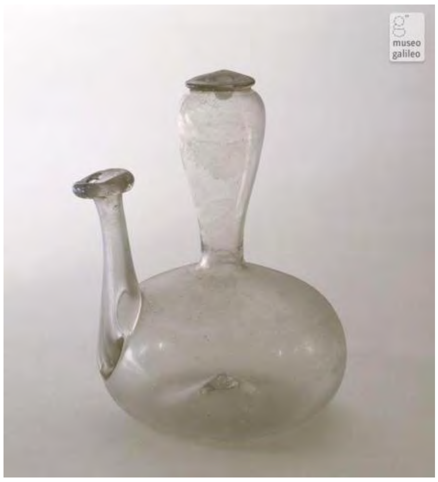
This apparatus (incomplete) is known as 's Gravesande column, named after its inventor. The "column" is an all-purpose stand suitable for a wide range of mechanical and hydrostatic experiments.
The square base supports a vertical column holding four crossbars, of which four rotate and one slides. A tackle and a polyspaston are suspended from two different crossbars. The tackle consists of two ebony blocks each carrying five ivory sheaves and interconnected by a single cord. With this combination, an effort applied to the free end of the cord can lift a load ten times greater. The polyspaston comprises two horizontal rods each carrying three pulleys connected by a cord. This combination makes it possible to lift a weight six times as great as the effort applied. Provenance: Lorraine collections.

Thermoscope

Setting:	Room VII
Inventor:	Galileo Galilei
Maker:	unknown
Date:	19th cent. (replica)
Materials:	glass
Dimensions:	height 460 mm
Inventory:	2444

Copy of the instrument to measure heat and cold invented by Galileo during his stay in Padua. Vincenzo Viviani, in his *Vita di Galileo* [Life of Galileo], states that the thermoscope was designed by Galileo in 1597. This is confirmed by Benedetto Castelli in his letter of September 20, 1638, to Ferdinando Cesarini, in which he describes the use of the instrument. The thermoscope consists of an egg-sized glass with a long neck. The jar is heated with the hands and partially immersed, upside down, in a container filled with water. When the hands are removed, the water rises in the neck. The experiment demonstrated the changes in air density caused by temperature variations. Santorio had built a similar instrument in Venice in 1612.

Thermoscope



Setting:	Room VII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height 135 mm, diameter 85 mm
Inventory:	3743

Glass object, probably part of a thermoscope. The upper aperture (which, however, is closed) should have accommodated a glass tube for the instrument to be complete.

Room VIII

The Accademia del Cimento: Art and Experimental Science

Paolo Galluzzi - Mara Miniati

This room contains many instruments utilized in research conducted by the members of the Accademia del Cimento. Founded in 1657 by Grand Duke Ferdinando II and Prince Leopoldo de' Medici, it was the first European society exclusively devoted to science, preceding the foundation of the Royal Society in London (1660) and the Académie Royale des Sciences in Paris (1666). Following in the footsteps of Galileo, the Cimento conducted experiments to verify some principles of natural philosophy hitherto universally accepted on the basis of Aristotle's authority. The Academy concluded its work in 1667 by publishing the *Essays on natural experiments,* summarizing its activity. Significant results were attained in observations of Saturn, and above all in the fields of barometry and thermometry (here we see the superb thermometers and glass instruments used by the Academy). Numerous experiments were designed to verify the possibility of creating a vacuum in nature, and observing its effects on animals and objects.

Barometer tube

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height 195 mm
Inventory:	114

This U-tube probably formed part of the instrument illustrated in the *Saggi di naturali esperienze* [Examples of natural experiments] (Florence, 1667) and used to demonstrate the changes in atmospheric pressure. The tube was placed on a base, with the two pipes parallel and divided into degrees. One pipe ended in a trumpet-shaped aperture; the other pipe, in one or more hollow crystal spheres, the last of which was fitted with a long spout to be flame-sealed after the introduction of mercury. When the instrument was delicately moved to the top of a tower, one could observe changes in the level of mercury in the pipes due to the lower atmospheric pressure. The Cimento academicians performed this experiment at the Palazzo Vecchio in September 1657, comparing the degrees on the same barometer at the Piazza della Signoria ground level and at the top of the tower. In the two different situations, they observed noticeable variations in the height of the thin mercury column. This corroborated Blaise Pascal's finding at the summit of the Puy de Dôme in 1648. The academicians reproduced the experiment at Villa Artimino, a property of the Medici.

Bottle

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	17th cent.
Materials:	transparent and blue glass
Dimensions:	height 280 mm, diameter 55 mm
Inventory:	3804

Bottle with an elongated conical body and receding bottom. The thin neck has a flared rim. There is no foot. The neck is decorated with a blue glass pincered collar, a common feature of similar objects *à la façon de Venise*.

Bottle

Setting:	Room VIII
Maker:	unknown
Date:	16th cent.
Materials:	glass
Dimensions:	height 143 mm
Inventory:	2067

Elegant decorated glass bottle bearing the Medici coat of arms. The screw lid is also made of glass.

Bowls

Setting:	Room VIII
Maker:	unknown
Date:	16th cent.
Materials:	glass
Dimensions:	height 86 mm, diameter 60 mm
Inventory:	2068, 2069, 2070, 2071

Four small bowls of pink decorated glass, with lids. These sixteenth-century items were later added to the Accademia del Cimento glassware.

Box with thermometers

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: box: leather, satin; thermometers: glass
Dimensions: 225x315x270 mm
Inventory: 195, 2450

The box contains seven glass instruments: a stem hydrometer; an *infingardo* [slow] thermometer; two fifty-degree thermometers; a seventy-degree thermometer; a thermometer with *acquarzente* and *migliaruole* [lead pellets], probably used to measure both temperature and density of liquids; and a clinical "frog" thermometer, added later. The seventy- and fifty-degree divisions are two of the many thermometric scales adopted by the Accademia del Cimento. The thermometric liquid is *acquarzente*.

Bucket

Setting: Room VIII
Maker: unknown
Date: 17th cent.
Materials: "lattimo" glass
Dimensions: height 180 mm, diameter 140 mm
Inventory: 329

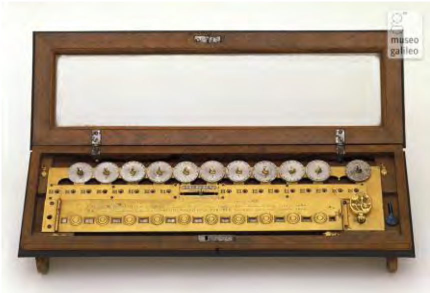
Made of milky white opaque glass, with a large round base that widens into a flared bell shape at the top. The bucket recalls the distinctive design of similar objects made in Venetian workshops and widely diffused in the seventeenth century.

Calculating machine

Setting: Room VIII
Inventor: unknown
Maker: unknown
Place: Italian?
Date: 17th cent.
Materials: gold plated brass, case: wood
Dimensions: max. length 210 mm
Inventory: 3179

This calculating machine is a money adder similar to those invented and built by Samuel Morland in ca. 1666. It consists of a thin gilded brass plate which carries, on the upper part, six main disks numbered from 0 to 9, and on the lower part, three main disks numbered respectively from 0 to 19, from 0 to 11, and from 0 to 6. A smaller auxiliary disk is internally connected to each main disk. This arithmetic machine cannot transfer carries from one order to the subsequent, but each auxiliary disks advances of one unit when the respective main disk exceeds 9 (for the upper six), or 6, 11, 19 respectively (for the lower three). The upper disks were used for pounds, the two lower disks on the right for shillings and pence. The lower disk on the left was possibly used for the German *gulden*, divided in 7 long schillings. Donated by Tito Livio Burattini to Ferdinand II de' Medici.

Calculating machine



Setting:	Room VIII
Inventor:	Samuel Morland
Maker:	Henri Sutton, Samuel Knibb
Place:	London
Date:	1664
Materials:	brass, silver
Dimensions:	555x180 mm
Inventory:	679

This is one of the oldest still-functioning devices for performing calculations with mechanical systems. It may be regarded as a precursor of modern calculators. The machine consists of a gilt brass plate carrying 55 numbered silver circles and 17 numbered silvered brass circles. It is housed in a wooden case with a crystal lid. The machine is divided into three sections: the upper section contains the numbered disks used for the operations; the central section serves as a mechanical memory; the lower section is where the calculations are performed after installing the appropriate disks. Invented by Sir Samuel Morland and built by Henri Sutton and Samuel Knibb, it was donated by Morland himself to Grand Duke Cosimo III de' Medici in 1679. The dedication to the Grand Duke contains an obvious error: it gives 1666 as the year of invention and 1664 as the year of manufacture.

"Capriccio" glass

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: height 165, diameter 43 mm
Inventory: 341/i

The glass has a bell foot and an ovoid body ending in a sphere with a hook. The top of the body is entirely decorated with small drops and adorned with four crested pincered fins. This specimen of *capriccio* glassware seems to have been blown in only one piece. It probably formed part of a more complex structure.

Centerpiece

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: height 163 mm
Inventory: 302

The artichoke-shaped body is decorated with leaves outlined by applied glass threads. The narrow neck swells at the top, opening into a flared mouth. The stem displays a bulge in the middle. There is a lampworked spout. The object was the crowning element of a centerpiece.

Centerpiece

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: height 230 mm
Inventory: 86

The object—a small bird placed on a baluster stem and round foot—must have belonged to a more complex glass structure, probably a centerpiece. This is suggested by the flared rim opening placed on the bird's head and by the elaborate stems protruding from the body.

Chalice

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: smoked glass
Dimensions: height 320 mm, diameter 200 mm
Inventory: 315

Chalice with a conical cup whose surface undulates up to the rim. There is a bell-shaped base and a ribbed connecting knop of dark glass. The distinctive cone form recalls the archaic models of Nordic origin, which were also made of metal. Such models were adopted by Veneto glassmakers in the first half of the sixteenth century. The chalice is analogous to these examples, which have different knop shapes and decorations, but are of similar structure and dimensions.

Chalice glass

Setting:	Room VIII
Maker:	unknown
Date:	17th cent.
Materials:	glass
Dimensions:	height 190 mm, diameter 105 mm
Inventory:	3906

The glass is composed of a round foot, a long stem with gold decoration and alternating narrow and bulging sections, and a cone-shaped cup with a flared rim.

Chalice glass

Setting:	Room VIII
Maker:	unknown
Date:	17th cent.
Materials:	glass
Dimensions:	height 195 mm, diameter 110 mm
Inventory:	3905

The object is composed of a round foot, a hollow baluster stem, and a cup in the shape of an inverted cone. This design is typical of the *à la façon de Venise* [Venetian style] production found in Tuscany, particularly for ordinary glassware.

Chalice glass

Setting:	Room VIII
Maker:	unknown
Date:	17th cent.
Materials:	glass
Dimensions:	height 190 mm, diameter 180 mm
Inventory:	3904

The object is composed of a round foot, a straight, thin stem, and a very wide, shallow cup (called *bevante* ["for drinking"] by the Murano craftsmen).

Chalice with fins

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent glass
Dimensions:	height 175 mm, diameter 136 mm
Inventory:	341/38

This chalice features a hemispherical cup and a distinctive baluster stem with a smooth knop on a large round foot. The foot is adorned with three smooth fins carrying clear glass buttons. Similar cup shapes and fin motifs (often crested) are found in sixteenth- and seventeenth-century glassware of the Veneto, which probably inspired the Tuscan glassblower.

Chalice with handles

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent and blue glass
Dimensions:	height 200 mm, diameter 108 mm
Inventory:	280

This chalice has a conical flared cup and a round foot surmounted by a baluster faceted knop. Two small double handles, secured by two small chains, are placed at the center of the body and bounded by two *pincered* rope decorations. A similar pattern is illustrated in the sheets of glass-model designs preserved in the Prints and Drawings Department of the Uffizi Gallery and attributed to the *à la façon de Venise* draftsman, precisely because of the style of his glasses.

Chalices

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent glass
Dimensions:	height 195 mm, diameter 170 mm
Inventory:	104, 105

Two chalices made of transparent glass. The first has a round foot, a shallow cup mounted on a thin baluster stem, a faceted knop, and two small disks at the end. Its shape resembles objects found in the Veneto beginning in the first half of the sixteenth century.
The second chalice has a round foot, a thin baluster stem, a faceted knop, a double disk, and a distinctive shallow cup with central depression. Illustrated in Giovanni Maggi's manuscript *Bicchierografia* (1604), its design is a variant of the previous chalice. Both were produced in Tuscany *à la façon de Venise.*
Chalices of this type, along with variously shaped small stands and vases, are depicted in the Accademia del Cimento manuscripts preserved in the Biblioteca Nazionale Centrale of Florence. They were used to observe the "smoke given off by glasses filled with ice," a scientific experiment

also described in the *Saggi di naturali esperienze* [Examples of natural experiments] (Florence, 1667).

Cluster thermometer

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height 160 mm
Inventory:	196

Thermometer consisting of six phials (two missing) clustered on a column resting on a round foot. The phials contain *acquarzente*, in which small glass spheres of different density are immersed. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Cluster thermometer

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height 180 mm
Inventory:	190

Thermometer consisting of six phials, numbered from one to six, clustered on a column resting on a round foot. The phials contain *acquarzente*, in which small glass spheres of different density are immersed. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Communicating vases

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: glass
Dimensions: height 195 mm
Inventory: 186

The vessels are connected by a thin tube ending in a small cup. Their exact purpose in the Accademia del Cimento's experimentation program has not been established.

Condensation hygrometer

Setting: Room VIII
Inventor: Ferdinand II de' Medici [attr.]
Maker: unknown
Place: Tuscany
Date: Hygrometer: 19th cent. / Glass: 17th cent.
Materials: iron, wood, cork (hygrometer); transparent glass
Dimensions: height 925 mm
Inventory: 276, 2443

The condensation hygrometer was probably invented by Grand Duke Ferdinand II de' Medici. The Cimento academicians built many copies in various shapes, operating designs, and materials. The truncated cone in the lower part was lined with glass, to make it impermeable, and filled with "snow or ice very finely ground." The humidity in the air, in contact with the iced glass, condensed, causing the formation of water drops that descended toward the apex of the

cone, gathering in the graduated glass below. The higher the atmospheric humidity, the greater the condensation. The quantity of water gathered in the glass over a certain period of time was therefore a relative measure of the humidity. This large instrument corresponds in every particular to the drawing in the *Saggi di naturali esperienze fatte nell'Accademia del Cimento* [Examples of natural experiments made in the Accademia del Cimento] (Florence, 1667).
The glass dates from the seventeenth century. It has a cylindrical body with a flared rim, a small stem with an annular knop, and a round foot. Its design derives from the Venetian style of reliquary illustrated in the manuscripts of Giovanni Maggi's *Bichierografia* (1604).

Conical glass

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent glass
Dimensions:	height 240 mm, diameter 135 mm
Inventory:	309

This glass has a conical cup with a smooth surface, a round foot, and a stem consisting of an annular knop. The object was probably used for scientific purposes, like item inv. 3803. The glass is illustrated in the sheets of glass-model designs attributed to the *à la façon de Venise* draftsman and preserved in the Prints and Drawings Department of the Uffizi Gallery.

Conical glass

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent glass
Dimensions:	height 225 mm, diameter 125 mm
Inventory:	3803

The glass has a round foot (broken), a short baluster stem with small disks, and a cup with conical body and a spiral decoration running across its surface. Because of the cup's shape, the glass may be regarded as a variant of item inv. 309. Like the latter, it may have been used for scientific purposes—despite the spiral decoration, which gives it a more refined character.

Conical glass

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent glass
Dimensions:	height 255, diameter 155 mm
Inventory:	310

Glass with a round foot (broken) and a short stem consisting of a smooth annular knop. The cup has a flared conical body whose surface is covered with a light decoration composed of vertical ribs. Because of the shape and size of its cup, it resembles items inv. 309 and inv. 3803. The decoration is similar to that applied by the anonymous *à la façon de Venise* draftsman in the sheets for glass-model designs preserved in the Prints and Drawings Department of the Uffizi Gallery.

Conical glass

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent glass
Dimensions: height 240 mm, aperture 198 mm
Inventory: 320

Glass with a flared conical cup, whose walls are flattened to form an oblong opening. The round foot is surmounted by a smooth collar. Represented in Giovanni Maggi's manuscript *Bicchierografia* (1604).

Crab-shaped "capriccio" glass

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: height 273 mm
Inventory: 103

Capriccio glass in the shape of a crab, whose nippers rest on a baluster stem with a round collar, supported by a three-pronged foot. The three prongs of the foot are, in turn, divided into three curl-shaped parts. There is an opening with a fringed rim on the round body and another aperture at the top. The object belongs to a category of glassware that, from the early seventeenth century, catered increasingly to the vogue for the fanciful and the bizarre.

Cup

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: smoked glass
Dimensions: height 380 mm, diameter 235 mm
Inventory: 268

This item has a tall bell-shaped base with heavy bean-shaped ornaments, a stem with a thick knop, and crests decorated in the *morise* style. The circular cup has a smooth rim and bean-shaped decorations, obtained with the *mezza stampatura* ["half-stamping"] technique. The distinctive Gothic structure of the foot and the bean patterns on the cup recall similar examples of smaller fruit-stands or fruit-cups with feet found in the Veneto area in the first half of the sixteenth century. Their designs were inspired by ceramics, metalworking, and rock crystals.

Cups joined by a stem

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: glass
Dimensions: height 260 mm, diameter 65 mm
Inventory: 3805

Two cups joined by a stem. Their exact purpose in the Accademia del Cimento's experimentation program has not been established.

Cups with "blobs"

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent glass
Dimensions: height 165 mm, diameter 150 mm
Inventory: 266, 267

The bodies of these bell-shaped cups with flared rims are completely covered by a drop-shaped decoration. The short stems consist of faceted knops and rest on short round feet. The drop pattern resembles the *bugne* ["blob"] chalices found throughout the Veneto in the sixteenth and seventeenth centuries. In the Veneto specimens, however, the blobs are pincered; in this item, the drops seem to have been obtained by blowing the glass in a mold.

Cylindrical vase

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: height 320 mm, diameter 125 mm
Inventory: 304

This vase has a smooth cylindrical body, a connecting knop, and a round foot. There is no lid. The design is a simplified version of Renaissance reliquaries of the Veneto.
The use of vases of this shape for scientific purposes is attested in the manuscript diaries of the Accademia del Cimento, preserved at the Biblioteca Nazionale Centrale of Florence. The vase was employed as a vessel for liquids whose specific gravity was to be determined by means of hydrometers.

Cylindrical vase

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	17th cent.
Materials:	transparent glass and blue glass
Dimensions:	height 270 mm, diameter 90 mm
Inventory:	252

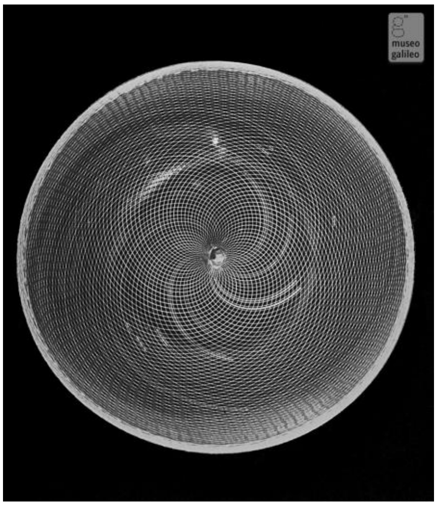
Vase with a smooth cylindrical body, a folded annular base, and a round foot. The connecting stem consists of two bulges enclosing the doughnut knop, on which blue glass buttons have been applied. Both the form and the decoration are evidence that the vase was inspired by Veneto glassmaking.
The use of vases of this shape for scientific purposes is attested in the manuscript diaries of the Accademia del Cimento, preserved in the Biblioteca Nazionale Centrale of Florence. The vase was employed as a vessel for liquids whose specific gravity was to be determined by means of hydrometers.

Decorated chalice

Setting:	Room VIII
Maker:	unknown
Date:	17th cent.
Materials:	crystal
Dimensions:	height 230 mm, diameter 110 mm
Inventory:	3801

Chalice glass with a conical cup and baluster stem mounted on a round foot. The cup's entire surface displays a hunting scene engraved with a wheel or diamond-point.

Display plate



Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	"reticello" glass
Dimensions:	diameter 600 mm
Inventory:	291

This *reticello* plate lacks a foot and has a receding bottom. It is decorated with canes of *lattimo* glass that depart from the center and widen up to the external rim in a spiral course. This technique, which came into use in the Veneto in the second half of the sixteenth century, was also introduced at the Medici glassworks by Venetian glassmakers, particularly of Bartolo d'Alvise.

Double-handle vase

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	late 16th cent. - early 17th cent.
Materials:	transparent and blue glass
Dimensions:	height 140 mm, diameter 80 mm
Inventory:	279

This vase has a rounded body whose underside is decorated with pincered ornaments, a flared neck, a double handle, a round foot, and a medium knop. There is a lid in the shape of a small dome with a blue glass end. The curled handles and the button relief pattern at the joint are also of blue glass. The design resembles glassware found in the Veneto but also in Tyrol. A variant without handles is illustrated in Giovanni Maggi's manuscript *Bicchierografia* (1604). Identical forms are also represented by Tuscan painters, most notably by Alessandro Allori in his frescoes at the Medici villa of Poggio a Caiano c. 1579. This specimen—a more complex variant of items inv. 330—was probably made in the Medici glasshouse and dates from between 1570 (when the glasshouse was opened) and 1604.

Double-handle vase

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: ice glass
Dimensions: height 280 mm, diameter 100 mm
Inventory: 341/34

This vase has a rounded body with a cylindrical neck, a medium knop, and a round foot. The two curled handles are made of blue glass and decorated with flower-shaped reliefs. The entire body, including the rounded lid, is made of ice glass. This type of glass was introduced into Florentine glassmaking by Venetian craftsmen, particularly Bortolo d'Alvise.

Double-handle vases

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent and blue glass
Dimensions: heights 194 - 199 mm, diameter 80 mm
Inventory: 330

Two glass vases with double handles. The first has a smooth rounded body, a cylindrical neck, a round foot, a medium knop, and two double handles with conch-shaped decoration in blue glass

at the joint. It was probably fitted with a rounded lid with a knop end and three fins, preserved in the Istituto e Museo di Storia della Scienza. The vase was probably made at the Medici glasshouse between 1570 and 1604.
The second vase has a rounded body, a middle band decorated with blue glass buttons, a cylindrical neck, a round foot, a medium knop, and two double handles with conch-shaped decoration in transparent glass at the joint. There is a round lid ending in a knop with two fins. Both vases are a variant of item inv. 279.

Eyepiece lens

Setting: Room VIII
Maker: Eustachio Divini
Place: Rome
Date: 1665
Materials: glass, cardboard, florentine paper
Dimensions: length 46 mm, diameter 55 mm
Inventory: 2573

Biconcave eyepiece lens mounted in a cardboard ring. The edge is covered with red marbled paper. The lens diameter is c. 35 mm, the focal length -67 mm (the negative focal length means that the lens is diverging). The glass has a slight green tint and contains small bubbles. The lens is mounted in a cardboard housing covered with red marbled paper. The tube, 46 mm long and 55 mm in diameter, has a nineteenth-century label with the inscription "Eustachio Divini Roma 1665 acuto per braccia 4" i.e., diverging eyepiece for a telescope of 4 *braccia* (2,340 mm)

Fifteen- and twenty-degree thermometers

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 115 mm, 105 mm
Inventory: 179, 182

Two compact thermometers graduated with small black and yellow enamel dots. One of the thermometers is divided into fifteen degrees, the other into twenty. Both stems end in a small spherical bulb at one end and a cylindrical one at the other. The thermometric liquid is *acquarzente*.

Fifty-degree thermometer

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 150 mm
Inventory:	173

This thermometer, ending in a spherical bulb, is divided into fifty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The upper part of the stem carries inscriptions in white enamel. The degree marks on the stem are also of enamel: the black dots indicate single degrees, the white ones ten degrees. The thermometric liquid is *acquarzente*. Invented by Grand Duke Ferdinand II de' Medici, fifty-degree thermometers were generally used to measure the variations in heat and cold of the air, both outdoors and indoors. The academicians made extensive use of the instrument, chiefly for meteorological observations: the advantage of these thermometers was that their readings were comparable with one another, even though they were not the most sensitive.

Fifty-degree thermometer with colored liquid

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 110 mm
Inventory:	102

This thermometer has a spherical bulb. The thermometric liquid was dyed with ox blood, as shown by the red traces on the thermometer. Because of the transparency of *acquarzente*, the level of the liquid in the pipe was not easy to read. Therefore, as specified by Lorenzo Magalotti in *Saggi di naturali esperienze* [Examples of Natural Experiments] (Florence, 1667), "it is sometimes the practice to dye it with infusion of crimson or of that liquid which is commonly called *sangue di drago* [dragon's blood]." This thermometer is divided into fifty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The degree marks on the stem are of enamel; the black dots indicate single degrees, the white dots ten degrees. Invented by

Grand Duke Ferdinand II de' Medici, fifty-degree thermometers were generally used to measure the variations in heat and cold of the air, both outdoors and indoors. The academicians made extensive use of the instrument, chiefly for meteorological observations: the advantage of these thermometers was that their readings were comparable with one another, even though they were not the most sensitive.

Fifty-degree thermometers

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	thermometers: glass; stand: wood
Dimensions:	310x210 mm
Inventory:	85

Set of twelve thermometers divided into fifty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The thermometers are fixed to a wooden table and end in spherical bulbs. The degrees are represented by small dots of black enamel for single degrees and white enamel for ten degrees. The thermometric liquid is *acquarzente*. Invented by Grand Duke Ferdinand II de' Medici, fifty-degree thermometers were generally used to measure the variations in heat and cold of the air, both outdoors and indoors. The academicians made extensive use of this instrument, chiefly for meteorological observations: the advantage of these thermometers was that their readings were comparable with one another, even though they were not the most sensitive.

Fifty-degree thermometers

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	thermometers: glass; stand: wood
Dimensions:	315x220 mm
Inventory:	79

Set of twelve thermometers divided into fifty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The thermometers are fixed to a wooden table and end in spherical bulbs. The degrees are represented by small dots of black enamel for single degrees and white enamel for ten degrees. The thermometric liquid consists of *acquarzente*. Invented by Grand Duke Ferdinand II de' Medici, fifty-degree thermometers were generally used to measure the variations in heat and cold of the air, both outdoors and indoors. The academicians made extensive use of the instrument, chiefly for meteorological observations: the advantage of these thermometers was that their readings were comparable with one another, even though they were not the most sensitive.

Fifty-degree thermometers

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 145 mm
Inventory:	31, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 46, 48, 49, 50, 52, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64

Set of twenty-six matching thermometers divided into fifty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The graduations consist of small enamel dots, black for single degrees, white for ten degrees. The thermometers end in spherical bulbs and carry white enamel markings on their small upper bulbs. The thermometric liquid is *acquarzente*. Invented by Grand Duke Ferdinand II de' Medici, fifty-degree thermometers were generally used to measure the variations in heat and cold of the air, both outdoors and indoors. The academicians made extensive use of the instrument, chiefly for meteorological observations: the advantage of these thermometers was that their readings were comparable with one another, even though they were not the most sensitive.

Flute chalice

Setting: Room VIII
Maker: unknown
Date: 17th cent.
Materials: transparent glass
Dimensions: height 262 mm, diameter 65 mm
Inventory: 262

This cone-shaped is very narrow at the base and gradually widens to the upper rim. The cone rests on a round foot with a baluster knop and small disk. The surface of the cup walls is decorated with vertical ribbing. Similar examples can be found in sixteenth- and seventeenth-century Nordic glassware, but the style was also copied in Venice throughout the seventeenth century.

Fountain

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass, iron
Dimensions: height 265 mm
Inventory: 88

The body, open at the top, is unusually shaped, with a double bulge and two arms protruding from the lower part. The glass instrument rests on an iron support.

Fountain on stand

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany
Date:	16th cent.
Materials:	majolica
Dimensions:	diameter 560 mm, height 340 mm
Inventory:	802

The foot and cup of this majolica stand display the same bean pattern. The outer surface, which carries the Medici coat of arms in the middle, is decorated with harpies, snails, and satyrs. The inside surface is also richly decorated with mythological characters. This splendid object, certainly dating from the Renaissance, was used by the Cimento academicians as a base for a fountain that is no longer extant.

"Frog" thermometer

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 80 mm
Inventory:	2449

The "frog" thermometer or—as the Cimento academicians defined it, the *botticino* [small-toad] thermometer—contained small glass spheres of different density, which were immersed in *acquarzente*. The glass is cracked and therefore the liquid has been lost. The device was used as a clinical thermometer, tied to the wrist or the arm of the patient with the head of the frog facing upward. The variations in body temperature were registered by the movement of the spheres. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Glass with handles

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany?
Date:	early 17th cent.
Materials:	transparent and blue glass
Dimensions:	height 140 mm, diameter 75 mm
Inventory:	258

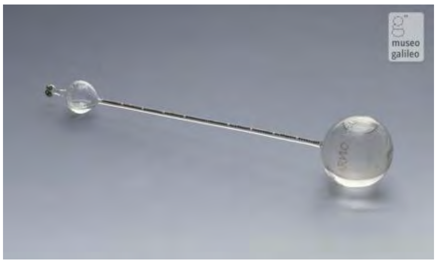
This glass has a flared cup with an octagonal mouth; the cup walls are decorated with mold-stamped motifs. The baluster stem carries two small double handles in blue glass, secured by two small chains. Similar shapes and ornamentation are found in sixteenth- and seventeenth-century Veneto glassware. This example is an *à la façon de Venise* variant, probably made in Tuscany.

Globe for experiments with bladders in vacuum

Setting:	Room VIII
Maker:	unknown
Date:	19th cent.
Materials:	glass, brass
Dimensions:	total length 325 mm, diameter 265 mm
Inventory:	358

Glass globe with brass collar. Inside there is a bladder connected to the collar. Used to demonstrate the force of pressure. The globe would be connected to an air pump and evacuated, producing a partial vacuum. The bladder, which contained air, would expand. The first such experiment was developed in 1657 by the Accademia del Cimento, using a modified Torricellian barometric apparatus. Provenance: Lorraine collections.

Hundred- and eighty-degrees thermometers



Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 230 mm
Inventory: 175, 176

The first of these two similar thermometers is divided into one hundred, one of the many thermometric scales adopted by the Accademia del Cimento. It has a spherical bulb and white enamel inscriptions ("Arno A3G Alla Tinozza A"). The second, divided into eighty degrees, carries the inscription "Alla Tinozza A Gradi 77 1/2 Arno A Gradi 47 1/2"). These markings refer to readings in the Arno river for the minimum temperature and in a *tinozza* [tub filled with hot water] for the maximum. The thermometric liquid is *acquarzente*.

Hundred-degree thermometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: height 270 mm
Inventory: 172

Thermometer divided into one hundred degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The thermometric liquid is *acquarzente*. The degree divisions are indicated by small enamel dots. The instrument was placed on a round foot (now broken).

Hydrometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 70 mm
Inventory: 3740

Fragment of a hydrometer, consisting of a small phial ending in a yellow spherical bulb.

Hydrometer with thermometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 240 mm
Inventory: 213

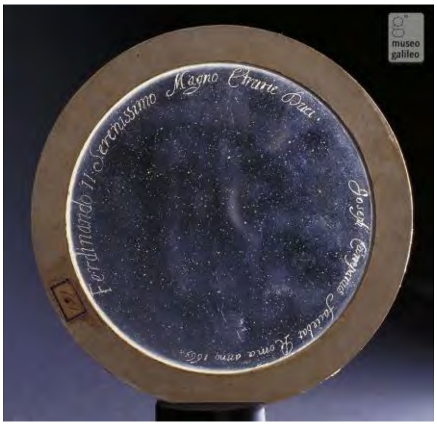
Inside this hydrometer is soldered a thermometer with a spherical bulb, containing a red-tinted liquid (probably *acquarzente*). The hydrometer stem has green enamel graduations and ends in two bulbs, one of which contains lead pellets. This instrument, probably invented in the Accademia del Cimento circle, allowed the simultaneous measurement of the density and temperature of liquids.

Hygrometer glasses

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: height 50 mm
Inventory: 99, 100

Two small glasses graduated with enamel dots and resting on four small feet. They are, probably, accessories for small condensation hygrometers. The graduated glass was placed under the hygrometer to collect the condensation water from the outer surface of the hygrometer cone. The quantity of water collected in the glass in a given time was a relative measure of atmospheric humidity (see inv. 2443, 276).

Objective lens



Setting:	Room VIII
Maker:	Giuseppe Campani
Place:	Rome
Date:	1665
Materials:	glass
Dimensions:	diameter 137 mm
Inventory:	2587

Biconvex objective lens belonging to the terrestrial telescope inv. 3185. The aperture is 111 mm, the focal length 111.6 mm. It was given by its maker, Giuseppe Campani, to Ferdinand II de' Medici, as shown by the dedication engraved on the glass along the rim: "Ferdinando II. Serenissimo Magno Etrurie Duci. Joseph Campani faciebat Romae anno 1665." The glass has a slight red tint but is otherwise very clear except for some bubbles. The lens is well worked, but has some scratches.

Pedometer

Setting:	Room VIII
Maker:	Christoph Schissler, Hans Christoph Schissler [attr.]
Place:	German
Date:	second half 16th cent.
Materials:	wood, brass
Dimensions:	height 1300 mm, diameter 500 mm
Inventory:	3384

The pedometer is used to measure distances traveled. It consists of a wheel and a handle. One end of the handle is attached to the center of the wheel; the other end carries a brass recording disk. Thanks to a gear mechanism, every turn of the wheel (whose circumference is, of course, known) is registered on the disk. The instrument, probably from the workshop of Christoph and Hans Christoph Schissler, belongs to the group of instruments that Prince Mattias de' Medici bought in Germany in 1635. The Cimento academicians used it to attempt to measure the arc of the terrestrial meridian.

Phial

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 115 mm
Inventory: 3737

Phial consisting of a kind of test-tube with protruding sealed spout and open neck. Part of an unidentified experimental apparatus.

Phial

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: glass
Dimensions: length 330 mm
Inventory: 3800

The phial, placed at the center, communicates through pipes with a small cup at one end, and with a small basket hanging from the forked pipe at the other end. Its exact purpose in the Accademia del Cimento's experimentation program has not been established.

Phial thermometer

Setting: Room VIII
Inventor: Ferdinand II de' Medici [attr.]
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: max. length 165 mm
Inventory: 184

Set of four small phials ending in a bulb. The phials contain *acquarzente*, in which small glass spheres of different density are immersed. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Phial thermometer

Setting: Room VIII
Inventor: Ferdinand II de' Medici [attr.]
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 65 mm
Inventory: 78

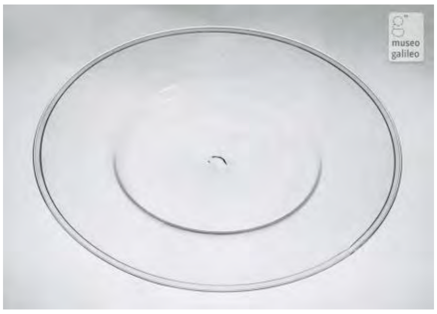
Thermometer consisting of a single tiny phial containing small glass spheres of different density immersed in *acquarzente*. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Phials

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: max. height 115 mm, diameter 45 mm
Inventory: 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209

Eleven phial-shaped instruments on a flat base, most of which still contain a liquid. They were used by the Cimento academicians in Leghorn in January 1658 for experiments on the "icings" of water with different amounts of salt. The phials were filled with liquids containing different proportions of salt, then the pipes were flame-sealed. The instrument was left outdoors and the icing times of the liquids were recorded. The experiment showed that the times depended on the type and quantity of salt introduced.

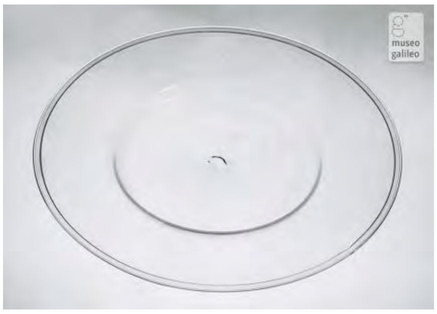
Plates



Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: diameter 265 mm
Inventory: 286, 287, 289, 290, 292, 293, 296, 299, 300, 337, 338

Eleven pieces of identical size, probably part of a set and used as tableware. They lack feet. They have wide brims, folded rims, and blowing-iron marks at the center.

Plates



Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: min. diameter 450 mm, max. 490 mm
Inventory: 285, 294, 295, 297

Four plates of slightly different sizes with wide brims, folded rims, and blowing-iron marks at the center. Although their size is similar to that of display ware, the lack of decoration suggests that they were for everyday use.

"Serpent" chalice

Setting:	Room VIII
Maker:	unknown
Place:	Tuscany?
Date:	17th cent.
Materials:	transparent glass
Dimensions:	height 243 mm, diameter 90 mm
Inventory:	341/33

Chalice composed of a hemispherical cup with undulated walls, a large round foot, and a medium baluster stem surmounted by a smooth knop. The stem is adorned with crested fins and curled volutes. At the center of the stem is the distinctive, well-known Veneto serpent motif: a double winding ribbon with crests, possibly alluding to a stylized dragon.

Seventy-degree thermometers

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	17th cent.
Materials:	thermometers: glass; stand: wood
Dimensions:	220x210 mm
Inventory:	192

Series of thermometers divided into seventy degrees. The thermometers are attached to a wooden board and end in small spherical bulbs. The graduations consist of black enamel dots for single degrees and white enamel dots for ten degrees. The thermometer liquid is alcohol.

Siphon barometer

Setting: Room VIII
Maker: Giovanni Domenico Tamburini
Date: early 18th cent.
Materials: wood, glass, paper
Dimensions: height 1050 mm, width 190 mm
Inventory: 3627

Siphon barometer mounted on a green-varnished wooden board adorned with gilt wood carvings. The instrument is protected by two doors. The upper (and larger) door is fitted with a glass window; the lower (and smaller) door hides the tube bulbs. The barometric tube is slightly tilted. The barometric scales, the captions in various languages, and the elegant zodiac signs are printed on paper. Next to the barometer is an alcohol thermometer surmounted by the inscription "Thermometrum Academiae Florentinae." Two recording pointers slide along a pair of vertical metal wires. The instrument, similar to barometers inv. 1142 and inv. 1141, is signed by Giovanni Domenico Tamburini, about whom we have no information.

Siphon barometer

Setting: Room VIII
Maker: Giovanni Domenico Tamburini
Date: early 18th cent.
Materials: wood, glass, paper
Dimensions: height 979 mm, width 121 mm
Inventory: 1141

Siphon barometer mounted on a wooden board protected by a glass window and a smaller wooden shutter. Next to the barometric tube is a thermometer, whose bulb is broken, surmounted by the caption "Le Grand Thermometre de Florence." The barometric scale, the thermometric scale, and the captions in three languages (Italian, Latin, and French) are printed on paper. Two recording pointers slide along a pair of vertical metal wires. The instrument, similar to barometers inv. 1142 and inv. 3267, is signed by Giovanni Domenico Tamburini, about whom we have no information.

Sixty-degree thermometers

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 130 mm
Inventory:	66, 67

Two small thermometers divided into sixty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The numbers "56" and "54" can be observed, but their meaning is not known. The graduation is indicated by small enamel dots, black for single degrees, white for ten degrees. The thermometric liquid is *acquarzente*. In his *Notizie degli aggrandamenti delle scienze fisiche accaduti in Toscana* [News of the developments in the physical sciences that have taken place in Tuscany] (Florence, 1780), Giovanni Targioni Tozzetti notes that with a sixty-degree thermometer it was proved that "heat" was necessary to make "chicks hatch in ovens, placing the instrument first under the brooding hen, and recording the degree of heat obtained with such an effect." This artificial incubation of sorts was tested in the Boboli Garden, in a large room "for keeping citrus plants in the winter months."

Small cup

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: glass
Dimensions: height 210 mm
Inventory: 80

Small cup consisting of a thin square foot that rises and widens, ending in a small vase. Its exact purpose in the Accademia del Cimento's experimentation program has not been established.

Small hydrostatic balance

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: height 323 mm, arm length 265 mm
Inventory: 27

This small, blown-glass hydrostatic balance consists of an arm suspended on a fulcrum at its center. A small sealed glass sphere hangs from one end of the arm; a small basket containing crystal fragments hangs at the other end. The balance measures the density of fluids. This is done by immersing the glass sphere in a fluid. To counterbalance the buoyancy of the fluid and keep the balance in equilibrium, it is necessary to place a weight (corresponding to a certain number of crystal fragments) in the basket. The denser the fluid, the fewer the crystal fragments needed to achieve equilibrium. The instrument combines the principles of Archimedean upward thrust and of Galileo's *bilancetta* [small balance].

Small single-barrel air pump

Setting:	Room VIII
Maker:	Filippo et Haveri Fratelli De Dranchy
Date:	late 18th cent.
Materials:	brass, iron, glass
Dimensions:	total height 350 mm, max. base dimensions 350x180 mm
Inventory:	831

Unconventional and rather primitive air pump with a large-diameter barrel. The piston is operated by means of a rack and a handle fitted with a pinion. The plate supports a bell-jar with a ground-glass stopper. The instrument bears the inscription "Filippo et Haveri Fratelli De Dranchy," makers about whom we have no information. Provenance: Lorraine collections.

Sphere for hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height ca. 35 mm, diameter 30 mm
Inventory:	3738

Small glass sphere with a small foot. Probably part of a hydrometer.

Sphere for hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height ca. 65 mm, diameter ca. 55 mm
Inventory:	3739

Glass sphere with round aperture. Probably part of a hydrometer.

Sphere hydrometers

Setting:	Room VIII
Inventor:	Ferdinand II de' Medici [attr.]
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	max. height 80 mm, diameter 40 mm
Inventory:	218, 219, 220, 221, 222, 223, 224, 225, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236

Set of eighteen small spheres, some containing lead pellets, others sawdust. Used to examine the specific gravity of different fluids, particularly water. The invention of this type of hydrometer is attributed to Ferdinand II de' Medici, who perfected it during the experimentation program that he sponsored in the year prior to the founding of the Accademia del Cimento. On the neck of the spheres were placed six identical brass rings which, together with the sphere, weighed exactly one ounce. Such spheres were accordingly called "ounce to weigh waters and all the other liquids"—hence the name *palle d'oncia* [ounce balls], used to designate the instruments. Once the hydrometer was immersed in a liquid, ever-smaller rings were added so as to keep the top of the neck under the surface of the liquid. When the liquid was changed, the difference in the number of rings needed to keep the sphere under the surface indicated the difference in density between the liquids.

Spheres for hydrometers

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: height ca. 80 mm, diameter ca. 6.5 mm
Inventory: 721

Set of six small glass spheres with "peduncles," used as hydrometers. They are illustrated in the manuscript *Diari* [Diaries] of the Cimento academicians in connection with an experiment on the density of water, performed on June 19, 1657. The sphere was placed in equilibrium in a cylindrical vase filled with water. The density was then increased by dissolving salt in the water, causing the sphere to rise. Adding ashes to the water augmented the upward thrust on the sphere.

Spheres for testing the non-compressibility of fluids

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: tin, copper
Dimensions: max. diameter 100 mm
Inventory: 1266, 1267, 1268, 1269, 2644, 2645, 2646, 2647

These four metal spheres were used by the Cimento academicians to prove the impossibility of compressing liquids. Indeed, the volume of fluids cannot be reduced even under heavy pressure. To demonstrate this principle, the academicians filled the spheres with liquid and sealed them. The spheres were then struck violently with a mallet in order to compact them. This caused the liquid to start leaking—proof of the non-compressibility of liquids.

Spiral thermometers

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: min. height 300 mm, max. 340 mm
Inventory: 193, 194/a, 194/b

Set of four thermometers with spiral or "snail" stems. These carry 420 enamel buttons indicating the degrees of one of the thermometric scales used by the Accademia del Cimento. The black buttons indicate single degrees, the white buttons ten degrees, and the blue buttons one hundred degrees. The thermometric liquid is *acquarzente*. As noted by the academicians themselves in *Saggi di naturali esperienze* [Examples of natural experiments] (Florence, 1667), this type of thermometer was less fragile than longer models, but it was built "rather for the eccentricity and for the curiosity of seeing the water run the dozens of degrees, moved by the simple closeness of breath, than for determining correct and infallible proportions of heat and cold."

Stand

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass
Dimensions: diameter 405 mm
Inventory: 3802

This stand has the usual round form with a smooth-rimmed platform mounted on a bell-shaped base that widens at the bottom. The shape is simpler than that of the analogous objects commonly found in the Veneto in the sixteenth century.

Stem

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: glass
Dimensions: height 205 mm
Inventory: 87

Thin stem with a small cup attached to the side. The stem ends in a sphere surmounted by a small enamel bird. The exact purpose of this object in the Accademia del Cimento's experimentation program has not been established.

Stem hydrometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 280 mm
Inventory: 191

Hydrometer consisting of a graduated stem with green enamel dots. The bulb extends into an enamel ring from which a pierced iron triangle is suspended by means of small chains. This type of instrument was probably intended to measure the density of wines.

Stem hydrometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass

Dimensions: length 110 mm
Inventory: 185

Hydrometer consisting of a graduated stem with white enamel dots. The glass has yellow traces. Attached to the bulb, where traces of mercury can be observed, are three glass rings from which a small iron triangle is suspended by means of small chains. This type of instrument was probably intended to measure the density of wines.

Stem hydrometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 180 mm
Inventory: 217

Hydrometer consisting of a stem with white and black enamel graduations. It ends in two bulbs, one of which contains mercury. This type of instrument was probably intended for measuring the density of wines.

Stem hydrometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 125 mm
Inventory: 178

Hydrometer consisting of a short stem, graduated with enamel dots and ending in two bulbs of different diameters. The smaller bulb contains lead pellets; the liquid in the larger one is almost certainly *acquarzente*.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 215 mm
Inventory:	187

Hydrometer consisting of a graduated stem with white enamel dots. The bulb has three glass rings from which an iron disk is suspended by means of small chains. This type of instrument was probably intended for measuring the density of wines.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 132 mm
Inventory:	214

Hydrometer consisting of a graduated stem with small black and white enamel dots. The bulb contains lead pellets and is fitted with three rings, from which a pierced iron disk is suspended by means of small chains. This type of instrument was probably intended to measure the density of wines.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 100 mm
Inventory:	188

Small hydrometer whose stem is graduated with black and white enamel dots. The stem ends in two bulbs of different sizes, both containing lead pellets.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 205 mm
Inventory:	180

Hydrometer with a stem ending in a small spherical bulb. The bulb contains lead pellets. The stem is graduated with white and black enamel dots. Four short tubes depart from the stem and end in spheres, one of which is broken. The spheres are in a radial arrangement perpendicular to the stem.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 140 mm
Inventory:	3742

Hydrometer with a stem ending in two spherical bulbs of different sizes. The stem, graduated with green enamel dots, has a ring-shaped top. The smaller bulb contains lead pellets.

Stem hydrometer

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	length 125 mm

Inventory: 3741

Hydrometer consisting of a pipe-shaped phial, open at the top and ending in two bulbs. The smaller bulb has a pointed shape and contains mercury. The phial, which is not graduated, has two enamel spouts, one white, one black.

Tall-stem chalice

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent glass
Dimensions: height 154 mm, diameter 108 mm
Inventory: 318

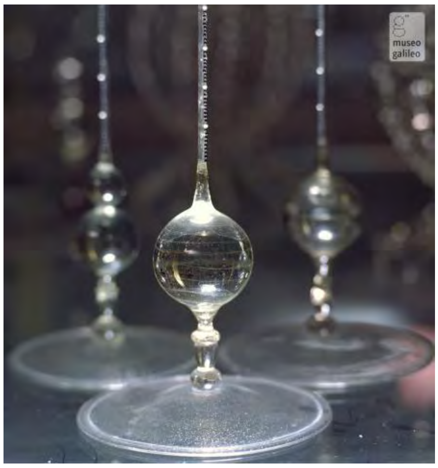
Chalice composed of a bell-shaped flared cup with a lightly ribbed, undulated surface, a tall striped stem with alternating narrow and bulging sections, and a round foot. The pattern is characteristic of sixteenth- and seventeenth-century glassware, as illustrated in the drawings attributed to the *à la façon de Venise* draftsman, and preserved in the Prints and Drawings Department of the Uffizi Gallery.

Tall-stem thermometers

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	min. height 1020 mm, max. 1065 mm
Inventory:	282, 283, 2447, 2448

Four tall-stem thermometers resting on branched feet. The stems carry enamel buttons indicating the degrees of one of the thermometric scales used by the Accademia del Cimento. The black buttons indicate single degrees, the white buttons ten degrees, and the blue buttons one hundred degrees. The thermometric liquid is *acquarzente*.

Tall-stem thermometers



Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	min. height 660 mm, max. 1130 mm
Inventory:	16, 17, 18, 20, 21, 25, 26, 160, 163, 164, 166, 167, 169, 170, 171

Set of fifteen tall-stem thermometers; each rests on a round foot and ends in a small round bulb. The stems carry enamel buttons indicating the degrees of one of the thermometric scales used by the Accademia del Cimento. The black buttons indicate single degrees, the white buttons ten degrees, and the blue buttons one hundred degrees. The thermometric liquid is *acquarzente*.

Thermometer phials

Setting: Room VIII
Inventor: Ferdinand II de' Medici [attr.]
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 140 mm
Inventory: 73, 74, 75, 76, 77

Set of five phials, probably part of the same thermometer. The phials contain *acquarzente*, in which small glass spheres of different density are immersed. The rise in temperature causes an increase in the volume of the *acquarzente*, reflected in the movement of the small spheres (first the less dense, then the more dense). Because of the spheres' sluggish motion, this thermometer was also called *infingardo* [slothful, slow]. The invention of this model is attributed to Grand Duke Ferdinand II de' Medici.

Thirty-degree thermometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass
Dimensions: length 225 mm
Inventory: 216

Thermometer divided into thirty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The thermometric liquid is *acquarzente*. The capillary tube, ending in a cylindrical bulb, is marked with small enamel dots, black for single degrees, and yellow for ten degrees.

Thirty-degree thermometer

Setting: Room VIII
Maker: unknown
Place: Florence
Date: mid-17th cent.
Materials: glass

Dimensions: length 70 mm
Inventory: 70

Minuscule thermometer graduated with small enamel dots, black for single degrees, white for ten degrees. It ends in a spherical bulb and it is divided into thirty degrees, one of the many thermometric scales adopted by the Accademia del Cimento. The thermometric liquid is *acquarzente*.

Trigonometric machine

Setting: Room VIII
Inventor: Samuel Morland
Maker: John Marke
Place: London
Date: 1670
Materials: silvered brass, silver
Dimensions: 330x275 mm
Inventory: 689

Device for determining the value of a trigonometric function (sine and cosine) of a known angle or, vice versa, for finding the value of an angle when its function is known. The machine was invented by Sir Samuel Morland in 1663 and built by John Marke. The instrument consists of a rectangular box holding a disk with a toothed circumference. At the center of the disk are mounted compasses with a fixed arm and a mobile arm rotating with the disk itself. Below are two smaller disks. The left-hand one shows the angle values. Its index is connected to the toothed circumference of the large disk and completes one revolution for every 30° traveled by the mobile compass arm. The right-hand disk shows the linear sine values. Its index is connected to the mobile horizontal rod on the upper half of the box, and completes one revolution for every 25 units traveled by the rod on the side channels. The numbering of the horizontal rod and vertical channels basically represents the sine grid or reduction quadrant. The instrument is housed in an ebony case with a lid and engraved plate. Provenance: Medici collections.

Vase

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: 17th cent.
Materials: transparent glass and blue glass with gilt traces
Dimensions: height 290 mm, diameter 95 mm
Inventory: 341/36

This vase has an ovoid body with vertical ribs running though it, a round foot with annular knop, and a large flared mouth. The spout and handle have blue glass ornaments. Two other parts are made of blue glass as well: the riveted limb of the spout and the pincered ribbon that covers the handle and ends in a knop and a small sphere. Inspired by Veneto glassmaking, the vase illustrates the *à la façon de Venise* style. Probably made in Tuscany, where the working of gilt glass is also documented.

Vases

Setting: Room VIII
Maker: unknown
Date: 16th cent.
Materials: glass
Dimensions: height 154 mm, diameter 45 mm
Inventory: 2064, 2065

Four vases made of decorated glass, each bearing the Medici coat of arms. Similar small vases are illustrated in the manuscript diaries of the Accademia del Cimento, preserved at the Biblioteca Nazionale Centrale of Florence. They were used for experiments on temperature changes in liquids, measured by means of alcohol thermometers placed inside them.

Vases with handles

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent glass
Dimensions: height 90 mm, diameter 135 mm
Inventory: 316, 317

These two small vases have no foot. Their ovoid body narrows toward the top, then opens up into a wide neck with a flared mouth. The vases have two double handles ending in curls. The entire body surface is covered in light ribbing typical of sixteenth- and seventeenth-century Veneto glassware. In fact, the anonymous Tuscan maker was inspired by the stylistic and decorative models illustrated in the drawings *à la façon de Venise* preserved in the Department of Prints and Drawings of the Uffizi Gallery.

Vases with spouts

Setting: Room VIII
Maker: unknown
Place: Tuscany
Date: late 16th cent. - early 17th cent.
Materials: transparent and blue glass, white and azure glass
Dimensions: height 300 mm, diameter 120 mm
Inventory: 257, 275

The vases have a double spherical body whose lower part carries pincered decorations, an octagonal flared neck, and a round foot surmounted by a medium faceted knop. Each vase has three spouts and two handles with crests. The handles are adorned with applied flowers in blue, white, and azure glass. The flowers were produced by lampworking, a technique in which Niccolò di Vincenzo Landi was an expert.

Wine-testing

Setting:	Room VIII
Maker:	unknown
Place:	Florence
Date:	mid-17th cent.
Materials:	glass
Dimensions:	height 210 mm
Inventory:	107, 108

The two flasks with lateral pipes ending in small cups were used to determine the aging of wine. The experiment consisted in filling the wine flask up to a certain level and bringing it to boil: the younger the wine, the higher it rose in the flask.

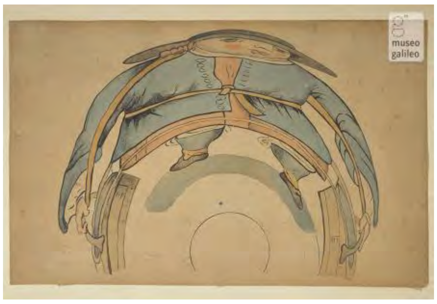
Room IX

After Galileo: Exploring The Physical and Biological World

Paolo Galluzzi - Giorgio Strano

Displayed in this room are various instruments used in some of the scientific disciplines that began to develop in the second half of the 17th century. At this time meteorology was progressing rapidly, thanks to perfected instrumentation for measuring variations in thermometric, barometric and hygrometric values. The systematic use of increasingly improved microscopes led to striking achievements in the fields of biology and entomology. Francesco Redi, a pioneer in these fields of research, brilliantly combined refined strategies of experimentation with scrupulous microscopic observations. Telescopes of ever greater size and more complex optical systems were also being produced by expert instrument makers. With such progress in telescopic instrumentation, astronomical observations led to crucially important discoveries.

Anamorphoses



Setting: Room IX
Maker: unknown
Date: 17th cent.
Materials: cardboard
Dimensions: 350x200 mm
Inventory: 490

The seemingly bizarre images drawn on cardboard are actually projections of "normal" images (one is a human figure, the other a picture of dice). When the drawing is placed in front of a suitably distorted mirror, the reflected image is restored to its normal shape. Such toys, called anamorphoses, were widely diffused in the seventeenth century, in keeping with the contemporary taste for the Baroque. Anamorphoses were made famous by the productions of Jean-François Niceron.

Burning mirror

Setting: Room IX
Maker: unknown
Date: 18th cent.
Materials: metal, brass
Dimensions: diameter 130 mm
Inventory: 791

White metal disk inserted into a brass frame with two rings. It was used for experiments on the reflection of light. It also served to heat or calcinate various substances. These were placed in the point where the solar rays reflected by the mirror were concentrated, producing very high temperatures.

Cistern barometer

Setting: Room IX
Maker: Antonio Matteucci
Place: Siena
Date: ca. 1850
Materials: wood, brass, glass
Dimensions: height 1002 mm, width 143 mm
Inventory: 1148

Cistern barometer mounted on a wooden base. The top is decorated with a wooden tympanum and a brass sphere. The mercury level is adjusted by means of a screw acting on the leather bottom of the cistern. The barometric scale, divided into Paris inches, is drawn on paper with floral decorations. Made by Antonio Matteucci, about whom we have no information.

Cistern barometer

Setting: Room IX
Maker: unknown
Date: second half 19th cent.
Materials: wood, brass, glass
Dimensions: height 1010 mm, width 168 mm
Inventory: 1161

Cistern barometer mounted on a wooden base. The mercury level is adjusted by means of a screw acting on the leather bottom of the cistern. The cistern is enclosed in a box placed at the base of the instrument. The barometric scale, fitted with a vernier, is divided into millimeters. There are three thermometers with centigrade scales: one is inserted into the cistern; a second, of the same shape, is partially immersed in the mercury at the top of the barometric tube; the third and largest is fixed to the wooden base.

Compound microscope

Setting:	Room IX
Maker:	unknown
Place:	Italian
Date:	late 17th cent.
Materials:	cardboard, vellum, wood, brass
Dimensions:	height 200 mm, diameter 58 mm
Inventory:	3247

Compound microscope made of cardboard covered in vellum. Supported in a brass collar with three legs. This support may be modern. The body-tube is made of cardboard covered in green vellum. The mounts are wooden. The only lens present is the objective (diameter 12 mm, thickness 3.5 mm). The glass is pale green and has some bubbles. Provenance: Medici collections.

Compound microscope, body-tube

Setting:	Room IX
Maker:	unknown
Place:	Italian
Date:	early 18th cent.
Materials:	cardboard, vellum, wood
Dimensions:	length 165 mm, diameter 41 mm
Inventory:	3797

Body-tube of compound microscope made of cardboard covered in vellum decorated with gold tooling and red and green blotches. Only the eyepiece is present. The quality of the glass, which shows a large number of bubbles, suggests that the instrument was made in the early eighteenth century, or perhaps slightly earlier. The colored patterns on vellum are mainly characteristic of

English microscopes, but this example is certainly Italian. The lower part of the tube was probably either held in a collar fastened to a pillar mounted on a base, or was inserted in a tripod. Provenance: Medici collections.

Compound microscope, part of body-tube

Setting:	Room IX
Maker:	unknown
Place:	Italian
Date:	late 17th cent.
Materials:	cardboard, vellum, wood
Dimensions:	length 195 mm, diameter 52 mm
Inventory:	1309

Part of the body-tube of a compound microscope, made of cardboard covered with green vellum. The outer tube is decorated with gold tooling; the inner tube is undecorated. Similar tooling is also found on the two telescopes made in Bologna by Paolo Belletti in 1682 and 1689 (see inv. 3639). While this does not constitute incontrovertible evidence that Belletti was the maker, we can at least claim that the instrument is the work of an Italian maker of the same period. The words in Latin (possibly from a legal document) inside the tubes shows that these were made of waste paper. The lenses are missing from the wooden mounts. The outer-tube mount shows signs of a tripod stand. Provenance: Vincenzo Viviani bequest.

Eyepiece lens

Setting:	Room IX
Maker:	Eustachio Divini
Place:	Rome
Date:	1666
Materials:	glass, cardboard, florentine paper
Dimensions:	length 107 mm, diameter 63 mm
Inventory:	2574

Biconcave eyepiece lens mounted in a cardboard ring covered with red marbled paper. The diameter of the lens is c. 35 mm, the focal length -94 mm (the negative focal length means that the lens is diverging). On the ring is the inscription "Eustachio Divini in Roma 1666 Acuto per Palmi 26," i.e., diverging eyepiece for a telescope of 26 palms (5,780 mm). The glass has a slight yellow tint and contains some bubbles and inclusions. The lens is mounted in a cardboard housing covered with red marbled paper. The tube, 107 mm long and 57 mm in diameter, has a nineteenth-century label with the same inscription as on the ring.

Eyepiece lens

Setting:	Room IX
Maker:	Ippolito Francini or Evangelista Torricelli or Jacopo Mariani [attr.]
Place:	Florence
Date:	1640-1660
Materials:	glass, wood, paper
Dimensions:	diameter 44 mm
Inventory:	2584

Plano-concave eyepiece lens, with cracked glass, mounted in a wooden ring covered with paper. The lens diameter is 30 mm, the aperture 24 mm, the focal length -200 mm (the negative focal length means that the lens is diverging). On the ring can be read "B: 10," indicating that it was to be combined with an objective of 10 *braccia* (5,840 mm). Intended for very powerful instruments, this type of eyepiece was used in the years between 1640 and 1660. The lens is of Florentine origin, as can be deduced from the reference to *braccia.* Moreover, the ring and the inscription, which resemble those of items inv. 2572 and inv. 2571, suggest an attribution to Evangelista Torricelli or another Florentine optician such as Ippolito Francini or Jacopo Mariani.

Eyepiece lens

Setting: Room IX
Maker: Ippolito Francini or Evangelista Torricelli or Jacopo Mariani [attr.]
Place: Florence
Date: 1640-1660
Materials: glass, wood, cardboard
Dimensions: diameter 39 mm
Inventory: 2585

Biconcave eyepiece lens mounted in a wooden ring covered with cardboard. The diameter of the lens is 27 mm, the focal length -84 mm (the negative focal length means that the lens is diverging). The glass, which has a slight green tint, contains elliptical bubbles. On one side of the ring all that remains legible is the written word "braccia," a unit of measure indicating the Florentine origin of the lens. The whole inscription is, however, preserved in an old catalogue: "Di braccia 5 1/2." This eyepiece was therefore to be used with a telescope of 5.5 *braccia* (3,210 mm). The lens can be dated to between 1640 and 1660. It may have been made by Evangelista Torricelli, Ippolito Francini or Jacopo Mariani.

Folli's paper-ribbon hygrometer

Setting: Room IX
Inventor: Francesco Folli
Maker: unknown
Date: second half 17th cent.
Materials: wood, brass
Dimensions: length 711 mm, height 238 mm
Inventory: 2434

Type of hygrometer invented by Francesco Folli c. 1660. A square-sectioned wooden rod carries a small roll at each end, on which is wrapped the end of a paper ribbon serving as a hygroscopic substance. The center of the rod holds a support for a decorated brass dial fitted with a circular graduated scale. The dial is integral with a pointer that, by means of a simple mechanical system, indicates the changes in ribbon length due to the variations in atmospheric humidity.

Folli's paper-ribbon hygrometer

Setting: Room IX
Inventor: Francesco Folli
Maker: unknown
Date: second half 17th cent.
Materials: brass
Dimensions: length 280 mm, height 100 mm
Inventory: 2435

Type of hygrometer invented by Francesco Folli c. 1660. A brass frame, in the shape of a finely decorated balustrade, carries a small roll at each end, on which is wrapped the end of a paper (now missing) ribbon serving as a hygroscopic substance. The center of the frame holds a decorated brass dial fitted with a circular graduated scale. The dial is integral with a pointer that, by means of a simple mechanical system, indicates the changes in ribbon length due to the variations in atmospheric humidity.

Glass cone

Setting: Room IX
Maker: unknown
Date: second half 18th cent.
Materials: glass
Dimensions: base diameter 73 mm, height 65 mm
Inventory: 2617

This glass cone, whose mount is missing, was probably used for experiments on refraction.

Lens with central bore

Setting: Room IX
Maker: unknown
Date: early 18th cent.
Materials: glass, brass
Dimensions: lens diameter 65 mm, height 90 mm
Inventory: 2596

Biconvex lens hollowed out and bored at the center. The lens is mounted in a brass ring that extends to form a short handle.

Lens with mount

Setting: Room IX
Maker: unknown
Date: late 18th cent.
Materials: glass, wood
Dimensions: lens diameter 84 mm, mount diameter 175 mm
Inventory: 1339

Biconcave diverging lens mounted in a large wooden ring. Probably an accessory for optical bench.

Lens with mount

Setting: Room IX
Maker: unknown
Date: 16th cent.
Materials: rock crystal, wood
Dimensions: lens diameter 60 mm, height 182 mm
Inventory: 2586

Biconcave diverging lens mounted in a wooden ring with a finely turned handle. In the old inventories it is described as "said to be that of Leo X" since a celebrated painting by Raphael shows Pope Leo X with a similar lens in his hands.

Lens with mount

Setting:	Room IX
Maker:	unknown
Date:	17th cent.
Materials:	glass, bone
Dimensions:	lens diameter 66 mm, height 150 mm
Inventory:	2595

Biconvex converging lens with mount and handle (corroded) in worked bone.

Lens with mount

Setting:	Room IX
Maker:	unknown
Date:	late 17th cent.
Materials:	glass, silver
Dimensions:	lens diameter 55 mm, height 90 mm
Inventory:	2630

Biconvex converging lens mounted in a silver ring with a worked handle.

Lens with mount

Setting:	Room IX
Maker:	unknown
Date:	late 18th cent.
Materials:	glass, wood
Dimensions:	lens diameter 75 mm, mount diameter 160

mm
Inventory: 2583

Plano-convex converging lens with a strong curvature, called a "bull's eye," mounted in a wooden ring. Probably an accessory for an optical bench.

Lens with mount

Setting: Room IX
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood
Dimensions: lens diameter 150 mm, height 340 mm
Inventory: 784

Biconvex converging lens mounted in a wooden ring with a turned handle. Probably an accessory for an optical bench.

Mercury thermometer

Setting: Room IX
Maker: unknown
Date: 19th cent.
Materials: wood, glass, brass
Dimensions: height 529 mm, width 70 mm
Inventory: 1795

Mercury thermometer mounted on a brass plate and fixed to a wooden box with a glass front. The bulb is broken. A Réaumur scale is engraved on the brass plate.

Model of the eye

Setting: Room IX
Maker: Giovan Battista Verle [attr.]
Date: 17th cent.
Materials: boxwood, ivory, glass
Dimensions: height 60 mm, base diameter 53 mm
Inventory: 644

The turned boxwood base holds a small spherical ivory container with a screw lid. Inside the container is a model of the eyeball—with all its parts—that can be taken apart. The detachable base houses a wooden model of the external part of the eye. The eyeball structure is as described by Giovan Battista Verle in a pamphlet published in Florence in 1679 (*Anatomia artifitiale dell'occhio umano, inventata e fabbricata nuovamente da Gio-Battista Venetiano*), dedicated to Ferdinand de' Medici, Prince of Tuscany. Provenance: Medici collections.

Model of the eyeball

Setting: Room IX
Maker: Chérubin d'Orléans [attr.]
Date: late 17th cent. (?)
Materials: wood, glass
Dimensions: length 450 mm
Inventory: 2582

Model of the eyeball that can be taken apart. The crystalline lens and vitreous humors are made of glass, the other parts of painted wood. The old inventories of the Museo di Fisica e Storia Naturale attribute the model to Chérubin d'Orléans. Provenance: Medici collections.

Objective lens

Setting:	Room IX
Maker:	Evangelista Torricelli
Place:	Florence
Date:	1646
Materials:	glass, cardboard, leather
Dimensions:	diameter 115 mm
Inventory:	2571

Plano-convex objective lens mounted in a cardboard ring. The edge is covered with leather. The aperture is 84 mm, the focal length 6,050 mm, and the ring diameter 115 mm. The glass, which has a red tint, contains elliptical bubbles and some inclusions. One side of the ring is inscribed "Vangelista Torricelli. Fiorenza 1646 Braccia 10.1/4" (5,970 mm).

Objective lens

Setting:	Room IX
Maker:	Evangelista Torricelli
Date:	1643
Materials:	glass, cardboard
Dimensions:	diameter 54 mm
Inventory:	2572

Biconvex objective lens mounted in a cardboard ring. The aperture of the lens is 40 mm, the focal length 1,480 mm, the diameter of the ring 54 mm. The glass, which has a red tint, contains elliptical bubbles and some inclusions. The lens is scratched. One side of the ring has an inscription ("V. Torr: 8.feb.1643") indicating the maker (E. Torricelli) and the construction date. On the other side can be read "B. 2 1/2," i.e., 2.5 *braccia* (1,460 mm, a measure of the focal length).

Objective lens

Setting: Room IX
Maker: Jacopo Mariani
Place: Florence
Date: 1660-1670
Materials: glass
Dimensions: diameter 70 mm
Inventory: 2632

Objective lens with a diameter of 70 mm, a thickness at the center of 4 mm, and a focal length of 3,600 mm. It is chipped on the edge, probably because of a forced mounting in a ring. The glass has a slight red tint and contains many small elliptical bubbles. Still partially legible along the circumference is the inscription "Jacopo Mari... Fior...," which allows a definite attribution to Jacopo Mariani.

Octagonal telescope

Setting: Room IX
Maker: Eustachio Divini
Place: Rome
Date: 1664
Materials: wood, cardboard, florentine paper
Dimensions: length 2980 mm
Inventory: 2553

Terrestrial telescope consisting of six tubes. Five are made of wood and have octagonal sections. The sixth (the smallest) is made of cardboard and has a circular section. All are covered with red marbled paper. The biconvex objective is mounted in a separate tube that slides into the end of the largest draw tube. Both the lens and the ring enclosing it are inscribed "Eustachio Divini in Roma Palmi 12" (c. 2,700 mm). The smallest tube contains the compound eyepiece. The erector tube could be removed, converting the instrument into a simple astronomical telescope. The eyepiece lens and the front lens of the erector are now missing. The instrument's magnification is 44.

Octagonal telescope

Setting: Room IX
Maker: Eustachio Divini
Place: Rome
Date: 1674
Materials: wood, cardboard, florentine paper
Dimensions: length 5650 mm
Inventory: 2557

Terrestrial telescope consisting of seven main tubes, a separate tube for the objective, and three small tubes for the compound eyepiece. Of the seven main tubes, six are made of wood and have octagonal sections; the seventh, the smallest, is cylindrical. It is made of cardboard and covered with red marbled paper. The plano-convex objective is contained in a little cardboard tube that slides into the largest draw tube. The objective is signed on the glass and on the diaphragm by the maker, Eustachio Divini. The complex optical configuration gave the instrument a magnification of c. 55.

Optical toy

Setting: Room IX
Maker: unknown
Author: unknown
Date: 17th cent.
Materials: wood
Dimensions: 375x490 mm
Inventory: 3688

A wooden board to which wooden strips are fixed lengthwise and crosswise. Both the strips and board are painted in such a way that three different figures will appear, depending on the viewer's position. If we stand in front of the board, we will see the image of the Virgin and Child; if we look at the board from the right, we will see the Virgin alone; if we look from the left, we will see a figure of a saint.

Pillar barometer

Setting:	Room IX
Maker:	Daniel Quare
Place:	London
Date:	early 18th cent.
Materials:	wood, brass, ivory
Dimensions:	height 985 mm
Inventory:	1136

Elegant cistern barometer placed in an ebony column mounted on a tripod. The top of the barometric tube is housed in a decorated brass compartment with a glass front. Behind the glass are two silvered metal barometric scales, divided into English inches and bearing inscriptions in Spanish. Two recording pointers sliding along the scales are moved by two of the three finials inserted at the top of the glazed compartment. The cistern, in the quadrangular base, is made of wood with a leather bottom. The instrument, made by Daniel Quare, closely resembles item inv. 1135.

Pillar barometer

Setting:	Room IX
Maker:	Daniel Quare
Place:	London
Date:	early 18th cent.
Materials:	wood, brass, ivory
Dimensions:	height 1026 mm
Inventory:	1135

Elegant cistern barometer placed in an ebony column mounted on a tripod. The top of the barometric tube is housed in a decorated brass compartment with a glass front. Behind the glass are two silvered metal barometric scales, divided into English inches and bearing inscriptions in

French. Two recording pointers sliding along the scales are moved by two of the three finials inserted at the top of the glazed compartment. The cistern, in the quadrangular base, is made of wood with a leather bottom. The instrument, made by Daniel Quare, closely resembles barometer inv. 1136.

Pocket aneroid barometer

Setting:	Room IX
Maker:	Giustino Paggi
Place:	Florence
Date:	ca. 1880
Materials:	brass, glass
Dimensions:	diameter 47 mm
Inventory:	3659

Aneroid barometer housed in a metal box similar to those of pocket watches. The instrument has two barometric scales; one of them rotates and enables the instrument to be used as an altimeter. The first effective aneroid barometers of this type were made by Lucien Vidie. This model is by Giustino Paggi.

Telescope

Setting:	Room IX
Maker:	unknown
Place:	Italian
Date:	first half 18th cent.
Materials:	cardboard, wood
Dimensions:	length 650 mm
Inventory:	3090

Telescope consisting of three cardboard tubes, the largest of which is covered with brown leather with gold tooling. The eyepiece and the objective are missing. The objective was lodged in the largest tube, the eyepiece in the smallest. This configuration was typical of the Italian telescopes built between the mid-seventeenth and late eighteenth centuries.

Telescope

Setting: Room IX
Maker: unknown
Date: 1650-1670
Materials: cardboard, marbled paper, wood
Dimensions: length c. 3500-4000 mm
Inventory: 3377

Telescope consisting of nine tubes. The largest is made of cardboard and covered with red and white ornamental paper (the white part has turned yellow). It contained the objective, now missing. All the other tubes are covered with red marbled paper. The last tube contains is the biconcave eyepiece, which has a diameter of 20 mm and a focal length of c. -50 mm (the negative focal length means that the lens is diverging). The glass has a very slight green tint and contains some spherical bubbles. The quality of the glass, the concave eyepiece, and the tube characteristics suggest that the instrument dates from the mid-seventeenth century; the paper with Italian and Latin words lining one of the tubes indicates an Italian provenance.

Telescope for Torricelli's lens

Setting: Room IX
Maker: unknown
Date: Objective: 1647 / Tube: second half 18th cent. (?)
Materials: brass
Dimensions: length 1115 mm
Inventory: 2554

Telescope with a single brass tube, made from two tubes soldered together. There is a wooden diaphragm about halfway along the tube. The biconvex objective by Evangelista Torricelli is inserted in a cardboard ring bearing the inscription "V. Torr. in Fior. 1647. Br 1 3/4," i.e., a focal length of 1.75 *braccia* [1,022 mm]. The eyepiece is plano-convex, with a focal length of 32 mm. The glass quality of the two lenses is very different: the objective, typical of the first half of the seventeenth century, has a slight yellow tint and contains many small bubbles and inclusions; the eyepiece glass, certainly of later date, is clear and homogeneous. The instrument's magnification is 32. First mentioned in the 1776 inventory of the Museo di Fisica e Storia Naturale, it was probably made in the second half of the eighteenth century to house the Torricelli objective.

Terrestrial telescope

Setting: Room IX
Maker: Giuseppe Campani
Place: Rome
Date: ca. 1664
Materials: cardboard, leather
Dimensions: length 2250 mm
Inventory: 2551

Terrestrial telescope consisting of eight cardboard tubes. The largest is covered with green leather with gold tooling and contains the biconvex objective lens, 47 mm in diameter. The lens is signed by the maker (Giuseppe Campani) and inserted in a boxwood mount. The other tubes are covered with red marbled paper; some contain diaphragms. The eighth and smallest tube consists of two parts. The first is reversible. It contains two biconvex lenses and constitutes Campani's "compound spectacle"; the size and luminosity of the objects vary depending on which end of the housing is placed inside the tube. The second part contains a diaphragm and the sliding eyepiece, whose focal length is 58.4 mm. The instrument's magnification is 29 or 36, depending on the optical configuration. This is probably one of the 10-palm (2,230-mm) telescopes made by Campani in the mid-1660s; it is almost certainly the one he sent to Ferdinand II de' Medici in 1664.

Terrestrial telescope

Setting: Room IX
Maker: Eustachio Divini
Date: 1660-1670
Materials: cardboard, paper
Dimensions: length c. mm 3800
Inventory: 2552

Terrestrial telescope consisting of seven cardboard tubes. The largest is covered with green paper with gold tooling, the others in red marbled paper. The objective, now missing, was inserted into the largest tube. The eyepiece and the erector are contained in separate little tubes that slide into the smallest draw tube. The compound eyepiece consists of three pairs of plano-convex lenses placed close together. All the lenses have a focal length of 150 mm; the focal length of every pair is therefore 75 mm. This telescope was built by Eustachio Divini in the 1660s, probably for experimental purposes.

Terrestrial telescope

Setting: Room IX
Maker: Giovanni Battista Magnelli
Place: Italian
Date: 1695
Materials: cardboard, leather
Dimensions: length 2290 mm
Inventory: 2550

Terrestrial telescope consisting of seven cardboard tubes. The largest is covered with green leather with gold tooling. It carries the inscription "Io: Bap:Magnelli. Fior: F.1695," indicating the construction date and the maker, Giovanni Battista Magnelli. All we know about him is that he was a Florentine optician active in the second half of the seventeenth century. The other tubes are all covered with marbled paper. Two of them contain wooden diaphragms. The erector is inserted in the smallest tube, which accommodates the eyepiece lens at one end. The plano-convex objective is lodged in the largest tube, which ends with an ivory mounting. The instrument's magnification is 25.

Terrestrial telescope

Setting: Room IX
Maker: Johann Wiesel [attr.]
Place: German
Date: ca. 1650
Materials: paper, velvet, silk
Dimensions: length c. 1000 mm
Inventory: 2562

Terrestrial telescope consisting of seven tubes. The largest is covered with green velvet decorated with white silk ribbons. It carried the eyepiece, now missing. In the 1776 inventory of the Museo di Fisica e Storia Naturale the eyepiece of this telescope is defined as "compound," suggesting a date between 1640 and 1660. The smallest tube contains the objective. Many tubes are lined with pages of printed books in Latin and German. The instrument can therefore be ascribed to a maker active in the German area—quite probably Johann Wiesel of Augsburg.

Terrestrial telescope

Setting: Room IX
Maker: unknown
Place: English
Date: early 18th cent.
Materials: cardboard, leather
Dimensions: length 1640 mm
Inventory: 2558

Terrestrial telescope consisting of six tubes. The tubes are made of cardboard. The largest is covered with green leather decorated with lilies, the others with white leather. The compound eyepiece, contained in the first and second largest tubes, consists of three lenses showing a green tint. The objective, now missing, was housed in the smallest tube. Some tubes contain diaphragms. A typical terrestrial telescope of the late seventeenth or early eighteenth century, almost certainly of English manufacture.

Terrestrial telescope

Setting: Room IX
Maker: unknown
Place: Italian
Date: late 17th cent.
Materials: cardboard, leather
Dimensions: length c. 4400 mm
Inventory: 2560

Terrestrial telescope consisting of nine cardboard tubes. The largest, which contained the objective (missing), is covered with green leather with gilt tooling. The other tubes are covered with red marbled paper. The eyepiece (now missing) was in the smallest tube. The erector survives. It comprises two lenses and is placed in a small little inside the smallest draw tube. The instrument displays all the characteristics of a typical Italian terrestrial telescope of the late seventeenth century.

Terrestrial telescope

Setting: Room IX
Maker: Giuseppe Campani
Place: Rome
Date: 1666

Materials:	wood, leather
Dimensions:	length 3430 mm
Inventory:	2556

Terrestrial telescope consisting of six wooden tubes. The largest is covered with green leather with gold tooling. The others are covered with cardboard and red marbled paper. The biconvex objective lens has a diameter of 65 mm and an aperture of 40 mm. It is signed on the glass and fitted in a boxwood housing. The second to fifth draw tubes contain diaphragms; the sixth (the smallest) has a little tube—a typical feature of Giuseppe Campani's telescopes—which can be inserted in only one way. This erector unit contains two biconvex lenses. The eyepiece consists of a third biconvex lens. The three lenses form the compound eyepiece and have the same focal length. Removing the erector converts the telescope from terrestrial to astronomical. The magnification is 36.

Terrestrial telescope

Setting:	Room IX
Maker:	Giuseppe Campani
Place:	Italian
Date:	1665
Materials:	wood, cardboard, leather
Dimensions:	length c. 12000 mm
Inventory:	3185

Large terrestrial telescope consisting of ten wooden tubes covered with cardboard. The largest is additionally covered with green leather with gilt tooling and the Medici coat of arms. It houses the wooden mount for the objective lens. The other tubes are covered with red marbled paper. The smallest contains the compound eyepiece. The objective lens inv. 2587 and the compound eyepiece inv. 3449.2 belong to this telescope. The compound eyepiece inserted in the telescope carries the inscription "lente meno acuta" ["less acute (i.e., less powerful) lens"]. The tube in which it slides has two inscriptions: "Per la lente più acuta" ["for the more acute lens"] and "Lente meno acuta" ["(for) the less acute lens"]. The magnification is 223 or 112, depending on the eyepiece. Toward the mid-1660s, Giuseppe Campani built a telescope of 52 palms (11.6 m) that—in a *paragone degli occhiali* [one of several telescope competitions]—proved superior to one made by Eustachio Divini. In 1665, Campani presented another instrument of the same length to Grand Duke Ferdinand II de' Medici, which is the instrument here described. On July 11, 1665, the Grand Duke observed Jupiter and its moons.

Terrestrial telescope

Setting:	Room IX
Maker:	John Marshall [attr.]
Place:	English
Date:	1690-1720
Materials:	cardboard, parchment
Dimensions:	length 2190 mm
Inventory:	2561

Terrestrial telescope consisting of ten cardboard tubes covered with white parchment. The largest tube also has green, white, and red spots with gilt tooling. It carries the biconvex eyepiece and has a small opening that contains a metal mirror for observing at a right angle to the axis. The erector is missing. The thinnest tube contains the objective. Both lenses have a slight green tint and show few bubbles. The instrument's magnification is 54. It is certainly of English manufacture and of the same type as those made by John Marshall between 1690 and 1720. Similar to items inv. 3458 and inv. 2564.

Terrestrial telescope

Setting:	Room IX
Maker:	Jacques Tendre de Moulina
Place:	French?
Date:	first half 18th cent.
Materials:	cardboard, leather
Dimensions:	length 1470 mm
Inventory:	2548

Terrestrial telescope consisting of seven tubes. The tubes, made of cardboard, are covered with green leather (now faded) with gold tooling. The biconvex objective lens, held in the smallest tube, has a diameter of 30 mm, an aperture of 20 mm and a focal length of 1,070 mm. The eyepiece lens, now missing, was accommodated in the largest tube. The second and third tubes contain the two lenses of the erector, which, together with the missing eyepiece lens, formed the compound eyepiece. The magnification is c. 16. The second-largest tube carries the name of "Anthoine Dumner." The smallest tube bears the inscription "Jacques Tendre Iray [?] de Moulina." Neither person has been identified. The instrument dates from the late seventeenth or early eighteenth century and is probably of French construction.

Terrestrial telescope

Setting: Room IX
Maker: unknown
Place: Italian
Date: second half 17th cent.
Materials: cardboard, paper
Dimensions: length 1220 mm
Inventory: 3493

Terrestrial telescope consisting of five cardboard tubes. The largest, covered with green paper, contains the biconvex objective in a wooden mount. The other tubes are covered with marbled paper. The fifth draw tube contains a small two-part housing for three biconvex lenses forming the compound eyepiece. The quality of the glass and the characteristics of the compound eyepiece suggest that this is an Italian instrument of the late seventeenth century.

Terrestrial telescope

Setting: Room IX
Maker: John Marshall [attr.]
Place: English
Date: 1690-1720
Materials: cardboard, parchment
Dimensions: length 2160 mm
Inventory: 2564

Terrestrial telescope consisting of six tubes. All the tubes are made of cardboard and are covered with white parchment. The largest tube had the eyepiece and the erector (now missing). The smaller tube contains the biconvex objective, with a focal length of 2,200 mm. The glass of the objective shows a slight green tint. Many tubes are lined with pages of English texts. The instrument is of English manufacture and was almost certainly made by John Marshall between 1690 and 1720. It is similar to items inv. 2561 and inv. 3458.

Terrestrial telescope

Setting: Room IX
Maker: John Marshall [attr.]
Place: English
Date: late 17th cent.
Materials: cardboard, parchment

Dimensions:	length 1950 mm
Inventory:	3458

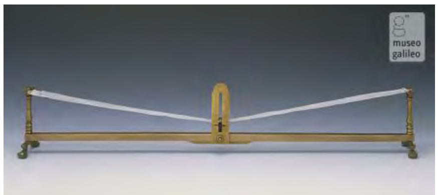
Terrestrial telescope consisting of eight tubes. All the tubes, made of cardboard, are covered with white parchment. The first also has red and green spots with gilt tooling. The largest tube contained the eyepiece, now missing, in a wooden mount. The first and second tubes each contain a lens. The eighth tube, the smallest, houses the objective lens. The instrument displays the characteristics of a typical English telescope, perhaps attributable to John Marshall. It is similar to items inv. 2564 and inv. 2561.

Terrestrial telescope

Setting:	Room IX
Maker:	Paolo Belletti
Place:	Italian
Date:	1689
Materials:	cardboard, leather, paper
Dimensions:	length 1730 mm
Inventory:	3639

Terrestrial telescope consisting of seven tubes, all made of cardboard. The largest is covered with red leather (turned brown with the passage of time) with gold tooling. It contains the objective. The other tubes are covered with decorative paper in various colors. The ring enclosing the objective bears the maker's signature and the construction date: "Paolo Belletti, Bolognese Año 1689." The compound eyepiece, 38 mm in diameter, is contained in the smallest tube and consists of three lenses, one of which is missing. The lens glass has a slight green tint and contains many bubbles and some inclusions. A typical example of a terrestrial telescope of Italian manufacture.

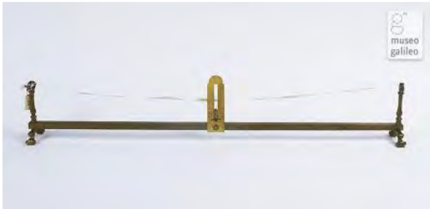
Viviani's paper-ribbon hygrometer



Setting:	Room IX
Inventor:	Vincenzo Viviani
Maker:	unknown
Date:	second half 17th cent.
Materials:	brass
Dimensions:	length 600 mm, height 110 mm
Inventory:	3, 2437

Hygrometer of the type invented or perfected by Vincenzo Viviani. The hygroscopic substance is a paper ribbon. The brass bar has a small turned column at each end. The columns carry two small rolls on which the ends of the paper ribbon are wrapped. The ribbon is weighted at the center by a wooden staff carrying a small pointer (the ribbon and staff are modern restorations). The changes in atmospheric humidity cause variations in the length of the paper ribbon, which are registered on a scale. This instrument is identical, even in size, to item inv. 2436.

Viviani's paper-ribbon hygrometer



Setting: Room IX
Inventor: Vincenzo Viviani
Maker: unknown
Date: second half 17th cent.
Materials: brass
Dimensions: length 600 mm, height 110 mm
Inventory: 2436

Hygrometer of the type invented or perfected by Vincenzo Viviani. The hygroscopic substance is a paper ribbon. The brass bar has a small turned column at each end. The columns carry two small rolls on which the ends of the paper ribbon are wrapped. The ribbon is weighted at the center by a wooden staff carrying a small pointer (the ribbon and staff are modern restorations). The changes in atmospheric humidity cause variations in the length of the paper ribbon, which are registered on a scale. This instrument is identical, even in size, to item inv. 3, 2437.

Viviani's paper-ribbon hygrometer

Setting: Room IX
Inventor: Vincenzo Viviani
Maker: unknown
Date: second half 17th cent.
Materials: iron, brass
Dimensions: length 610 mm, height 128 mm
Inventory: 1, 2439

Hygrometer of the type invented or perfected by Vincenzo Viviani. The instruments are incomplete: the hygroscopic substance—a paper ribbon—and the pointer are missing. The iron frame bears a small plate to which a paper scale is glued. A small strip of hygroscopic paper was fitted with an indicator and held by the frame. It lengthened or shortened with the changes in atmospheric humidity. This instrument is identical, even in size, to item inv. 2, 2438.

Viviani's paper-ribbon hygrometer

Setting:	Room IX
Inventor:	Vincenzo Viviani
Maker:	unknown
Date:	second half 17th cent.
Materials:	iron, brass
Dimensions:	length 610 mm, height 128 mm
Inventory:	2, 2438

Hygrometer of the type invented or perfected by Vincenzo Viviani. The instruments are incomplete: the hygroscopic substance—a paper ribbon—and the pointer are missing. The iron frame bears a small plate on which a paper scale is glued. A small strip of hygroscopic paper was fitted with an indicator and held by the frame. It lengthened or shortened with the changes in atmospheric humidity. This instrument is identical, even in size, to item inv. 1, 2439.

Viviani's rope hygrometer

Setting:	Room IX
Inventor:	Vincenzo Viviani
Maker:	Vincenzo Viviani [attr.]
Place:	Italian
Date:	second half 17th cent. (oldest part)
Materials:	wood, brass
Dimensions:	length 2560 mm, height 675 mm
Inventory:	799

Hygrometer attributed to Vincenzo Viviani, fully resembling the model invented by Santorio Santorio. On a wooden board, to be hung on a wall, a horizontally stretched rope of twisted gut is used as hygroscopic substance, weighted at the center by a boxwood ball. The changes in air humidity cause the gut to lengthen or shorten, modifying the ball's vertical position. This is measured by means of a graduated brass plate attached to the board. The brass plate is probably the only original part.

Wind vane

Setting:	Room IX
Maker:	unknown
Date:	Base: late 17th cent. / Horse: late 16th cent.
Materials:	bronze
Dimensions:	height 410 mm, base diameter 149 mm
Inventory:	3623

A small bronze horse is attached to the circular base. The horse carries a T-shaped support on which a wind vane pivots vertically to show wind direction, and two pairs of vanes pivot horizontally, their rotation indicating wind velocity. A decorative object rather than a scientific instrument.

Room X

The Lorraine Collections

Mara Miniati

When Gian Gastone de' Medici died in 1737, the Habsburg-Lorraine family became the sovereigns of Tuscany. At the initiative of Grand Duke Peter Leopold (1747-1792), the scientific collections were rearranged. Starting in 1769, they were moved from the Uffizi Gallery to the Imperial and Royal Museum of Physics and Natural History near Palazzo Pitti, inaugurated in 1775 under the direction of Felice Fontana (1730-1805). To the original Medicean core collection were added, over the years, apparatus built in the Museum's workshops, such as dividing machines, various instruments used in physics, wax anatomical models, workbenches and cabinets, as well as precision instruments imported from abroad. Some of these objects can be seen here, in the original display cases of the Physics Museum. The Museum also had an astronomical observatory, directed at one time by the renowned astronomer and optician Giovanni Battista Amici (1786-1863). In 1841, under the direction of Vincenzo Antinori, the most ancient part of the collection was placed in the Galileo Tribune. The collection continued to grow until 1859, when the last Grand Duke of the Lorraine dynasty, Leopold II, left Tuscany, never to return.

Air pump, twin barrels, table-top model

Setting: Room X
Maker: unknown
Place: Paris
Date: ca. 1830
Materials: mahogany, brass, iron, glass
Dimensions: total height 520 mm, base 460x400 mm
Inventory: 3777

Typical nineteenth-century French air pump, fairly common in physics laboratories until the early twentieth century. Mounted on a wooden base, it is fitted with two glass barrels whose pistons carry racks and are operated by a pinion with two handles. The mechanism is housed in a frame supported by a pair of small brass pillars. A stop-cock at the base of the barrels regulates the flow of air from the bell-jar, which rests on a metal plate covered by a ground-glass disk. In 1827, the Italian physicist Giuseppe Belli invented a special faucet for adjusting the connections between the pistons and the plate so as to obtain a better vacuum. This device was reinvented independently a few years later by Jacques Babinet, whose name is engraved on the faucet. A mercury pressure-gauge or manometer fitted with a second faucet is screwed onto the connection between the plate and the barrels. English-made pumps of this type always had brass barrels, while those made in France generally had glass barrels. Provenance: Lorraine collections.

Alidade for clockmaker's lathe

Setting: Room X
Maker: Francesco Comelli
Place: Bologna
Date: ca. 1780
Materials: iron
Dimensions: length 333 mm
Inventory: 3599

The lathe alidade consists of an adjustable rod for blocking at a selected point the dividing plate incorporated into the wheel-cutting machine. This specimen is of unusually refined construction and considerable length. Made by Francesco Comelli.

Altazimuth quadrant

Setting:	Room X
Inventor:	Giovanni Domenico Cassini
Maker:	Dubois
Place:	Paris
Date:	18th cent.
Materials:	brass
Dimensions:	250x220x280 mm
Inventory:	684

This altazimuth quadrant is called a *Cassini* quadrant (after Giovanni Domenico Cassini). A frame is placed upright on a graduated brass arc. A small telescope slides along the graduated arc of a second quadrant attached to the frame. A second finder telescope pivots on a small pillar. The instrument served to measure vertical and horizontal angles and perform astronomical and topographic observations (such as determining the time and latitude). This specimen was built by a French maker named Dubois, about whom we have no information. Provenance: Lorraine collections.

Balance

Setting:	Room X
Maker:	unknown
Date:	18th cent.
Materials:	wood, brass; case: wood, glass
Dimensions:	360x345x530 mm
Inventory:	567

Incomplete balance with steel balance beam and small brass pans, housed in a wooden and glass case. The pillar is sphinx-shaped. The item was already listed in the 1807 Inventory of the Chemistry Laboratory of the Museo di Fisica e Storia Naturale.

Castelli hydraulic pump (hydraulic fan)

Setting:	Room X
Maker:	unknown
Place:	Florence
Date:	1794
Materials:	wood, brass, iron, leather
Dimensions:	total height 1320 mm, base 1210x787 mm
Inventory:	1029

This type of pump - also known as *idrobalo* - was invented c. 1785 by the Milanese provost Carlo Castelli, who called it a "hydraulic fan" [*ventilatore idraulico*] for its resemblance to fan systems used in mines. Indeed, the pump lacks pistons and rotating parts, but operates by means of a moving compartment. It is fastened to a large varnished wooden case with two removable covers that serves as a water tank. The machine body consists of a large brass cylinder topped by a spherical dome that carries a horizontally-moving handle. A long nozzle-tipped pipe is screwed diagonally to the dome. Two water-intake tubes lead out from either side of the pump into the tank through cord-covered leather sleeves. The pump body is internally divided by a pair of prism-shaped panels fitted with valves. When the handle is rotated, it activates a moving partition hinged vertically between the panels. The movement of the panel draws water from the tank on one side and drives it toward the upper dome and the pipe. The dome also acts as an air chamber to maintain a constant pressure. Such pumps were used for irrigation, drawing water from wells, and firefighting. The specimen displayed here was built in the workshop of the Museo di Fisica e Storia Naturale of Florence between 1793 and 1794.

Chemistry cabinet

Setting:	Room X
Maker:	unknown
Date:	18th cent.
Materials:	wood, slate
Dimensions:	open 2570x1170x1400 mm; closed 1840x970x1260 mm
Inventory:	319, 824, 1605, 1616, 1623, 1632, 1642, 1645, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1730, 1739, 1758, 1759, 1760, 1813, 1815, 1822, 1823, 1824, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1836,

1838, 1839, 1840, 1841, 1843, 1846, 1848, 1850, 1858, 1859, 1871, 1877, 1878, 1879, 1880, 1883, 1890, 1892, 1893, 1900, 1901, 1904, 1906, 1907, 1908, 1933, 1934, 1951, 1952, 1953, 1999, 2066, 2080, 2081, 1082, 3537, 3559, 3785, 3788, 3791, 3793, 3917, 3918, 3919, 3920, 3921, 3922, 3923, 3924, 3925

Grand Duke Peter Leopold installed a chemical laboratory in the Museo di Fisica e Storia Naturale of Florence, in which he personally performed experiments as a hobby, often assisted by Giovanni Fabbroni. The equipment is housed in a large cabinet with walnut inlays. The cabinet opens up to form a slate working surface with three cavities, one of which is internally connected to a pedal-operated bellows for combustion and calcination operations. There are small shelves, drawers, and compartments for storing bottles of chemical preparations and assorted glassware. Also exhibited are objects from the Granducal period.
The following items belonged to Peter Leopold's chemistry cabinet:
- thirteen small flat-based cylindrical glass jars with lids with ball knobs, containing various substances;
- ten small square-shaped glass jars, some with boxwood lids;
- a black varnished wooden inkstand;
- a silvered brass two-branched candlestick, whose arms are decorated with a tendril motif;
- two ivory mortars with pestles;
- a gilt bronze mortar with pestles;
- an agate mortar with egg-shaped pestle;
- brass tongs for holding tubes, partly covered in leather, with two threaded boxwood handles;
- a small white porcelain basin with a hole at the center and a porcelain stopper;
- a glass funnel, with a small handle;
- a wooden funnel for pouring mercury;
- a fireclay funnel without handle;
- a porphyry slab on a wooden base;
- a small dismountable brass casting furnace, internally lined with refractory material;
- a white glass smooth-necked matrass with a round body, for preparing solutions of salts in water;
- two glass jugs; two small garnet-red crystal bowls with lids;
- four small hard-stone bowls;
- a glass chalice decorated with scenes;
- a small crystal basin with arabesque motifs;
- a boxwood clamp with pressure screw;
- a flat-bottomed, long-necked wax bottle.

Chinese balance

Setting:	Room X
Maker:	unknown
Date:	19th cent.
Materials:	brass, steel, wood; case: wood, glass
Dimensions:	530x232x690 mm; pan diameters 160 mm
Inventory:	817

Chinese balance whose base consists of a drawer containing 37 brass weights in the shape of violin cases—a widespread, characteristic pattern used by Chinese balance-makers. On the drawer is mounted a bridge structure acting as a support for hanging the balance. At the center of the balance beam is the pointer, in the distinctive shape of an isosceles triangle: a small rod placed in the upper central section of the bridge holds a brass ring containing the pointer needle. Two bowl-shaped pans are suspended from the balance beam by two pairs of four thin chains. The balance can be taken apart and stored in the drawer for carrying. Provenance: Lorraine collections.

Circle-dividing engine

Setting:	Room X
Inventor:	Michel-Ferdinand d'Albert d'Ailly, Duc de Chaulnes
Maker:	unknown
Place:	Florence
Date:	1762
Materials:	wood, brass, marble
Dimensions:	1610x1170x1250 mm
Inventory:	586, 3244

This dividing engine, built in the workshop of the Museo di Fisica e Storia Naturale, was used to mark scale divisions on arcs of circles (of astronomical and nautical instruments, for example). Some features resemble those of the engine designed by the Duc de Chaulnes.
The engine is mounted on a heavy marble slab resting on an elegant eighteenth-century table. It consists of a large brass disk with a toothed rim and a mechanical system for guiding and adjusting the motion of a tracing burin. A handle with a graduated quadrant serves to rotate a worm screw that meshes with the rim of the disk, on which the scale to be divided was fastened.

Each turn of the handle translated into a minuscule rotation of the disk. Two micrometric microscopes (of which one is now missing) served to check the positioning of the divisions etched by the burin.

Cistern barometer

Setting: Room X
Maker: Edward Nairne
Place: London
Date: ca. 1770
Materials: wood, brass, glass
Dimensions: height 1080 mm, width 116 mm
Inventory: 1147

Elegant cistern barometer mounted on a shaped wooden base. The lower part of the cistern is enclosed in a wooden hemisphere. The barometric scale, in English inches, is engraved on a silvered brass plate and fitted with a vernier. The instrument has a mercury thermometer with a Fahrenheit scale, and an oat's-beard hygrometer placed above the barometric scale. Made by Edward Nairne.

Cistern barometer

Setting: Room X
Maker: Nairne & Blunt firm
Place: London
Date: ca. 1780
Materials: wood, glass, brass
Dimensions: height 1160 mm, width 150 mm
Inventory: 3707

Elegant cistern barometer mounted on a wooden base with glass windows. An ivory floating weight with reference index is inserted in the cistern; a screw underneath it adjusts the level of the mercury by acting on a leather membrane. The barometric scale, in English inches, is fitted with a vernier. There is also a mercury thermometer with a Fahrenheit scale and recording pointer, and an oat's-beard hygrometer calibrated by means of a handle. Made by Nairne & Blunt.

Lens of Archduke Leopold of Lorraine

Setting:	Room X
Maker:	unknown
Date:	second half 18th cent.
Materials:	lens: glass, ivory; case: leather, velvet
Dimensions:	diameter 55 mm, height 33 mm
Inventory:	3561

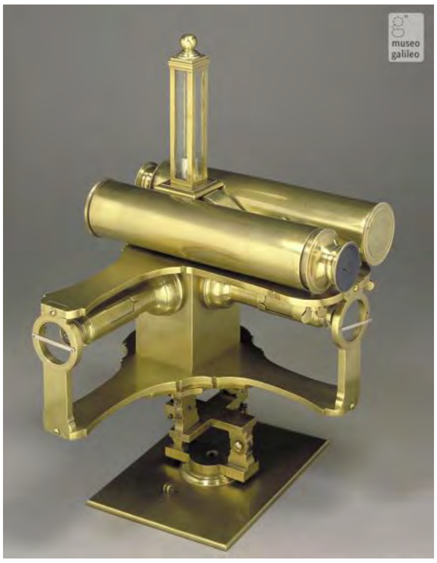
Magnifying lens that belonged to Archduke Leopold of Lorraine. Consists of two biconvex lenses, fitted in a short turned ivory tube. Enclosed in a leather case with the initials "A.L." [Arciduca Leopoldo]. The crown prince of Tuscany took the title of Archduke before he became Grand Duke Leopold II.

Lens-grinding lathe

Setting:	Room X
Maker:	Andrea Frati
Place:	Florence
Date:	second half 18th cent.
Materials:	lacquered and marbled wood, iron, brass
Dimensions:	height 930 mm, width 1050 mm, wheel diameter 480 mm
Inventory:	3194

The machine is mounted on a richly decorated wooden frame. A handle moves a wheel that rotates a small vertical boxwood plate by means of a pulley. The lenses to be ground were attached to the plate. The wheel axle also moves a series of toothed gears that simultaneously actuate a disk with different gear ratios (on which the lenses are mounted) and a tool holder that could be lowered. Some parts are missing. The instrument's construction and decoration suggest that it was more a demonstration apparatus than an efficient machine-tool. However, it may have been designed for cutting and cleaning semi-precious stones. The 1776 inventory of the Museo di Fisica e Storia Naturale listed Andrea Frati as the inventor.

Level



Setting:	Room X
Inventor:	Felice Fontana [attr.]
Maker:	unknown
Place:	Florence
Date:	second half 18th cent.
Materials:	brass
Dimensions:	240x225x350 mm
Inventory:	735

Level consisting of a frame to which are attached two parallel telescopes pointing in opposite directions. A plumb line housed in a miniature kiosk with windows passes in front of the eyepieces of two micrometer microscopes at right angles. These are used to verify the perfectly horizontal position of the telescopes relative to the vertical plane of the plumb line. The arrangement enabled the telescopes to align two points on the horizontal plane. The instrument, probably designed by Felice Fontana, was built in the Museo di Fisica e Storia Naturale workshop.

Level

Setting:	Room X
Maker:	unknown
Date:	late 18th cent.
Materials:	brass, wood
Dimensions:	205x235x165 mm
Inventory:	733

The instrument comprises a telescope with bubble level mounted on a wooden base (not original). There is a thread micrometer; one of the threads is moved by means of a small handle with a graduated scale fitted on the telescope tube. Provenance: Lorraine collections.

Level checker

Setting:	Room X
Maker:	unknown
Date:	late 18th cent. - early 19th cent.
Materials:	brass, glass
Dimensions:	length 540 mm, height 110 mm
Inventory:	725

The device, used to check bubble levels, consists of a brass frame in which the level to be checked is inserted. By means of a screw and a pair of sliding indexes, one can either determine the exact position of the air bubble contained in the liquid, or change it. The instrument rests on a brass base engraved with a goniometer and fitted with leveling screws. Provenance: Lorraine collections.

Line-dividing engine

Setting:	Room X
Maker:	unknown
Place:	Florence
Date:	second half 18th cent.
Materials:	wood, brass
Dimensions:	1020x730x1300 mm
Inventory:	1023, 3244, 3368

This dividing engine, built in the workshop of the Museo di Fisica e Storia Naturale, was used to mark divisions on rectilinear scales such as thermometric and barometric scales. Its features resemble those of the model designed by the Duc de Chaulnes. It consists of a micrometric screw rotated by means of a handle fitted with an index and graduated scale. The rotation moved forward a board holding the piece on which the scale was to be engraved. The markings were engraved by a point mounted in a frame.

Mechanical equinoctial dial

Setting:	Room X
Maker:	Felice Gori
Place:	Florence
Date:	ca. 1820
Materials:	brass
Dimensions:	diameter 133 mm
Inventory:	3754

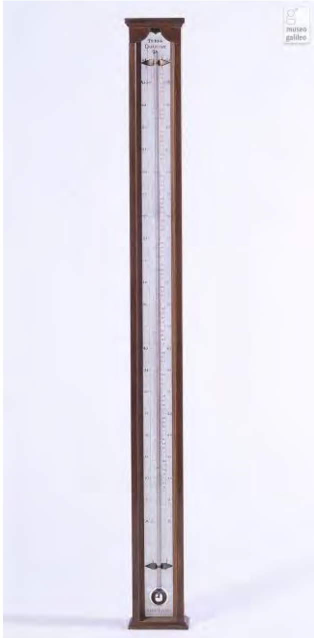
The instrument, made by Felice Gori, consists of an optical tube that rotates and tilts by means of an arc. The tube rests on a disk whose angle with the base plate can be adjusted by means of a second arc. The disk is tilted to match the local latitude and the optical tube is pointed at the Sun so that the Sun's image is projected on the center of a small tilted ivory plate inserted in the tube. When the tube is oriented in this way, a window in the rotating disk shows the hour, while a mobile pointer displays the minutes on a circular scale. Provenance: Lorraine collections.

Medallion of Peter Leopold

Setting:	Room X
Author:	Johann Tobias Sergel
Date:	18th cent.
Materials:	chalk
Dimensions:	650x545 mm
Inventory:	1902

Plaster medallion by the sculptor Johann Tobias Sergel showing the effigy of Peter Leopold.

Mercury thermometer



Setting: Room X
Maker: Felice Fontana
Place: Italian
Date: second half 18th cent.
Materials: wood, glass
Dimensions: height 554 mm, width 50 mm
Inventory: 3464

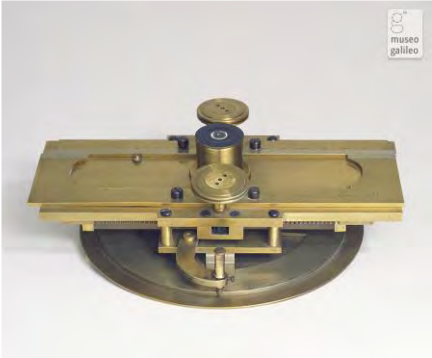
Mercury thermometer mounted on a glass plate on which the centigrade scale is written in red ink. Housed in a box with two glass walls. One of the few surviving instruments signed by Felice Fontana, it was built in the workshop of the Museo di Fisica e Storia Naturale.

Meter

Setting: Room X
Maker: Felice Gori
Place: Florence
Date: 19th cent.
Materials: brass
Dimensions: length 1016 mm
Inventory: 3107

Brass meter with millimeter divisions, signed by the maker, "Gori," (Felice Gori) and built in the mechanical workshop of the Museo di Fisica e Storia Naturale. The length of this standard is provided either by the ends of the bar (which has two recesses for the purpose) or by the distance between two lines engraved on its surface. Provenance: Lorraine collections.

Mobile mount for eyepiece



Setting: Room X
Maker: Galgano Gori
Place: Florence
Date: 1838
Materials: brass
Dimensions: length 175 mm
Inventory: 3242

This device, signed by Galgano Gori, served to move the eyepiece on the focal plane of the telescope by means of a slide and rack mechanism. The mount enabled the observer to explore the sky with controlled movements, or to track an object when it was escaping from view because of the apparent motion of the celestial sphere. The mount could also rotate on an axis parallel to the optical axis of the telescope so as to orient the eyepiece in the direction required by the observation.

Model of breech birth

Setting: Room X
Author: unknown
Place: Florence
Date: 1770-1775
Materials: terracotta
Dimensions: 220x460x400 mm
Inventory: Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, describes a birth with "feet-first" breech presentation. The lower limbs of the fetus, in posterior position, protrude from the vulva and the operator assists in the expulsion by pulling the legs with the right hand.

Model of breech birth

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	190x450x430 mm
Inventory:	Dep. OSMN, Firenze

This teaching model describes a breech birth, in which the upper limbs form a barrier to the expulsion of a fetus in anterior position. This adverse occurrence was caused by one or more abrupt tractions on the feet by the operator. The arms undergo attrition against the uterine walls and the pelvic entrance. They therefore depart from their normal attitude in front of the thorax and do not engage with the trunk of the fetus, which is moving out of the womb. The model was commissioned by Giuseppe Galletti.

Model of caput succedaneum

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	440x480x480 mm
Inventory:	Dep. OSMN, Firenze

The fetus depicted in this obstetrical wax model displays a lump on its head known as a *caput succedaneum* [Latin for "substitute head"]. This is a deformation of the head with a swelling of the occipital region and a distortion of the cranial bones. The anomaly can arise at any stage of delivery. If subjected to moderate pressure, the soft parts of the head form a lump mainly affecting the scalp and supra-osseous connective tissue. The fetus of this wax model is detachable and in face presentation. The umbilical cord winds around the neck and the placenta is in fundal position.

The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of disengagement of the head in vertex presentation

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	450x320x380 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model illustrates vertex presentation: it represents the position of the head in the muscular-membranous birth canal formed by the soft parts of the pelvic floor. The occiput is now below the pubis almost up to the nape of the neck, and the back has followed the head in the rotation subsequent to engagement.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of face presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	260x330x45 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, describes a face presentation with the fetus in anterior position. For birth to occur in this presentation, the chin must rotate under the pubis.

Model of forceps delivery

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	400x550x340 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows forceps being used to disengage the head of a fetus in cephalic presentation. This is a "low forceps" application, to disengage the head from the inferior strait.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of forceps delivery

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	450x330x630 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows forceps being used to disengage the head of a fetus in cephalic presentation. The head is grasped transversally (above the ears) with the forceps when it has descended into the inferior strait and the occiput has rotated forward, under the pubis.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of forceps delivery

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	360x400x520 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model represents the application of forceps in a breech birth. In this situation, with the placenta in anterior fundal position, the forceps are applied with the blades below the trunk of the fetus, along the transverse diameter of the pelvis, in order to raise the trunk and disengage the head.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of forceps delivery

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	360x450x480 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows a vertex presentation, and the umbilical cord is broken. The forceps are applied to the inferior portion of the pelvic cavity diagonally to the head, and with the blades consistently facing the occiput. Head and forceps are about to rotate so as to position the occiput below the inferior strait.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of forceps delivery

Setting: Room X
Author: unknown
Place: Florence
Date: 1770-1775
Materials: terracotta
Dimensions: 240x390x430 mm
Inventory: Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, shows a situation similar to the one described in other wax models on display in the same room. Forceps are thus needed to disengage the head from the inferior strait.

Model of forehead presentation

Setting: Room X
Author: unknown
Place: Florence
Date: 1770-1775
Materials: terracotta
Dimensions: 200x290x390 mm
Inventory: Dep. OSMN, Firenze

The forehead presentation, shown in this terracotta model, occurs when the occiput is higher than the chin, making the forehead coincide with the pelvic axis. This is a rare event (1 in 2,500 births). In the past, an attempt would be made to rotate the fetus manually into a breech presentation or face presentation. Today, natural birth with forehead presentation is regarded as impossible and the fetus is delivered by Cesarean section. This teaching model was commissioned by Giuseppe Galletti.

Model of incomplete breech presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	220x300x470 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, describes a birth with incomplete, "buttocks-first" breech presentation. The fetus, in posterior position, presents its buttocks, with both lower limbs extended slightly upward. We can see that the membranes are ruptured and the uterus compresses the presentation, squeezing the thigh and tibia against the abdomen to reduce the sacro-tibial diameter. The longitudinal uterine fibers drive the presented part forward; it will then be compressed by the pelvic girdle.

Model of incomplete breech presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	180x290x340 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, shows a "buttocks-first" breech presentation, with the fetus in right sacro-iliac position. The lower right limb is extended upward; the foot of the lower left limb, flexed at the knee joint, is facing downward. The umbilical cord winds around the neck and the placenta is posterior, in lateral right position.

Model of incomplete breech presentation

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	300x500x360 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows a "buttocks-first" breech presentation, in which the fetus engages the lower part of its trunk (podex) in the pelvic entrance.
The model, with detachable fetus, was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of incomplete breech presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	210x300x450 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, shows a "buttocks-first" breech presentation. The fetus, in anterior position, engages the lower part of its trunk (podex) in the pelvic entrance. The umbilical cord is wound around the neck and the upper left limb, with a true knot.

Model of knee presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	200x380x360 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, describes a "knees-first" breech presentation. The fetus, in posterior sacro-iliac position, has its limbs extended up to the knee joint, which is flexed so as to present the knees. The placenta is lateral right.

Model of malformed fetus

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	190x400x520 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows a *symmetrical malformation* consisting of a cephalothoracopagus monstrosity, in which two symmetrically developed fetuses are joined at the head and thorax. They are in breech presentation, the inferior uterine segment is overdistended, and the umbilical cord is prolapsed. The expulsion stage has been interrupted because the largest part of the fetus is facing the pelvis. The fetus is removable. Of the countless varieties of malformations described in developed and even mature fetuses, double monsters were the most significant in obstetric terms, because of the difficulty of their expulsion during delivery. The smallness and malleability of the two fetal bodies favored their delivery. Nevertheless, forceps and craniotomes were often used.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of pregnancy at term: cephalic presentation of engagement

Setting: Room X
Author: Giuseppe Ferrini and/or Clemente Susini [attr.]
Place: Florence
Date: after 1771
Materials: wax
Dimensions: 360x330x380 mm
Inventory: Dep. OSMN, Firenze

This obstetrical wax model shows the end of the dilation of the uterine mouth, now totally flattened with no sign of the cervix. Dilation precedes the second stage of labor: the expulsion of the fetus. This wax model shows an engagement with cephalic presentation. The head is flexed, lowering the occiput to advance in the continuous canal formed by the cervix and vagina.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of pregnancy with complications

Setting: Room X
Author: Giuseppe Ferrini and/or Clemente Susini [attr.]
Place: Florence
Date: after 1771
Materials: wax
Dimensions: 400x470x450 mm
Inventory: Dep. OSMN, Firenze

This obstetrical wax model documents an *abdominal pregnancy*. This occurs after the rupture of a Fallopian tube releases the zygote (fertilized ovum), which, in extremely rare cases, continues to grow in the abdominal cavity. There the fetus can develop to full maturity. The fetus is shown here completely free between the intestinal folds, without alterations or adhesions to the abdominal organs. The placenta is in the posterior pelvic wall.
The model, with detachable fetus, was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of shoulder presentation

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	400x430x600 mm
Inventory:	Dep. OSMN, Firenze

This obstetrical wax model shows a labor situation in which the fetus is in shoulder presentation or transverse posterior presentation (*duplicato corpore* delivery). The spinal column is everted and the head rests on the lower part of the trunk (podex). The abdomen of the fetus is wedged in the pelvis. The umbilical cord, initially prolapsed, is now broken. This type of birth very seldom progresses spontaneously, and occurs only with dead fetuses that have macerated or are very small.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of shoulder presentation

Setting:	Room X
Author:	Giuseppe Ferrini and/or Clemente Susini [attr.]
Place:	Florence
Date:	after 1771
Materials:	wax
Dimensions:	400x500x450 mm
Inventory:	Dep. OSMN, Firenze

In the advanced stage of labor depicted in this obstetrical wax model, the fetus, has its back in anterior position and presents the left shoulder. The uterine muscle is pressing heavily against the fetus and is shown retracted toward the back and overextended in the inferior segment. The spinal column is folded and curved on its cervical side. The left shoulder is wedged in the pelvic cavity, and the corresponding limb has moved away from the trunk and is visible in the vulva. Without medical intervention, this situation inevitably caused the mother's death owing to the rupture of the uterus. The fetus died as well, owing to the compression of the visceral organs and the umbilical cord. Until the eighteenth century, it was believed that the exit of the arm precluded expulsion or rotation, and hence that the limb had to be reduced or extracted in order

to deliver the fetus. In the nineteenth century, practice showed that the obstetrician's hand could fit into the vagina even with the arm present; consequently, the fetus could be rotated.
The model was commissioned by Felice Fontana, who was working on the installation of the Museo di Fisica e Storia Naturale of Florence, from the sculptor Giuseppe Ferrini and his assistant Clemente Susini.

Model of shoulder presentation

Setting: Room X
Author: unknown
Place: Florence
Date: 1770-1775
Materials: terracotta
Dimensions: 230x460x450 mm
Inventory: Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, shows a labor in which the fetus is in shoulder presentation or transverse posterior presentation (*duplicato corpore* delivery). The spinal column is everted and the head rests on the lower part of the trunk (podex). The abdomen of the fetus is wedged in the pelvis and the prolapsed umbilical cord is everted from the vulva.

Model of shoulder presentation

Setting: Room X
Author: unknown
Place: Florence
Date: 1770-1775
Materials: terracotta
Dimensions: 320x300x360 mm
Inventory: Dep. OSMN, Firenze

In this terracotta model, commissioned by Giuseppe Galletti, the fetus, in shoulder presentation or transverse presentation, has its head in the left half of the uterus and its back facing the anterior part. After the rupture of the fetal membranes, the waters have flowed out and cervix, no longer maintained in an extended position by a large fetal mass, has shortened and is now incompletely distended. The uterine walls are thus resting on the fetal body; the two extremities of the fetus—the lower part of the trunk (podex) and the head—are pressed together and the spinal column bends. The placenta is in posterior fundal position.

Model of shoulder presentation

Setting:	Room X
Author:	unknown
Place:	Florence
Date:	1770-1775
Materials:	terracotta
Dimensions:	170x420x380 mm
Inventory:	Dep. OSMN, Firenze

This terracotta model, commissioned by Giuseppe Galletti, shows an advanced stage of labor with the fetus in shoulder presentation or transverse presentation. The head is in the right half of the uterus and the back of the fetus faces downward. The inferior uterine segment is over-distended. The upper right and lower left limbs are visible in the vulva.

Model winch

Setting:	Room X
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass
Dimensions:	210x190x300 mm
Inventory:	990

This model winch, resembling others in the collection but of rather modest size, was built in the woodworking shop of the Museo di Fisica e Storia Naturale. The construction is rudimentary: a plain frame supports the axle, which carries a brass weight and the wheel.

Odometer

Setting: Room X
Maker: John Dollond
Place: London
Date: ca. 1750
Materials: wood
Dimensions: length 1320 mm, height 1200 mm, wheel diameter 820 mm
Inventory: 580

Odometer made by John Dollond and used to measure the length of a route. A wheel pivoting on a handle is pushed by hand. Its rotating motion is transmitted to a pair of pointers that show the distance traveled on a quadrant with three scales (miles - poles - yards). Ten revolutions of the wheel correspond to about 27 yards (25 meters). Provenance: Lorraine collections.

Odometer

Setting: Room X
Maker: Dollond firm
Place: London
Date: late 18th cent.
Materials: ebony, ivory, brass
Dimensions: length 480 mm, width 60 mm
Inventory: 2641

Odometer composed of an ebony rule, whose edges carry two ivory strips with scales in inches. Two wheels with graduated scales are connected to a mobile pointer pivoting on a central quadrant with a double scale. By sliding the rule (at right angles to its length) on a geographic map or sea chart, one obtained directly the distance between two points. The instrument is signed Dollond, but the maker's identity cannot be conclusively established because many Dollonds worked as instrument-makers between the late eighteenth and early nineteenth centuries. Provenance: Lorraine collections.

Plane with variable inclination

Setting:	Room X
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, ivory, brass, lead
Dimensions:	590x160x589 mm
Inventory:	1403

This instrument, described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748) and built in the woodworking shop of the Museo di Fisica e Storia Naturale, was used for many important experiments in classical mechanics. In particular, it allows the study of equilibrium conditions and the attrition of bodies placed on surfaces inclined at different angles.
The base holds a veneered wooden arc at one end. At the other end is hinged a moving wooden board whose inclination on the arc can be adjusted by means of a sliding brass strip. The top of the board holds a pair of pulleys. Two cords connect two lead weights through the pulleys to a stirrup holding an ivory cylinder that rolls down the inclined plane.
By changing the angle of the board and applying different weights to the cylinder, one can examine the changes in the equilibrium conditions and the attrition of the cylinder on the wooden plane. Provenance: Lorraine collections.

Plate electrical machine

Setting:	Room X
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, glass
Dimensions:	total height 675 mm, base 335x450 mm, glass disk diameter 450 mm, thickness 10 mm
Inventory:	3766

Frictional electrical machine with disk. The massive uprights and general appearance are characteristic of certain Italian machines, such as the type used by Luigi Galvani in his famous experiments on frogs. The separate prime conductor is missing. Provenance: Lorraine collections.

Portrait of Peter Leopold

Setting:	Room X
Author:	L. Paradisi
Place:	Florence
Date:	19th cent.
Materials:	paper
Dimensions:	420x560 mm
Inventory:	3718

Engraved portrait of Peter Leopold dedicated to the new Grand Duke of Tuscany, Leopold II.

Prism with stand

Setting:	Room X
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	185x75x86 mm, prism side 35 mm
Inventory:	746

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. The base has two holes for inserting the pins of a support to position the prism on an optical bench or other fixture. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum. The prism resembles other specimens in the Lorraine collection.

Registering barometer

Setting: Room X
Inventor: Felice Fontana
Maker: Felice Fontana
Place: Italian
Date: late 18th cent.
Materials: marble, glass, iron, brass
Dimensions: 310x230x1036 mm
Inventory: 1163

This type of registering barometer, or barometrograph, was invented by Felice Fontana and built at the Museo di Fisica e Storia Naturale. A siphon barometric tube of iron and glass is mounted on a marble base. A floating weight sliding into the shorter arm of the siphon is connected to a brass balance mechanism with counterweights and mounted on frictionless wheels. A paper ribbon is stretched on the balance mechanism, which carries the barometric scale in Paris inches. Above the balance mechanism is a clock, fixed to the marble base by means of a support. The clockwork activates a metal pointer that perforates the paper ribbon at regular intervals. The pointer's lateral motion prevents it from perforating the same point again, even in the absence of pressure changes. The series of perforations thus forms a record of pressure variations over time.

Sextant

Setting: Room X
Maker: Louis-Félix Védy firm
Place: Paris
Date: 19th cent.
Materials: brass, silver
Dimensions: 140x100 mm; box: 150x150x95 mm
Inventory: 3723

The sextant, a reflection instrument derived from the octant, consists of an arc of a circle of about 60 degrees. It is used to measure the altitude of the Sun or a celestial body above the horizon at sea. It was sometimes used on land as well, to determine the angular distance between two points. A mobile arm carrying a mirror and pivoting on a graduated arc provides a reflected image of the celestial body overlapping the image of the horizon, which is observed directly. The desired angle is read directly on the scale through an eyepiece. This highly compact model was also suitable for travelers who liked to take bearings on deck. Made by Louis-Félix Védy firm.

Simple microscope, aquatic

Setting: Room X
Maker: unknown
Place: Italian?
Date: second half 18th cent.
Materials: wood, ivory
Dimensions: length of arm 223 mm, base 200x130
Inventory: 3233

Simple aquatic microscope, very similar to the one used by Abraham Trembley. The wooden base is covered in ivory and supports an articulated arm with ball joints holding the collar that carried the lens (missing). Provenance: Lorraine collections.

Simple microscope, pocket

Setting: Room X
Maker: unknown
Place: French or Dutch?
Date: early 19th cent.
Materials: silver
Dimensions: height 105 mm
Inventory: 3239

Simple pocket microscope made in silver. Intended to facilitate field observations by naturalists. A pillar set on three folding legs carries the mirror, the stage with a forceps, and the simple lens with a lieberkuhn (the latter accessory being named after its inventor, Johannes Nathanael Lieberkühn). Despite some resemblance with English microscopes of the late eighteenth and early nineteenth centuries, details of construction point to a different country of origin, possibly the Netherlands or France. Provenance: Lorraine collections.

Single gold-leaf electroscope, Bohnenberger type

Setting:	Room X
Inventor:	Johann Gottlieb Friedrich von Bohnenberger
Maker:	Carlo Dell'Acqua
Date:	ca. 1850
Materials:	walnut, brass
Dimensions:	total height 385 mm, diameter 210 mm
Inventory:	2691

Electroscope made by Carlo Dell'Acqua in the workshop of the Museo di Fisica e Storia Naturale. There is a circular base with groove for the missing glass bell-jar. The single gold leaf (missing) was suspended in the bell-jar between two brass plates connected to two De Luc or Giuseppe Zamboni high-voltage dry piles (i.e., without liquid electrolytes). The electrically charged leaf would be deflected toward the plate with the opposite electrical charge. This type of instrument was developed by Johann Gottlieb Friedrich von Bohnenberger c. 1814.

Siphon barometer

Setting:	Room X
Maker:	Deleuil firm
Place:	Paris
Date:	ca. 1850
Materials:	wood, glass, brass
Dimensions:	height 1070 mm, width 180 mm
Inventory:	1144

Siphon barometer mounted on a wooden base. A tap enables the longer arm of the siphon to be filled, preventing the mercury from moving during transport. The barometric scale is made of glass paste, as is the corresponding vernier. On the base are fixed two liquid thermometers, a mercury version with Réaumur and centigrade scales, and an alcohol version with Fahrenheit and centigrade scales. Made by Deleuil firm.

Six's maximum and minimum thermometer

Setting: Room X
Inventor: James Six
Maker: Antonio Matteucci
Date: ca. 1790
Materials: glass, wood
Dimensions: height 780 mm, width 98 mm
Inventory: 1897

Maximum and minimum thermometer invented by James Six and built by Antonio Matteucci for the Museo di Fisica e Storia Naturale. Mounted on a semicylindrical wooden column with a profiled top and bottom, it is composed of a central vessel filled with alcohol, connected to a U-tube. The alcohol is used as thermometric liquid, while the mercury serves as an indicator. The indicators placed on the mercury surfaces consist of iron needles inserted into small blue glass tubes fitted with a thin elastic metal wire. As the alcohol expands and contracts, the mercury moves the indicators. These are wedged in the thermometric tube by the metal, and thus record the maximum and minimum temperatures reached. To bring them back into contact with the mercury, they are simply dragged back into the capillary tube by means of a magnet. The Réaumur and Fahrenheit scales, drawn on strips of paper, are protected by thin glass plates.

Standard meter

Setting: Room X
Maker: Ferat
Place: Paris
Date: 1798
Materials: brass; case: wood
Dimensions: length 1015 mm
Inventory: 389, 3342

Brass standard meter, engraved with the signature of the maker, Ferat. The length of this standard is provided either by the ends of the bar (which has two recesses for the purpose) or by the distance between two lines engraved on its surface. The date of manufacture was determined from two letters from Francesco Favi in Paris to the Superintendent of the Museo di Fisica e Storia Naturale of Florence, Giovanni Fabbroni, who had commissioned the purchase of such an instrument.

Surgical instruments for obstetrical and gynecological procedures

Setting:	Room X
Inventor:	Giovanni Alessandro Brambilla
Maker:	Joseph Malliard
Place:	Vienna
Date:	second half 18th cent.
Materials:	instruments: steel, ivory, rubber / boxes: wood, leather, velvet
Dimensions:	450x335x145; 530x400x90; 415x310x95 mm
Inventory:	Dep. OSMN, Firenze

The surgical instrument kit for obstetrical procedures designed by Giovanni Alessandro Brambilla comprises two drawers, both labeled *PRO PARTU*:
No. *XV*, with dilators, forceps, pincers, and speculum to dilate the uterus for exploration;
No. *XVI* with pelvimeter, forceps, hooks, head extractor, blunt hook, syringe, and lever.
The gynecological instruments are in the drawer
no. *XVII*, *PRO POLYPIS MATRICIS*, which contains the implements needed to remove utero-vaginal polyps with, at the center, a dilator for extracting gallstones.
The instruments were made by the cutler Joseph Malliard.

Surgical instruments for operations on the skull

Setting:	Room X
Inventor:	Giovanni Alessandro Brambilla
Maker:	Joseph Malliard
Place:	Vienna
Date:	second half 18th cent.
Materials:	instruments: steel, ivory / boxes: wood, leather, velvet
Dimensions:	430x375x80; 470x385x85; 480x355x80; 390x260x100 mm
Inventory:	Dep. OSMN, Firenze

Four drawers of the surgical instrument kit designed by Giovanni Alessandro Brambilla contain instruments for operations on the skull:
No. *V*, *PRO FRACTURA CRANI*—instruments for treating skull fractures (scrapers, knives, hooks, levers, tweezers, clamps, hammer);
No. *VI*, *TRAPANUM*—trepanation instruments;
No. *XXX*, *SCALPELA ANOTOMICA*—dissection instruments (cutters, saw, lever);
No. *XXXI*, *PRO INIECTIONE*—supplements no. XXX, with syringes and cannules for injecting fluids in the vessels of a corpse. The last two drawers thus comprise the anatomical instrumentation.
The instruments were made by the cutler Joseph Malliard.

Telescope with accessories

Setting: Room X
Maker: François de Baillou
Place: Italian
Date: 1764
Materials: cardboard, wood, leather
Dimensions: length c. 2500 mm
Inventory: 3340

Telescope consisting of nine cardboard tubes. The largest is covered with brown paper (once white) with gold tooling. The others are covered with white paper (now turned yellow). Some tubes are wedged together and cannot be extended. There are no lenses in the tubes. A rectangular wooden case, covered with brown leather and lined with red velvet, contains many accessories, including: three biconvex lenses (a fourth is apparently missing), housed in a cardboard tube covered with brown and green leather with gold tooling; a biconvex objective lens in a wooden mount, with the signature of the maker, François de Baillou; and a cardboard disk (diameter 325 mm) with a central hole (65 mm). There are other, minor accessories, such as eyepiece mounts, lens boxes, diaphragms, and covers.

The writing hand

Setting:	Room X
Inventor:	Friedrich von Knaus
Maker:	Friedrich von Knaus
Date:	1764
Materials:	silvered copper
Dimensions:	680x1000 mm
Inventory:	3195

The clockwork mechanism moves a hand, causing it to dip the pen in the inkstand and write the words "Huic Domui Deus / Nec metas rerum / Nec tempora ponat" ["May God not impose ends or deadlines on this house"] on a small card. The mechanism's silvered metal coating carries the words "Pro patria." The machine is dedicated by the craftsman Friedrich von Knaus to the House of Lorraine, which ruled Tuscany at the time.

Room XI

The Spectacle of Science

Paola Bertucci

Spectacular effects were typical of many aspects of 18th-century science. The high society of the time, avid for innovation and entertainment, was fascinated by the phenomena of experimental physics. In salons and courts - such as the one we see replicated at the back of the room - the laws of nature were illustrated by travelling lecturers who taught science through spectacular demonstrations. Using air pumps, planetariums, solar microscopes and machines for studying impact, they offered courses in physics that avoided the abstruse language of mathematics. Their lectures, often staged like theatrical performances, were real social events. Over the course of the century, the newly invented electrostatic "rubbing" machines were used in amusing "electric soirées," where the demonstrators staged spectacular performances based on attraction, repulsion, shocks and sparks experienced by the ladies and gentlemen on their own bodies.

Air pump, Nollet type

Setting: Room XI
Inventor: Jean-Antoine Nollet
Maker: unknown
Date: ca. 1780
Materials: wood, brass, glass
Dimensions: total height 1600 mm, sides of triangular base 750 mm
Inventory: 1534

This single-barrel air pump resembles the one described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748). The pump is mounted on a wooden tripod, ornately carved with period motifs. In the vertical barrel runs a piston moved by a crank carrying a toothed pinion that meshes with a rack. A large brass faucet connects the barrel with the plate above it, which supports a glass bell-jar (not original). Two brass supports attached to the tube entering the plate are fitted with pinchers carrying two butterfly screws. They were used to conduct experiments in the rarefied air inside the bell-jar. In the pump described by Nollet, the piston is operated by means of a simple stirrup. Provenance: Lorraine collections.

Aurora flask

Setting: Room XI
Maker: unknown
Date: late 18th cent.
Materials: glass, brass, lead foil
Dimensions: total height 275 mm, max. diameter 94 mm
Inventory: 423

Pear-shaped glass vessel with central brass spike and threaded brass collar, covered by a cap. The outer half of the flask is covered with lead foil (originally tin foil).
This device was used to simulate the aurora borealis phenomenon. The flask was connected to an air pump and partially evacuated. It was then electrified by means of the prime conductor of an electrical machine. The glow produced at the spike, which greatly resembled an aurora borealis, behaved differently for positive and negative electrical charges. Provenance: Lorraine collections.

Aurora tube

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, glass, brass
Dimensions:	total height 580 mm
Inventory:	1203

This device was used to simulate the aurora borealis phenomenon.
The glass tube is supported on a glass pillar, with a turned mahogany base, weighted by means of a lead ring to prevent the instrument from toppling over. A brass spike projects at right angles from the upper brass collar. A ball electrode is joined to the lower brass collar. Inside the tube are two other electrodes: the upper one ends in a point, the lower one in a ball.
The tube is partially evacuated by means of an air pump. The glass is then rubbed with a cloth or the electrodes are touched with the conductor of an electrical machine. The electrification causes the inside of the tube to glow with a light closely resembling an aurora borealis.
William Henley used a comparable instrument to demonstrate the glow produced by positive or negative discharges. He claimed this as proving Benjamin Franklin's theory of a single electric fluid. Filippo Lucci depicted a very similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Azimuth compass

Setting:	Room XI
Maker:	unknown
Place:	English
Date:	late 18th cent.
Materials:	mahogany, brass, steel
Dimensions:	total height 175 mm, base 330x330 mm
Inventory:	3373

Azimuth compass mounted on gimbals. A mahogany box with brass frame is suspended inside a second box with handles. Hand-made and hand-colored windrose, above which pivots a broad magnetic needle with garnet bearing cup. This needle shape was suggested in 1774 by Jan Hendrik van Swinden. A small mirror is set at an angle at the center of one of the sides of the box. The sights are missing. Provenance: Lorraine collections.

Cecchi balance barometer

Setting:	Room XI
Inventor:	Filippo Cecchi, Giovanni Antonelli
Maker:	Niccolò Masini
Place:	Florence
Date:	ca. 1860
Materials:	iron, brass, glass
Dimensions:	marble quadrant: diameter 1630 mm; glass dial: diameter: 1620 mm; mechanism: width 1165 mm, height 2320 mm
Inventory:	3816

Large public barometer designed by Filippo Cecchi in collaboration with Giovanni Antonelli and made by the mechanician Niccolò Masini. In 1860, it was placed in the Loggia dei Lanzi in Piazza della Signoria (Florence) at the request of the Minister of Education, Cosimo Ridolfi. The instrument is of the balance type: it does not record the level of the mercury but its "weight." The barometric tube, fitted with a clutch, hangs from a balance mechanism fitted with a counterweight. The changes in pressure influence the mercury level in the tube; the subsequent variations in weight modify the position of the balance mechanism, which is connected to a pointer. The instrument, flanked by a large metal thermometer (now missing), ceased to operate as a public barometer c. 1930. The lodging for the mechanism was walled up and rediscovered by chance in 1993. The glass dial is a modern replacement. What remains of the original marble dials of the barometer and the thermometer is now displayed along the staircase leading to the second floor of the Istituto e Museo di Storia della Scienza.

Compound microscope

Setting:	Room XI
Maker:	Pietro Patroni
Place:	Milan
Date:	1726
Materials:	wood, paper, leather, brass, ivory
Dimensions:	height 530 mm, base 184x144x45 mm
Inventory:	3206

The tube of this compound microscope is attached by a ball-and-socket joint to a pillar in a wooden base. The pillar also carries the mirror and the stage. The wooden body-tube is covered in black leather. The eyepiece and objective mounts are of ivory. Complete with accessories, contained in the case that serves as base. They include tweezers, ivory and glass disks, and five numbered objectives. The microscope, made by Pietro Patroni, displays similar construction features to the instruments of John Marshall.

Compound microscope

Setting:	Room XI
Maker:	George Adams junior
Place:	London
Date:	ca. 1790
Materials:	brass; box: wood
Dimensions:	height 500 mm, box 380x220x118 mm
Inventory:	480, 3219, 3221

Compound microscope built by George Adams Junior, who described it as an *improved compound microscope*. A pillar mounted on a tripod bears a ball-and-socket joint to which a rod is fitted. The rod carries the illumination mirror, the stage, and the body-tube. The tube contains an eyepiece with two double-convex converging lenses and a field lens. The box for the microscope contains eight objectives and several accessories for preparing specimens. Provenance: Lorraine collections.

Conductor

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	mahogany, brass, glass
Dimensions:	total height 560 mm, large sphere diameter 340 mm, small sphere diameter 135 mm
Inventory:	2703

Large conductor consisting of a tapered brass tube terminating in a large sphere at one end and a smaller sphere at the other. One of the glass supports fits into a hole in the large sphere; the other secures the opposite end of the tube. These supports are similar to the ones for the large Edward Nairne machine and are probably of London origin. The apparatus has been restored. Provenance: Lorraine collections.

Cylinder electrical machine

Setting:	Room XI
Maker:	Edward Nairne
Place:	London
Date:	ca. 1778
Materials:	mahogany, brass, wood, cloth, tin foil
Dimensions:	total height 1700 mm; glass cylinder 600x360 mm
Inventory:	2739

Frictional electrical machine, similar to the small portable cylinder generators made by Edward Nairne, also referred to as the "English pattern" machine. The glass cylinder is rotated by a two-pulley system; the leather cushion is supported on a glass pillar and secured to wooden strips sliding in the cross-piece of the frame. This arrangement allows the operator to adjust the pressure of the cushion—and consequently the amount of friction—on the glass. A machine of this type was used by Nairne for experiments on lightning conductors c. 1778. Provenance: Lorraine collections.

Cylinder electrical machine

Setting: Room XI
Maker: George Adams junior
Place: London
Date: late 18th cent.
Materials: mahogany, brass, glass
Dimensions: total height 565 mm, base 530x200 mm, glass cylinder 300x230 mm
Inventory: 392

Typical example of cylinder frictional electrical machine made in England in the last decades of the eighteenth century. Described by Tiberius Cavallo, but the leading maker of this design was George Adams Junior.
The glass cylinder can be rotated rapidly by means of the multiplying-wheel arrangement. Rather unusually, the multiplying wheel has a long axle with its own support. In the common arrangement, the wheel is simply attached to one of the uprights supporting the glass cylinder. This alteration may have been made to prevent excessive vibration. The leather cushion is fixed to a shaped glass pillar and, to increase friction, can be pressed against the cylinder by means of a long screw. The separate prime conductor is missing—a usual occurrence with this type of machine. Provenance: Lorraine collections.

Dip circle

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: ivory, brass, steel
Dimensions: total height 210 mm, max. diameter 240 mm
Inventory: 1195

Marble base set in mahogany with three leveling screws, ivory case with hinged front and back windows. The magnetic needle pivots on a horizontal axle resting on brass supports set into the ivory frame. The instrument measures the magnetic dip generated by the lines of force of the Earth's magnetic field; the angle of dip is 0° at the equator and 90° at the poles. Provenance: Lorraine collections.

Drum electrical machine

Setting: Room XI
Maker: unknown
Date: ca. 1776
Materials: mahogany, velvet, glass, iron, brass
Dimensions: total height 1200 mm, drum 540x660
Inventory: 3408

This is probably the only large drum electrical machine extant. The drum consists of two mahogany disks connected by an internal frame covered in red velvet. It is rotated by a simple crank. The base is made up of a large wooden box with lid to store the accessories. The large cushion with chamois leather cover is supported by two flexible wooden strips secured to two solid glass rods that insulate the cushion from the base. The flexible wooden strips allow the cushion to follow the uneven contour of the drum. The brass knob at the back of the cushion is for the grounding chain, or it can be connected to a conductor to receive negative charges.
Little is known about this remarkable machine, formerly in the Lorraine collections and described in the inventory of the Museo di Fisica e Storia Naturale of 1776. Its frictional design was obviously inspired by Edward Nairne's two large generators in the Museum collection. Although glass was the most popular material for electrical machines, other substances were also tried.

Elastic and inelastic collisions apparatus

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: wood, ivory, brass
Dimensions: base: 1750x930 mm; total height 2700 mm, machine height 1810 mm
Inventory: 981

Large apparatus to study elastic and inelastic collisions. It consists of a large frame carrying two beams from which two rows of six and two wooden balls, respectively, are suspended from pairs of strings. The instrument was often used with two elastic balls (of ivory) or inelastic balls (of wet clay), of equal or different mass. By changing the parameters of the experiments such as height of fall and mass, one could conduct a systematic investigation of collision-related phenomena. For example, when the row of balls is struck by one of the outermost balls, the row of balls remains motionless and the impulse is fully transmitted to the ball at the opposite end, which rebounds. As it falls back, the cycle continues in the opposite direction. This apparatus was illustrated by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748). In his description, Nollet claims to have merely altered and developed a model previously used by Edme Mariotte. The most sophisticated devices for studying elastic and inelastic collisions were built by Willem Jacob 's Gravesande and Petrus van Musschenbroek. Provenance: Lorraine collections.

Electric bells

Setting:	Room XI
Inventor:	Benjamin Franklin
Maker:	unknown
Date:	second half 19th cent.
Materials:	mahogany, brass, nickeled brass, glass
Dimensions:	total height 330 mm, base 345 mm
Inventory:	3116

Later version of an accessory sold with electrical kits in the late eighteenth century to demonstrate the electrostatic repulsion of like charges and the attraction of unlike charges.
The circular mahogany base and turned pedestals support a series of nickel-plated brass bells attached to brass rods by means of threads. A brass rod terminating in a ball projects from the upper central ball to communicate with an electrical machine. When the connection is established, the clappers oscillate, causing the bells to ring.
The device, described by George Adams in *An Essay on Electricity* (London, 1799) and by other authors, was long used as a recreational physics "toy." Filippo Lucci depicted a similar device in the Stanzino of the Matematiche of the Uffizi in 1780.

Globe electrical machine, Nollet type

Setting: Room XI
Inventor: Jean-Antoine Nollet
Maker: Museo di fisica workshops
Date: ca. 1775
Materials: mahogany, brass, ceramic
Dimensions: total height 1615 mm, length 2250 mm, width 690 mm; ovoid globe: 230x190 mm
Inventory: 1341, 1342, 2737

Frictional electrical machine with white ceramic ovoid globe, secured between two wooden uprights in such a way that it can be easily replaced, for instance, when it gets broken because of excess friction. The leather cushion is attached to a flexible steel strip so that its pressure can be adjusted. Rapid rotation of the globe is made possible by the large spoked pulley wheel with two sheaves and a large handle on both sides, so that it can be turned by two men for lengthy experiments. The two sheaves of the pulley allowed two globes to be rotated at the same time. No fittings for a second globe have survived, but they may have disappeared in previous restoration.
In his *Leçons de physique expérimentale* (Paris, 1764 ed.)Jean-Antoine Nollet described a similar multi-globe machine, , which he employed for his physics demonstrations at the French court already in the 1740s. The separate prime conductor was suspended from the ceiling by silk ropes and collected the electric charge by means of a brass chain dangling onto the globe. The instrument was made in the workshops of the Museo di Fisica e Storia Naturale of Florence. A very similar version was described by Sigaud De La Fond still in 1771, in his *Traité de l'électricité*. Probably this is the only surviving example of a Nollet-type electrical machine. Provenance: Lorraine collections.

Henley quadrant electrometer

Setting: Room XI
Inventor: William Henley
Maker: Edward Nairne
Place: London
Date: second half 18th cent.
Materials: boxwood, brass, ivory
Dimensions: height 167 mm
Inventory: 1199

Henley quadrant electrometer signed "Nairne London." Comprises a boxwood stem with a brass collar and a short brass rod for insertion in the prime conductor of an electrical machine. When the instrument is charged, the light index, terminating in a light pith or cork ball, is repelled by the stem and moves across the semicircular ivory graduated scale. The device was invented in 1770 by William Henley to measure electrical "tension," i.e., voltage. It is the first single-pendulum repulsion electrometer. Provenance: Lorraine collections.

Hero's fountain

Setting:	Room XI
Inventor:	Hero of Alexandria
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, glass
Dimensions:	height 1180 mm, base 580x580 mm
Inventory:	2153

This type of fountain, described by Hero of Alexandria, was a fairly popular apparatus in physics collections up to the early twentieth century. A carved and decorated wooden tripod supports two stacked glass globes fitted with brass collars. The upper globe carries an engraved glass cup. A tube connected to a small hole in the cup runs through the upper globe and into the lower. A second tube connects the two globes. A third, shorter tube runs from the middle of the upper globe to the center of the cup, ending in a nozzle. To operate the apparatus, one must fill the upper globe with water. The fountain is primed by pouring water in the cup. The water flows into the lower globe, expelling air into the upper globe, where it is compressed. As a result, the water in the upper globe is driven by the air pressure up the shortest tube and spurts from the nozzle, falling back into the cup. The fountain continues to function until the lower globe is full and the upper empty. Hero's fountains—made in different designs and of various dimensions and materials—or similar devices such as intermittent fountains were sometimes used as eye-catching table centerpieces for dispensing wine or colored beverages. The construction features of this specimen are typical of the French machines described by Jean-Antoine Nollet. Provenance: Lorraine collections.

Kinnersley electrometer

Setting:	Room XI
Inventor:	Ebenezer Kinnersley
Maker:	unknown
Place:	English?
Date:	late 18th cent.
Materials:	brass, glass
Dimensions:	total height 275 mm
Inventory:	421

Electrometer, probably English-made, consisting of a glass tube with brass fittings and two electrodes, of which the upper is adjustable. A glass capillary tube is attached to the side. This is a simplified version of Ebenezer Kinnersley's "electrical air thermometer," which he described to his friend Benjamin Franklin in 1761. Colored water was poured into the airtight cylinder. A spark jumping between the two electrodes heated the air, which expanded, pushing the water up the capillary tube. This gave a crude measure of the electrical charge. Provenance: Lorraine collections.

Lane electrometer

Setting:	Room XI
Inventor:	Timothy Lane
Maker:	unknown
Date:	second half 18th cent.
Materials:	mahogany, brass
Dimensions:	height 360 mm
Inventory:	543

A large version of the Lane discharging electrometers for use with English-type plate electrical machines. The spark gap between the prime conductor and this electrometer can be accurately measured by a vernier and micrometer screw. The instrument has been restored and the glass support replaced by one of aluminum painted red. Originally, it may have been on a longer support and used with one of the two large Nairne machines (inv. 2736 - inv. 2739).

Timothy Lane described this discharging electrometer in 1766. He used it to determine the charge given to a Leyden jar by counting the number of sparks it received from the electrometer set at a constant gap. The instrument became popular in electrotherapy and was used to limit the power of the electrical discharge. Provenance: Lorraine collections.

Lane electrometer and Leyden jar on insulated support

Setting: Room XI
Inventor: Timothy Lane
Maker: unknown
Date: late 18th cent.
Materials: mahogany, brass, glass, tin foil
Dimensions: total height 435 mm
Inventory: 1326

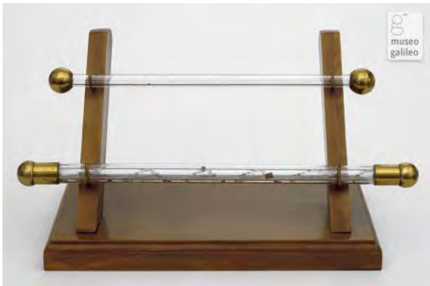
Lane discharging electrometer with sliding electrode secured to a Leyden jar by means of a brass ring, ensuring electrical contact with the outer tin-foil coating. The jar rests on an insulated support consisting of a small glass pillar with a wooden base. The spark gap between the electrode of the electrometer and that of the Leyden jar gives an indication of the quantity of electricity collected in the jar. The instrument was often used in electrical therapies. In such cases, it was also called "bottiglia medica" (medical bottle). Provenance: Lorraine collections.

Lucernal and compound microscope

Setting: Room XI
Maker: George Adams junior
Place: English
Date: ca. 1791
Materials: brass, wood
Dimensions: lucernal microscope: height 495 mm, support 477 mm; projection box 417 mm; compound microscope: height 272 mm; box 353x251x92 mm
Inventory: 502, 1457, 3222 (scatola), 3243 (microscopio)

This optical compendium, from the Lorraine collections, is unsigned, but was certainly made by George Adams Junior. It contains many elements and accessories, a lucernal microscope, and a compound microscope. Grand Duke Ferdinand III personally donated it to the Museo di Fisica e Storia Naturale of Florence in 1791.
The lucernal microscope is mounted on a pillar supported by a tripod. A ball-and-socket joint on the pillar supports a horizontal rod to which is fixed the pyramidal projection box. The box carries the objectives at one end and is fitted at the other end with a ground glass screen (protected by a wooden shutter) on which the images are projected. The rod also carries the frame for observing opaque objects, a mirror, and a converging lens. There are about ten objectives and many accessories for preparing specimens.
The compound microscope is mounted on a square-sectioned pillar fitted with a tripod. The illumination mirror is hinged near the base and above it travels the stage. The body-tube is attached to the top of pillar and its eyepiece is fitted with two converging lenses and a field lens. The instrument, which fits into the same box as the lucernal microscope, also has an objective.

Luminous discharge tubes



Setting:	Room XI
Maker:	unknown
Place:	English?
Date:	late 18th cent.
Materials:	glass, brass, tin foil
Dimensions:	length 332 mm, diameter 20 mm; length 300 mm, diameter 13 mm
Inventory:	850, 851

Two small tubes, known as "electric serpents" or "fulminating tubes," were popular in the late eighteenth century because of the spectacular effect that they produced in the dark.
The electric snake consists of two glass tubes, one inside the other. On the outside of the inner tube, a series of tin-foil patches are glued at short but equal intervals, forming a helical pattern. The outer tube is fitted with brass collars at both ends, which are in contact with the outermost patches of the helix.
When one end of the tube is held in the hand and the other approaches the prime conductor of an electrical machine, scintillating sparks appear between each of the tin-foil patches, producing a long helix of fire. Provenance: Lorraine collections.

Magnetic ducks

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: ceramic, iron, lodestone
Dimensions: length 200 mm, max. width 120 mm
Inventory: 1213

Two small ceramic ducks each with a magnet in its beak, one marked North and the other South. These were probably decorative ducks later modified by adding floats under their wings. They were floated in a basin of water to demonstrate the magnetic phenomena of attraction and repulsion. Instruments of this kind, arousing curiosity and wonder, are often described in eighteenth-century treatises. Provenance: Lorraine collections.

Mechanical paradox

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass
Dimensions: 1300x720x1460 mm
Inventory: 3387

This apparatus, mounted on an elegant table, consists of a trapezoidal veneered wooden frame with two brass rails. A pair of brass cones joined at their bases by a wooden disk rests on the rails. When the double cone is placed at the low end of the frame, it automatically starts to roll upward, giving the impression of escaping the universal law of the gravitational force. Because of this phenomenon, astonishing in its seeming contradiction of common sense, the apparatus was often described as a "mechanical paradox." In fact, the paradox is only apparent. This is due to the fact that the natural motion of bodies depends on that of their center of gravity, which has a natural tendency to descend. Since the rails diverge, the center of gravity of the double cone—when placed on the rotation axis at its maximum diameter—does not rise when the entire body seems to be moving upward; rather, the center is shifting downward. In its travel, the resting-points of the double cone on the rails converge toward its two apexes. As a result, the distance of the center of gravity from the horizontal plane decreases as the double cone rises. The phenomenon is thus hardly paradoxical. On the contrary, it is totally consistent with the laws of mechanics. Provenance: Lorraine collections.

Mercury pump

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	mahogany, iron, glass
Dimensions:	total height 2050 mm, side of tripod base 800 mm
Inventory:	1530

The instrument is supported by a wooden tripod frame holding a plate that serves as base for a bell-jar. A faucet connects the plate to an upright iron tube. The latter communicates with an upright wooden tube attached to the frame as well. A wooden rod fitted with a handle runs up and down inside the barrel. There is a box at the base of the barrel, which originally contained a valve. The pump was restored after being damaged in the 1966 Arno flood, and because of the many missing parts its exact mechanism cannot be determined. However, this type of mercury pump resembles the one described by Emanuel Swedenborg in his *Miscellanea* of 1722. The vacuum was obtained by lowering and raising the mercury column in the upright tube by the pumping action of the wooden rod. Resembles item inv. 1531. Provenance: Lorraine collections.

Mercury pump

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: mahogany, iron, glass
Dimensions: total height 1400 mm, side of tripod base 900 mm
Inventory: 1531

The instrument is supported by a wooden tripod frame holding a plate that serves as base for a bell-jar. A faucet connects the plate to an upright iron tube. The latter communicates with an upright wooden tube also attached to the frame. The pump was restored after being damaged in the 1966 Arno flood. This type of mercury pump resembles the one described by Emanuel Swedenborg in his *Miscellanea* of 1722. The vacuum was obtained by lowering and raising the mercury column in the upright tube by the pumping action of the wooden rod. Resembles item inv. 1530. Provenance: Lorraine collections.

Mounted glass cone

Setting: Room XI
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: cone diameter 66 mm, height 400 mm
Inventory: 771

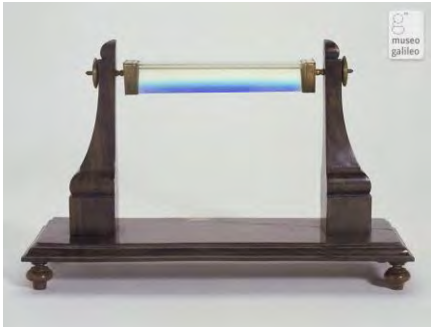
Glass cone mounted in a large wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Directing a beam of light on the vertex of the cone produces a round light spectrum, simulating a rainbow.

Mounted prism

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	330x125x145 mm, prism side 75 mm
Inventory:	744

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Mounted prism



Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	332x124x210 mm, prism side 30 mm
Inventory:	743

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. The prism can be fixed in the desired position with a pair of threaded knobs. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Mounted prism

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	base diameter 156 mm, height 366 mm, prism side 26 mm
Inventory:	774

Equilateral glass prism with a mount, fixed to a small turned wooden column by means of an elbow joint. Resembles prism inv. 773. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Mounted prismatic lens

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	lens diameter 65 mm, height 400 mm
Inventory:	768

Prismatic lens mounted in a large wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Closely resembles lenses inv. 769 and inv. 770. Prismatic lenses can be used as optical toys because of their ability to multiply images.

Mounted prismatic lens

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	lens diameter 68 mm, height 405 mm
Inventory:	770

Prismatic lens mounted in a wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Closely resembles lenses inv. 768 and inv. 769. Prismatic lenses can be used as optical toys on account of their ability to multiply images.

Mounted prismatic lens

Setting:	Room XI
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	lens diameter 78 mm, height 375 mm
Inventory:	769

Prismatic lens mounted in a wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Closely resembles lenses inv. 768 and inv. 770. Prismatic lenses can be used as optical toys on account of their ability to multiply images.

Nairne cylinder electrical machine

Setting: Room XI
Inventor: Edward Nairne
Maker: Edward Nairne
Place: London
Date: 1773
Materials: mahogany, brass, glass
Dimensions: total height 1370 mm, glass cylinder 470x255 mm
Inventory: 2736

Frictional electrical machine with a glass cylinder rotated by a large pulley wheel supported in such a way that it can be easily adjusted to keep the leather pulley cord taut. The large leather cushion is secured to a mahogany backplate supported by two flexible wooden strips, insulated by two thick horizontal glass rods. The prime conductor consists of a large wooden and canvas tube, on two wooden and glass supports mounted on tripods. The negative conductor has a turned wooden base covered with tin foil, an upright wooden and canvas tubular support also covered with tin foil, and a sliding electrode arrangement (replacement).
Twelve-inch long sparks could be generated—in modern terms, c. 170,000 volts. The generator was custom-made for Peter Leopold. The Grand Duke was so pleased with it that, in December 1774, he awarded a special gold medal and the sum of 1,415 Tuscan lire to its maker, Edward Nairne. The large battery of Leyden jars supplied with the machine is now lost. An engraving in the *Philosophical Transactions* of the Royal Society of 1774 shows the machine ready for experiments. Provenance: Lorraine collections.

Orrery

Setting: Room XI
Inventor: James Ferguson
Maker: unknown
Place: Florence
Date: 1775-1776
Materials: wood, glass, brass
Dimensions: brass disk diameter 390 mm, height 285 mm, width 460 mm
Inventory: 581

This Copernican planetarium was built at the workshop of the Museo di Fisica e Storia Naturale of Florence from the model designed by James Ferguson in 1773. It is one of the first examples of the mechanical planetarium known as *orrery*, after Charles Boyle, 4th Earl of Orrery, whom

Ferguson himself describes as the inventor. Thanks to a mechanical system, each planet of the solar system moves in its orbit at its own velocity. The Sun, at the center, is surrounded by Mercury, Venus, and the Earth orbited by the Moon. The superior planets are missing. Provenance: Lorraine collections.

Pharmacy jars

Setting: Room XI
Maker: unknown
Place: Faenzan style
Date: second half 18th cent.
Materials: majolica
Dimensions: height c. 290 mm, opening diameter 120 mm
Inventory: Dep. OSMN, Firenze

Forty-seven square-base majolica pharmacy jars with lids, made in Faenza (the Faenzan masters were among the most renowned producers of this type of object). Decorated with elegant, inventive patterns, they each carry a cartouche identifying the substance contained ("anise," "incense," "elder," "Bolivian coca," "valerian,", etc.). Provenance: Ospedale di Santa Maria Nuova in Florence.

Pharmacy jars

Setting: Room XI
Maker: unknown
Date: 19th cent.
Materials: majolica
Dimensions: max. height 200 mm, opening diameter c. 83 mm
Inventory: Dep. OSMN, Firenze

Twenty-one octagonal-base white majolica pharmacy jars with gold imperial-style ornamentation. Complete with lids. Same design as jars (Dep. OSMN, Firenze). The cartouche on each jar identifies the extract contained ("hellebore extract," "gentian extract," "rhubarb extract," etc.). Labels were initially hand-painted in crude black letters. As the ceramic art matured, they were applied directly by the potter, usually in Latin, and enclosed in a cartouche. Provenance: Ospedale di Santa Maria Nuova in Florence.

Pharmacy jars

Setting:	Room XI
Maker:	unknown
Place:	Venetian style
Date:	19th cent.
Materials:	glass
Dimensions:	max. height c. 200 mm, opening diameter c. 110 mm
Inventory:	Dep. OSMN, Firenze

Seven blue glass pharmacy jars with lids and gold ornamentation. The design is that of the albarello: a spool shape, tapered in the middle, and a lid with a knob and double handle. The content is indicated in a cartouche on the lower part of each jar. Provenance: Ospedale di Santa Maria Nuova in Florence.

Pharmacy jars

Setting:	Room XI
Maker:	unknown
Place:	Venetian style
Date:	19th cent.
Materials:	glass
Dimensions:	max. height c. 220 mm, opening diameter c. 112 mm
Inventory:	Dep. OSMN, Firenze

Twenty-three pharmacy jars of dark violet and dark green glass, with lids. The color can take on different hues depending on the light. There are gold ornamentations and the content is indicated in a cartouche on the lower part of each jar. The design is that of the albarello: a spool shape, tapered in the middle, and a lid with a knob and double handle. Provenance: Ospedale di Santa Maria Nuova in Florence.

Plate electrical machine

Setting:	Room XI
Maker:	unknown
Date:	early 19th cent.
Materials:	boxwood, brass, glass
Dimensions:	total height 1900 mm; table 1300x1050 mm; glass disk diameter 1000 mm, thickness 5,5 mm
Inventory:	Dep. LV, Torino

Frictional electrical machine with glass disk rubbed by four cushions with large taffeta flaps. These prevent the charges on the glass from dissipating into the air. The cross-piece of the frame supports a Volta pistol in the shape of a brass urn. The prime conductor consists of two brass tubes with spherical ends connected by a cross-tube fitted with an electrode, resting on glass supports; they terminate in jaw-collectors to facilitate the transfer of the charge at both sides of the glass disk. Positive charge is taken from the prime conductor, while negative charge is taken from the hook at the top of the machine. The signature plate is lost. In nineteenth-century manuals of electricity, this pattern is generally called the "Ramsden type," after the English maker Jesse Ramsden. In fact, it is a typical French design.

Plate electrical machine

Setting:	Room XI
Maker:	unknown
Date:	second quarter 19th cent.
Materials:	boxwood, brass, glass
Dimensions:	height 1420 mm; table 950x635 mm; glass disk diameter 590 mm, thickness 7 mm
Inventory:	3909

Frictional electrical machine with glass disk rubbed by four leather cushions. The prime conductor consists of two brass tubes with spherical ends connected by a cross-tube fitted with an electrode, resting on glass supports; they terminate in jaw-collectors to facilitate the transfer of the charge at both sides of the glass disk. Positive charge is taken from the prime conductor, while negative charge is taken from the hook at the top of the machine.

Portable globe electrical machine

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass, glass
Dimensions:	total height 650 mm, base 469x125 mm, globe 230 mm
Inventory:	516

Common English design of frictional electrical machine with globe and brass box for the gear mechanism and rackwork. The cushion arrangement, however, is unusual and may be due to a slightly later alteration made in the Museo di Fisica e Storia Naturale workshop. The machine is secured to the mahogany base between two glass uprights supporting a wooden cross-piece. Two leather cushions rub the glass at opposite sides. Both are supported by a flexible brass strip. The separate prime conductor, supported on a glass stand, consists of a long brass cylinder with a flattened knob at each end. The charge is transmitted by means of three sharp collecting points (stand and points are modern replacements). Provenance: Lorraine collections.

Portable globe electrical machine

Setting:	Room XI
Maker:	Edward Nairne
Place:	London
Date:	ca. 1770
Materials:	mahogany, brass, glass
Dimensions:	total height 330 mm, glass globe 165 mm
Inventory:	444

Frictional electrical machine made by Edward Nairne. There is a brass box with an endless screw and spur wheel so that the glass globe can be rotated at speed. The round leather cushion is attached to a flexible brass strip against which presses a screw to control the amount of friction. A G-clamp under the box secures the machine to a table. The separate prime conductor consists of a turned mahogany base and a thin brass cylinder with knobs at its ends and with a single collecting point to transfer electricity from the globe. This portable machine was fairly common in England in the closing decades of the eighteenth century. Provenance: Lorraine collections.

Portable plate electrical machine

Setting: Room XI
Maker: unknown
Place: English?
Date: ca. 1775
Materials: wood, brass, glass
Dimensions: total height 445 mm, base (excluding conductor) 305x137 mm, glass disk diameter 340 mm, thickness 4.6 mm
Inventory: 2688

This plate frictional electrical machine is similar to, but smaller than, item inv. 2705. One of a set of four machines used to demonstrate the effects of different materials on the polarity of the generated charge, positive or negative. According to the 1776 catalogue of the Museo di Fisica e Storia Naturale, the substances used were: glass, glass coated with red sealing wax, rough glass (inv. 2687), and glass covered with black velvet (inv. 2686). At a later stage, one of the machines (inv. 2689) had its disk replaced by one of bismuth. The brass prime conductor, supported by a glass pillar, has two curved arms, each ending in a concave disk with sharp points (the collectors), which end in close proximity to the surface of the glass disk. The amount of charge is controlled by the Lane discharging electrometer with vernier scale on its wooden support. Nearly all the machines of this type seen in European collections are English-made, usually from London. Provenance: Lorraine collections.

Portable plate electrical machine

Setting: Room XI
Maker: unknown
Place: English?
Date: ca. 1775
Materials: wood, brass, glass
Dimensions: total height 445 mm, base (excluding conductor) 329x150 mm, glass disk diameter 295 mm, thickness 5.8 mm
Inventory: 2687

Frictional electrical machine with ground (roughened) glass disk to generate a negative charge instead of the usual positive charge. One of a set of four machines (inv. 2688 - inv. 2689 - inv. 2686) used to demonstrate the effects of different materials on the polarity of the generated charge, positive or negative. The brass prime conductor, supported by a glass pillar, has two curved arms, each terminating in a concave disk with sharp points (the collectors). These end in close proximity to the surface of the glass disk. The amount of charge is controlled by the Lane discharging electrometer with vernier scale on its wooden support. Nearly all the machines of this type seen in European collections are English-made, usually from London. Provenance: Lorraine collections.

Portable plate electrical machine

Setting:	Room XI
Maker:	unknown
Date:	ca. 1775
Materials:	wood, brass, glass, black velvet
Dimensions:	total height 460 mm, base (excluding conductor) 325x140 mm, glass disk diameter 330 mm, thickness 6 mm
Inventory:	2686

Frictional electrical machine with a disk covered with black velvet. There is a Lane discharging electrometer. One of a set of four machines (inv. 2688 - inv. 2687 - inv. 2689) used to demonstrate the effects of different materials on the polarity of the generated charge, positive or negative. Provenance: Lorraine collections.

Portable plate electrical machine

Setting:	Room XI
Maker:	unknown
Place:	English?
Date:	ca. 1775
Materials:	wood, brass, glass, bismuth
Dimensions:	total height 450 mm, base (excluding conductor) 310x135, disk diameter 290 mm, thickness 8 mm
Inventory:	2689

Frictional electrical machine with bismuth disk and cushions. Bismuth was quite uncommon for this type of apparatus and was employed for experimental purposes. One of a set of four machines (inv. 2688 - inv. 2687 - inv. 2686) used to demonstrate the effects of different materials on the polarity of the generated charge, positive or negative. The brass prime conductor, supported by a glass pillar, has two curved arms, each terminating in a concave disk with sharp points (the collectors). These end in close proximity to the surface of the glass disk. The amount of charge is controlled by the Lane discharging electrometer with vernier scale on its wooden support. Nearly all the machines of this type seen in European collections are English-made, usually from London. Provenance: Lorraine collections.

Set of mercury friction tubes

Setting: Room XI
Maker: unknown
Date: first half 18th cent.
Materials: wood, glass, mercury
Dimensions: box 560x100x55 mm
Inventory: 3765

Wood box painted blue with green silk lining inside, containing a set of six differently shaped glass tubes. There are two bulbs with straight stems, one thin tube, one curved tube with remains of a head painted at one end, and two tubes with a number of restrictions. They are all sealed at one end with sealing wax. The tubes contain a little mercury and were originally evacuated. They were used to demonstrate that the friction of the mercury against the glass of the tubes in a vacuum produced the electric glow. The aim was to show the resemblance between this phenomenon and the glow of phosphorus in the dark. The experiment was accordingly known as the "electrical phosphorus" experiment. The glow was observed in a barometer by Jean Picard in 1676, and was demonstrated to be electrical by Francis Hauksbee Senior in 1706. Provenance: Lorraine collections.

Single-barrel exhausting and compressing pump

Setting: Room XI
Maker: unknown
Place: Florence
Date: 1767
Materials: mahogany, brass
Dimensions: total height 1300 mm, base 380x480 mm
Inventory: 1535

Well-made pump with single upright barrel, mounted on a double wooden tripod. The piston is operated by means of a crank and rack. The base of the barrel is fitted with a valve. A pair of Magdeburg hemispheres is screwed onto the plate on the upper part of the machine. A three-way stop-cock allows the reversal of air inlet and delivery to the plate. The instrument could thus be used either as a vacuum pump or a compressor. For the latter purpose, the air was compressed in a special compartment. This innovation was described by John Smeaton in 1753. The pipe connecting the plate to the pump is a modern replacement. Provenance: Lorraine collections.

Small cup for inflaming spirits

Setting: Room XI
Maker: unknown
Date: late 18th cent.
Materials: brass
Dimensions: total height 82 mm, diameter 66 mm
Inventory: 466

Shallow brass dish attached to a brass rod. When the device was attached to the prime conductor of an electrical machine, a spark would ignite the alcohol warmed in the dish. This experiment, first performed in 1744. Possibly associated with item inv. 516. Provenance: Lorraine collections.

Solar microscope

Setting: Room XI
Maker: Isidoro Gaspare Bazzanti
Place: Italian
Date: 1760
Materials: brass, cardboard, wood
Dimensions: plate 150x150 mm, mirror 182x76 mm, box 200x213x187 mm
Inventory: 3229

This solar microscope consists of two main parts: the light housing and the body-tube. The light housing is composed of a frame on which an adjustable mirror is hinged and a tube containing a condenser to concentrate the light on the specimen. In the light housing is inserted a second tube made of cardboard covered in decorated paper, with a wooden mount. Screwed into this is a wooden cylindrical body with the stage and projection lens. The instrument, housed in a wooden box (lid missing), is signed by Isidoro Gaspare Bazzanti, about whom no information is known.

Solar mirror

Setting:	Room XI
Maker:	unknown
Place:	Italian?
Date:	first half 19th cent.
Materials:	brass, glass, cardboard, leather
Dimensions:	plate 194x142 mm, mirror 160x75 mm, tube length 270 mm
Inventory:	3228

The *portaluce* [solar mirror] is an instrument for reflecting solar rays into a room. It consists of a brass plate fitted with a rotating disk bearing a mirror on one side and a tube on the other. The device is installed in an aperture—usually made in a window—with the mirror facing out. By rotating the disk and adjusting the inclination of the mirror with a screw, one can align the instrument so that the Sun's rays are reflected into the tube. The tube contains a diaphragm that admits only a thin beam of light into the room. The effects of the apparent motion of the Sun are corrected by periodically adjusting the mirror's position.

Spiral conductor

Setting:	Room XI
Inventor:	Gaetano Cari
Maker:	Gaetano Cari
Date:	1770
Materials:	wood, gold foil, glass
Dimensions:	total height 1350 mm, length 1450 mm, diameter 60 mm
Inventory:	2692

Large wooden helical conductor covered with gold foil, on two glass pillars coated with red sealing-wax varnish. This type of varnish was much used with electrostatic apparatuses as it increased the electrical insulation of the glass, which, without the varnish, tended to attract more moisture. The instrument's inventor, Gaetano Cari, wrote a small book about his conductor (*Nuovo Conduttore Spirale con la sua Teoria*, Pistoia, 1783). He believed that his device could carry more charge than the conventional cylinder. In the engraving in his book, the helical conductor is suspended from the ceiling by silk cords. Provenance: Lorraine collections.

Straw electrometer, Volta type

Setting: Room XI
Inventor: Alessandro Volta
Maker: unknown
Date: late 18th cent.
Materials: glass, brass, tin foil
Dimensions: height 175 mm, base 130x115 mm
Inventory: 1167

Volta's straw electrometer. The two long straws are suspended to the brass rod, which terminates in a small ball at the top. A glass jar encloses the lower part of the rod and the straws, preventing them from being moved by air currents. When the conductor is not charged, the straws will align vertically because of gravity. When, instead, the ball is touched by an electrically charged body, part of the charge is diffused throughout the conductor. The straws become identically charged and repel each other, forming an angle proportional to the charge. The phenomenon is based on one of the fundamental properties of electrostatics: bodies with electrical charges of the same sign repel each other, while those with opposite electrical charges attract each other. The straws' divergence is indicated on two paper scales glued on two opposite sides of the flat-sided glass jar. Two tin foil grounding strips are in contact with the brass base.
Although Abraham Bennet's gold-leaf electroscope was more sensitive, the instrument, first described by Alessandro Volta in 1787, had the advantage of giving readings almost directly proportional to the electrical voltage being measured, provided that the straws did not diverge by more than c. 25°. Provenance: Lorraine collections.

Straw electrometer, Volta type

Setting:	Room XI
Inventor:	Alessandro Volta
Maker:	unknown
Date:	late 18th cent.
Materials:	glass, brass, tin foil
Dimensions:	height 180 mm, base 60x55 mm
Inventory:	1188

Small straw electrometer of the kind described by Alessandro Volta c. 1787. Two straws are in contact with a conductor terminating at the upper end in a brass hook instead of the usual ball. The two long straws are suspended to the brass rod, which terminates in a small ball at the top. A glass jar encloses the lower part of the rod and the straws, preventing them from being moved by air currents. When the conductor is not charged, the straws will align vertically because of gravity. When, instead, the ball is touched by an electrically charged body, part of the charge is diffused throughout the conductor. The straws become identically charged and repel each other, forming an angle proportional to the charge. The phenomenon is based on one of the fundamental properties of electrostatics: bodies with electrical charges of the same sign repel each other, while those with opposite electrical charges attract each other. Two tin-foil grounding strips are in contact with the brass base, whose inside is coated with tin foil.
The instrument is very portable and was used for outdoor observations on atmospheric electricity.
Although these devices were referred to as "electrometers," they are more accurately described as "electroscopes," as by modern standards they are not very accurate and do not measure in absolute units. Provenance: Lorraine collections.

Tellurium

Setting:	Room XI
Maker:	Charles-François Delamarche [attr.]
Place:	Paris
Date:	ca. 1800
Materials:	wood, brass
Dimensions:	height 330 mm, width 290 mm
Inventory:	Dep. SBAS, Firenze

Copernican planetarium model to illustrate terrestrial and lunar revolutions around the Sun. Attributed to Charles-François Delamarche. The device can be hand-operated by means of a gear system to simulate the motions of the celestial bodies with varying degrees of approximation. Delamarche produced similar models in the early nineteenth century. There is a similar instrument in the collection of the Osservatorio Ximeniano, also in Florence.

Thunder house

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass, glass
Dimensions:	height 470 mm, base 225x130 mm
Inventory:	1164

This model of the façade of a house gives a spectacular demonstration of the destructive effect of a lightning bolt striking a house with an imperfect lightning conductor.
In the experiment, a small piece of mahogany jumps out of the façade when the conductor is interrupted. If, instead, the piece is arranged so as not to break the conductor circuit, the electricity will be discharged to the ground, leaving the house intact. The brass wire electrode, insulated by a glass tube, serves as a model for an "electric thunder cloud." It forms an explosive spark-gap with the ball of the conductor, set into the façade and rising above the chimney. The ball can be removed, revealing a sharp point.
Filippo Lucci depicted a very similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Thunder house

Setting: Room XI
Maker: unknown
Date: late 18th cent.
Materials: mahogany, brass
Dimensions: height 240 mm, base 90x60 mm
Inventory: 1253

This model of the façade of a house gives a spectacular demonstration of the destructive effect of a lightning bolt striking a house with an imperfect lightning conductor.
In the experiment, a small piece of mahogany jumps out of the façade when the conductor is interrupted. If, instead, the piece is arranged so as not to break the conductor circuit, the electricity will be discharged to the ground, leaving the house intact. The top of the conductor carries a ball that can be removed, revealing a sharp point.
Filippo Lucci depicted a similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Thunder house

Setting: Room XI
Maker: unknown
Date: late 18th cent.
Materials: mahogany, brass
Dimensions: height 250 mm, base 134x87 mm
Inventory: 1252

This model of the façade of a house gives a spectacular demonstration of the destructive effect of a lightning bolt striking a house with an imperfect lightning conductor.

In the experiment, a small piece of mahogany jumps out of the façade when the conductor is interrupted. If, instead, the piece is arranged so as not to break the conductor circuit, the electricity will be discharged to the ground, leaving the house intact. The top of the conductor carries a ball that can be removed, revealing a sharp point.
Filippo Lucci depicted a similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Thunder house

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass
Dimensions:	total height 245 mm, base 175x113 mm
Inventory:	1545

This model gives a spectacular demonstration of the destructive effect of a lightning bolt striking a house with an imperfect lightning conductor.
The small wooden house has hinged walls and carries a brass rod representing a lighting rod. A section of the conductor runs along a piece of wood placed on the façade. Inside the house is a spark gap housed in a small brass cylinder containing a small quantity of gunpowder.
When the piece of wood is removed, the lightning-conductor circuit is broken. The lightning bolt, simulated by a spark generated by a Leyden jar, ignites the powder, whose explosion causes the house to collapse. If, instead, the piece of wood is positioned correctly, the electricity will be discharged to the ground, leaving the house intact.
Filippo Lucci depicted a similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Thunder house

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent. or later
Materials:	mahogany, brass, cloth
Dimensions:	height 260 mm, base 218x115 mm
Inventory:	1211

This model gives a spectacular demonstration of the destructive effect of a lightning bolt striking a house with an imperfect lightning conductor.
The small wooden house has hinged walls and carries a brass rod representing a lighting rod. A section of the conductor runs along a piece of wood placed on the façade.
When the piece of wood is removed, the lightning-conductor circuit is broken. The lightning bolt, simulated by a spark generated by a Leyden jar, ignites the powder, whose explosion causes the house to collapse. If, instead, the piece of wood is positioned correctly, the electricity will be discharged to the ground, leaving the house intact.
Filippo Lucci depicted a similar device in the Stanzino of the Matematiche of the Uffizi in 1780—clear evidence of the popularity of such demonstrations in the late eighteenth century. Provenance: Lorraine collections.

Thunder obelisk

Setting:	Room XI
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass
Dimensions:	height 320 mm, base 86x50 mm
Inventory:	1174

This device simulates the potential damage to a building struck by lightning when the lightning conductor is not properly grounded.
There are four sections with a brass conductor running through them. The conductor in the base section is hidden and is connected to a brass hook. At the top of this section is a rectangular cutout into which fits a thin mahogany strip. Depending on how it is inserted, the strip can break or restore the continuity of the conductor. One of the pyramid's spherical feet rests on the mahogany strip and thus also makes electrical contact with the conductor.
When the mahogany strip is arranged so as not to break the conductor circuit, the spark from a Leyden jar at the tip of the lightning conductor is discharged to the ground without damaging the pyramid. But when the conductor circuit is broken by twisting the mahogany strip, a spark gap is formed. The violent discharge from the jar will cause the strip to fall out and the obelisk will fall to pieces. Provenance: Lorraine collections.

Tube Leyden-jar

Setting:	Room XI
Maker:	unknown
Date:	second half 19th cent.
Materials:	glass, brass, tin foil
Dimensions:	total length 870 mm, diameter 17 mm
Inventory:	2742

Tube-shaped Leyden jar consisting of a long glass bottle partly coated inside and outside with tin foil. The inner coating is connected to a brass electrode terminating in a hook and secured by a turned wooden knob coated with red varnish. This type of condenser was used enhance the discharges produced by induction machines. Provenance: Lorraine collections.

Twin-barrel air pump

Setting:	Room XI
Maker:	unknown
Date:	1743
Materials:	mahogany, brass, iron, lead, glass
Dimensions:	total height 1700 mm, base 590x600 mm
Inventory:	1533

Pump mounted on an ornate mahogany frame. There are two barrels in which the rods move by means of iron racks operated by a crank with pinion. A lead tube connects the pump to the plate, which serves as the base for a bell-jar (replica). Resembles the pump described by Francis Hauksbee Senior in 1709. The innovative feature of Hauksbee's pump was the automatic evacuation of the air via a leather valve. In this model, instead, the valves are operated manually by means of a faucet. Provenance: Lorraine collections.

Volta hydrogen lamp with electrophorus

Setting: Room XI
Inventor: Alessandro Volta
Maker: unknown
Date: early 19th cent.
Materials: wood, glass, brass
Dimensions: total height 545 mm, base 290x290x110 mm
Inventory: 1251

A more sophisticated version of the hydrogen lamp invented by Alessandro Volta (inv. 1243). Incomplete. A glass bottle rests on a wooden box whose top is fitted with a brass collar and stop-cock. A vase-shaped glass reservoir is fitted to a brass collar above the stop-cock. The bottle contained hydrogen generated by reaction between diluted sulfuric acid and zinc. The gas was expelled from a nozzle (missing) by the pressure of the water pouring from the reservoir. An electrophorus was used to produce a spark in the spark gap. This ignited the gas, lighting the taper. The electrophorus is in the base of the instrument and can be removed for charging by rubbing with silk or cat fur. A key moved the spark-producing upper electrophorus plate and the gas stop-cock simultaneously. Provenance: Lorraine collections.

Voltaic pistol

Setting: Room XI
Inventor: Alessandro Volta
Maker: Nairne & Blunt firm
Place: London
Date: 1778-1793
Materials: mahogany, brass, glass
Dimensions: total length 525 mm, tube diameter 53.8 mm
Inventory: 1244

Well-made specimen of Voltaic pistol made by Nairne & Blunt. It has a mahogany stock and brass barrel with two stop-cocks. A brass plunger terminating in a disk slides into the mouth of the barrel. An oval indentation in the barrel indicates the position of the ball (now missing) of the electrode forming the spark gap inside the barrel.
The pistol was partly filled with hydrogen by means of a rubber bag (now missing). The gas was detonated by a spark from a Leyden jar. The explosive force of the gas was measured by the movement of the plunger.

In 1776, Alessandro Volta began a series of experiments in which he used an electric spark to ignite methane (which he observed and collected in swamps) and detonate a mixture of hydrogen and air. Experiments with the electric pistol led to the invention of the hydrogen lamp and eudiometer. Provenance: Lorraine collections.

Wheel barometer

Setting:	Room XI
Maker:	unknown
Place:	Italian
Date:	late 18th cent.
Materials:	wood, glass
Dimensions:	height 1026 mm, max. width 330 mm
Inventory:	1139

Wheel barometer mounted on a gilt and decorated wooden base. The barometric scale is divided into Paris inches. Above the barometer is a thermometer, also with a dial. The back of the instrument holds a large tube, originally containing alcohol, connected to a U-tube filled with mercury. The volume of alcohol varies with the changes in temperature, altering the height of the mercury column. A floating weight on the mercury column moves the thermometer pointer by means of a cord and pulley.

Winter plate electrical machine

Setting:	Room XI
Inventor:	Carl Winter
Maker:	Museo di fisica workshops
Date:	second half 19th cent.
Materials:	mahogany and other woods, brass, iron, glass, tin foil, gold foil
Dimensions:	total height 2600 mm, base (max. dimensions) 2460x2255 mm, disk diameter 1215 mm, thickness 6 mm
Inventory:	1526

This is the largest generator of its kind still in existence, and the final development of plate frictional electrical machines. The glass plate has a composite axle of glass and brass. It is supported on the brass side by two glass pillars, and on the glass side by a stout wooden one. In this way, strength of construction is combined with efficient insulation. The plate is rubbed by two cushions in a mahogany frame supported on a glass stem. The most noteworthy construction feature is the two large "inductor" rings coated in gold foil and insulated on glass supports on either side of the machine. One of these acts as the "negative" conductor when connected to the cushions. The other is the prime or "positive" conductor, the glass plate rotating between its ring-shaped collectors. At the front is a brass sphere on an insulated support (replacement). At the back are two discharging conductors, one on a clear glass support, the other on a green glass support. At the prime-conductor side is a very large Leyden jar, protected in an eight-sided glass and wood case. Two long wooden rods, terminating in hooks and coated in gold foil, are suspended from the rings that were probably used to connect the various parts of the machine together. The machine has been heavily restored.
Carl Winter devised this generator type in the mid-eighteenth century. It is essentially a descendant of Jean Baptiste Le Roy's "long spark" machine of 1772. The capacity of this design was augmented by Winter's "inductor" rings, which contained one or more coils of thick iron wire. Provenance: Lorraine collections.

Rooms XII and XIII

Teaching and Popularizing Science

Paolo Brenni

These rooms contain instruments and machines designed to illustrate the basic principles of mechanics, hydraulics, electrostatics and optics to a vast public. In the 18th century, the cultural vogue that stimulated curiosity for spectacular experimental demonstrations also led to a demand for new educational instruments. The models for studying mechanics displayed in the first room faithfully reflect those described in the treatises of the most famous eighteenth-century scientists and demonstrators. They remained in use, with few modifications, up to the first decades of the 20th century. In the second room are displayed educational instrumentation for optics, hydraulics and pneumatics, electromagnetism and electrodynamics. The industrial production of educational instruments, with centres of excellence in London and Paris, remained limited in Italy, so that numerous collections were formed mainly of instruments purchased abroad.

Air pump, twin barrels, table-top model

Setting:	Room XIII
Maker:	William Cary
Place:	London
Date:	early 19th cent.
Materials:	mahogany, brass, glass
Dimensions:	total height 1705 mm, base 560x330 mm
Inventory:	1536

This pump, made by William Cary, is mounted on a wooden baseboard and fitted with two brass barrels whose pistons carry racks and are operated by means of a crank-and-pinion mechanism. A pair of small brass pillars supports the wooden pediment housing the mechanism. The bell-jar rests on a plate: the flow of air between the bell-jar and the barrels is controlled by a tap at the base of the barrels. Next to the bell-jar plate is a smaller plate that was used to evacuate an upright glass cylinder. This typical English portable air pump had evolved by c. 1760.

Air pump, twin barrels, table-top model

Setting:	Room XIII
Maker:	Christophe Bettally
Place:	Paris
Date:	first half 19th cent.
Materials:	wood, brass, glass
Dimensions:	total height 480 mm, base 500x280 mm
Inventory:	1537

The pump, made by Christophe Bettally, is mounted on a wooden base and fitted with two brass barrels. Their pistons carry racks and are operated by a pinion fitted with two handles. A pair of small brass pillars supports the brass frame housing the mechanism. The glass bell-jar rests on a plate connected to the pistons. A stop-cock controls the flow of air between the pistons and the bell-jar. A mercury pressure-gauge or manometer was originally screwed onto the second stop-cock, inserted laterally into the connector between the plate and the barrels. The instrument is a French version of the English pump inv. 1536.

Apparatus demonstrating electrodynamic attraction and repulsion

Setting:	Room XIII
Inventor:	Leopoldo Nobili
Maker:	Tecnomasio Italiano
Place:	Milan
Date:	ca. 1865
Materials:	boxwood, brass
Dimensions:	total height 90 mm, base 107x84 mm
Inventory:	375

This apparatus was made by Tecnomasio Italiano after the specimens built by Leopoldo Nobili for his electromagnetic kit (inv. 1553), but resembles one of the items (no IX) in the kit. A small rectangular coil is mounted on a wooden base. An adjacent support carried a thin conductor (missing), connected to a circuit comprising a battery by means of depressions filled with mercury. The conductor's position depended on the magnetic field produced by the coil.

Apparatus demonstrating pointed and ball lightning conductors

Setting:	Room XIII
Inventor:	Benjamin Wilson
Maker:	unknown
Date:	late 18th cent.
Materials:	wood, glass, brass, tin foil
Dimensions:	total height 485 mm, base 370 mm
Inventory:	2693

This device was described by Benjamin Wilson in the *Philosophical Transactions* of the Royal Society in 1778 to demonstrate that the lightning conductor should end in a ball rather than a point.

The large Leyden jar, is placed in a wooden container and supported on a massive wooden base. From one side of the jar, in contact with its outer tin-foil coating, projects a brass fork-shaped conductor, one prong terminating in a sharp point, the other in a ball. The sleeves ending in a ball and a point could be moved toward a large brass ball on another support, until the discharge from the Leyden jar would strike either the ball, or the point, or both. According to Wilson, this experiment demonstrated that the point produced a spark three times as long as the ball conductor, and that therefore the lightning conductor ending in a ball was less dangerous. These experiments had a strong political connotation in England. Benjamin Franklin, who argued for the efficiency of point conductors, was also the leading statesman in the American colonies and thus disliked by King George III. Provenance: Lorraine collections.

Apparatus for angles of incidence and reflection

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, ivory
Dimensions:	height 1260 mm, diameter 700 mm
Inventory:	2738

A richly decorated wooden base supports a column carrying a circular table. Along the edges of the table are inserted 36 ivory sectors, each of 10°. A diaphragm with three circular holes with shutters slides on the edge. A metal mirror is set in a brass frame at the center. Projecting a beam of light through the diaphragm onto the mirror, we can observe that it is reflected by an angle equal to the angle of incidence.

Apparatus for angles of incidence and reflection

Setting:	Room XIII
Maker:	unknown
Date:	18th cent.
Materials:	wood, brass
Dimensions:	140x320 mm
Inventory:	635

The instrument consists of an L-shaped wooden board carrying a rotating brass circle fitted with indexes and viewers. Between the wood and the circle is a brass plate with a ring to suspend the instrument. To the back of the board is attached a brass arm with a support for a mirror or prism that reflected the light. By projecting a light ray through the diaphragm onto the mirror, one could observe that the ray was reflected by an angle equal to the angle of incidence.

Apparatus for showing stable equilibrium

Setting:	Room XII
Maker:	unknown
Date:	late 18th cent.
Materials:	wood, brass
Dimensions:	base diameter 180 mm, height 480 mm
Inventory:	973

This apparatus was described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748) to introduce the study of levers. It is also used to illustrate the conditions of stable equilibrium.
A column holds a curved brass handle fastened to a gilt wooden statue of Mercury (lacking arms). The system can move freely without falling even though it rests on a metal point. The reason is that the handle is designed to consistently maintain the system's center of gravity below its resting point on the support. Small toys based on the same principle, representing tightrope walkers and jugglers, were once quite popular and are still widely available. Provenance: Lorraine collections.

Apparatus for showing the effects of the centrifugal force

Setting:	Room XII
Maker:	unknown
Date:	late 18th cent.
Materials:	wood, iron, brass
Dimensions:	650x720x800 mm
Inventory:	1384

This instrument, like the apparatus inv. 1027, is used to perform experiments on the centrifugal force. The wooden base carries a hinged board whose slope can be adjusted by a metal arc and a fastening screw. The board supports a vertical frame carrying a wheel fitted with a handle. The handle, via a lathe and pulley, rotates a horizontal iron axle bearing two perpendicularly placed elastic metal blades that form two meridians of a sphere. When the axle is spun, the centrifugal force distorts the blades, turning the sphere into a rotating ellipsoid whose flatness increases in proportion to the velocity. There is a mechanism for blocking the blades at the point of maximum flattening. The apparatus thus offers a convincing demonstration of the cause of the Earth's flattening at the poles, which is precisely the vortical rotation of our planet on its axis. The instrument also came with a glass globe (missing) to replace the axle with blades. The globe was filled with a mixture of water and a liquid of different density, or with water containing a wax pellet or an air bubble. With such combinations, the globe provided a demonstration of the effects of gravity combined with the centrifugal force. The operating principle of the apparatus was described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748). Provenance: Lorraine collections.

Apparatus for showing the hydrostatic paradox

Setting:	Room XIII
Inventor:	Simon Stevin, Blaise Pascal [attr.]
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, iron
Dimensions:	960x330x1450 mm
Inventory:	1370

This instrument is often called the Pascal apparatus, after Blaise Pascal, although the phenomenon known as the "hydrostatic paradox" was first analyzed by Simon Stevin. In *De l'équilibre des liqueurs et de la masse de l'air* (Paris, 1663), Pascal demonstrated with a similar instrument that the hydrostatic pressure acting on the bottom of a vessel is determined solely by the height of the column of liquid (and obviously by its specific weight)—not by its volume or the shape of the vessel.
This model is already described as largely incomplete in the 1776 inventory of the Lorraine collections. It is based on a version described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748).
A wooden box containing a tin-plated tub carries a frame supporting two rocking levers pivoting on a pair of posts. Two containers for weights are suspended from cords to the outer ends of the levers. The inner ends each carry a weight hanging over the center of the instrument. Originally, however, the rocking levers were connected to the piston of a square vessel (now missing) placed in the tub. The vessel had a threaded opening for attaching glass tubes of different diameters and shapes but equal base diameter. The piston thus fit on the bottom of all the tubes. By filling the tubes with water, one could show that the pressure exerted on the piston depended exclusively on the height of the liquid column, irrespective of the vessel's shape. For example, the base of a

rather large cone or of a fairly narrow tube (with, however, the same surface area at their base), filled with water, was kept sealed by an identical weight applied to the rocking levers, provided that the level of liquid in the vessels was the same. This phenomenon, which at first sight may seem surprising, was known as the "hydrostatic paradox."

Apparatus for showing the parabolic path of liquids

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, glass, ivory, brass
Dimensions:	670x230x910 mm
Inventory:	1024

This apparatus provides a visual display of the path of a liquid projected from a nozzle at different angles.
A profiled rectangular wooden vessel holds an upright panel carrying a glass tube at one end. The tube is fitted with a faucet whose angle is adjustable from 0° to 90°. When the tube is filled with mercury and the faucet is opened, the mercury spurts out, describing a parabolic path that stands out in sharp contrast against the vertical panel. The aperture of the parabola depends on the angle of the nozzle. The maximum projection of the liquid is obtained by setting the nozzle at 45°.
In his *Leçons de physique expérimentale* (Paris, 1743-1748), Jean-Antoine Nollet suggested replacing the mercury with water. Although it produced a more spectacular effect, mercury was very expensive and eventually corroded the faucet. Nollet also emphasized that the parabolic paths of liquids and solid bodies obeyed the same physical principles. In fact, the apparatus was used to demonstrate Galileo's discovery of the parabolic path of projectiles. Provenance: Lorraine collections.

Apparatus showing the composition of forces

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass
Dimensions: diameter 410 mm, height 430 mm
Inventory: 1404

This instrument, which demonstrates the composition of forces and the principle of the parallelogram of forces, is nearly identical to the one illustrated by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742).
A round wooden base supports a column topped by a disk. Four vertical sheaves run in a groove around the rim and can thus be positioned at different angles to one another. The ends of two pairs of cords (knotted together in the center) pass over the sheaves and hold four small pans with weights.
By changing the angles between the sheaves and the weights, one can visualize—thanks to the angles formed by the cords on the disk—the sum of the forces and the equilibrium conditions. Provenance: Lorraine collections.

Apparatus to illustrate reflection in elastic shocks

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, porphyry, brass
Dimensions: 550x700x1150 mm
Inventory: 1502

The apparatus shows that, in elastic shocks, the angle of incidence is equal to the angle of reflection.

A rectangular box with a small opening is mounted on a wooden base, fitted with three leveling screws to ensure that the apparatus is perfectly horizontal. The box carries an arm on which is mounted a horizontal board with a brass-lined hole. On the base is hinged a wooden frame bearing a porphyry slab, whose slope can be adjusted from 0° to about 45°. An ivory ball dropped through the brass-lined hole bounces off the porphyry slab; if the latter is tilted at 45°, the ball is deflected in such a way as to fall exactly into the box opening.
In describing the apparatus in *Leçons de physique expérimentale* (Paris, 1743-1748), Jean-Antoine Nollet notes that, in the real-life experiment, the angles of incidence and reflection are never exactly equal. The reasons include the imperfect elasticity of the materials, air resistance, and the ball's slightly curved trajectory after the rebound. Provenance: Lorraine collections.

Apparatus to study the composition of elastic shocks

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, ivory, brass
Dimensions:	length 1420 mm, width 1850 mm, height with table 1800 mm
Inventory:	971

This apparatus, described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748), is a sort of small billiard mechanism resting on an elegant table. It was used to study the composition of elastic shocks. The device consists of a pair of hammers hinged in two rotating quadrants. Two ivory scales, inserted in the arcs, serve to measure the distance traveled by the hammers. By dropping the two hammers on a ball from different heights at different angles, one can observed the trajectory produced by the combination of two different momentums. The experiments can be varied, for example, by placing the quadrants at a distance from each other so that they strike two separate balls, which will collide on the plane. Provenance: Lorraine collections.

Apparatus with simple machines

Setting: Room XII
Maker: Nairne & Blunt firm
Place: London
Date: 1774-1793
Materials: wood, brass
Dimensions: height 550 mm, max. width 420 mm
Inventory: 496

This multiple apparatus, built by Nairne & Blunt, is equipped with several simple demonstration machines. It is designated in the old inventories as "astuccio di Nairne" [Nairne's kit].
The round wooden base holds a columns with two arms. A small triangular inclined plane with a pulley is fixed to the end of one arm. The angle formed by the inclined plane with the horizontal is adjusted by means of a brass arc and a fastening screw. The second arm carries a brass frame that houses an axle fitted with an endless screw and a disk. A series of concentric holes are drilled along one of the disk's diameters, to which the weights can be applied by means of the cords. The screw meshes with a cogwheel whose axle carries a pulley bearing a weight hanging from a cord. Four pulley systems are fastened to the underside of the same arm: a fixed sheave, a two-sheave block, a four-sheave block, and a six-sheave block, to which different weights are applied. Provenance: Lorraine collections.

Cogwheels

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass, iron, lead
Dimensions: 450x360x900 mm
Inventory: 1387

A wooden frame resting on four legs carries four axles fitted with pinions and reduction cogwheels (i.e., that reduce the motion by an order of magnitude according to a determined ratio). The topmost axle is fitted with a handle; the lowest axle carries a drum around which is wound a cord bearing a lead weight. The model illustrates the ratio between the wheels' complete revolutions and those of the pinions. The ratio determines the force to be applied to the handle in order to lift the weight applied to the system. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XIII
Maker:	unknown
Place:	French
Date:	late 19th cent.
Materials:	brass
Dimensions:	height 155 mm; box 166x72x54 mm
Inventory:	3172

Compound microscope called a *cylinder* or *drum* microscope because of the shape of the base. The body-tube slides in a collar for focusing. The mirror is inserted in the base. An articulated arm holds a bull's eye lens. There are three objectives. Instruments of this type, used mainly for recreational purposes, were inexpensive and thus sold in large numbers.

Compound microscope, demonstration

Setting: Room XIII
Maker: Nachet firm
Place: Paris
Date: 1880-1892
Materials: brass
Dimensions: height 344 mm
Inventory: 3208

Compound microscope made by Nachet in Paris. Was designed mainly for demonstrations to students during lectures. The instrument, mounted on a bar attached to a base carrying a mirror, can also be removed from the base and held by means of a wooden handle (now missing). Two metal arms formed a tripod with the handle for putting down the microscope. Coarse focus is by sliding the body, fine focus by a screw. There was a substage condenser (now missing).

Compound microscope, demonstration

Setting: Room XIII
Maker: unknown
Place: German?
Date: late 19th cent.
Materials: brass
Dimensions: length 180 mm; plate of base 61x49 mm
Inventory: 2672

Compound microscope, probably German. Consists of a sleeve to which a disk stage is attached at one end. The body-tube slides in the sleeve. The objective is too powerful for this type of microscope. The observer held the instrument and pointed it toward a light source.

Cylinder on inclined plane

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood
Dimensions: diameter 140 mm, height 235 mm
Inventory: 1390

When placed on the inclined plane, this wooden cylinder tends to roll upward, coming to a halt at a well-determined position. Because of this apparently absurd phenomenon, the apparatus (like the climbing cone inv. 3387) was classified as a "mechanical paradox." Actually, the cylinder conceals a metal ballast that shifts the center of gravity away from the central axis. This mass thus creates a mechanical couple that offsets the action of the gravitational force, enabling the cylinder to move some way up an inclined plane and come to a stop. Provenance: Lorraine collections.

Demonstration model of Oersted's experiment

Setting: Room XIII
Maker: Carlo Dell'Acqua
Place: Milan
Date: ca. 1850
Materials: wood, brass, copper
Dimensions: total height 185 mm, base 145x126x43 mm
Inventory: 1201

Wooden base holding a magnetic compass with silvered scale; above it, secured in a brass frame, is a thick copper wire terminating in small brass screw-terminals. The rackwork is used to lower or raise the wire over the needle of the magnetic compass to examine whether the needle's deflection is influenced by its distance from the wire.
The instrument, signed by Carlo Dell'Acqua, was used by Luigi Magrini to reproduce Hans Christian Oersted's famous experiment of 1820, with which he demonstrated the action of electric current on a magnetic needle. The instrument is therefore a crude form of galvanometer. Provenance: Lorraine collections.

Device for boring glass

Setting: Room XIII
Inventor: Jean-Antoine Nollet
Maker: unknown
Date: 19th cent.
Materials: wood, brass
Dimensions: total height 185 mm, base 124x75 mm
Inventory: 3764

Apparatus used to pierce strips of paper, or even thin glass, by means of the electrical charge between two point electrodes. Jean-Antoine Nollet devised this experiment c. 1740, in an attempt to prove his theory of two electric fluids by the appearance of the holes punctured by the discharge in the paper. The two fluids were known as "effluent" and "affluent"—which, in the science of electricity, respectively denote an electric fluid flowing into and out of a body. The instrument, described by Nollet in *Essai sur l'électricité des corps* (Paris, 1750), was used for teaching purposes until the early twentieth century to illustrate the mechanical effects of the electrical discharge. Provenance: Lorraine collections.

Double pendulum to illustrate the damping of oscillations

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, iron
Dimensions: 305x710x840 mm
Inventory: 1386

The apparatus consists of a rectangular wooden box divided into two compartments in which the weights of two metal pendulums of equal length oscillate. By filling one compartment with water or another liquid and leaving the other empty, we observe that the damping of the pendulum oscillations is proportional to the resistance of the liquid used. Jean-Antoine Nollet used an apparatus of this type to explain the operation of a rowboat. Provenance: Lorraine collections.

Endless screw

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, iron
Dimensions:	base diameter 500 mm, height 850 mm
Inventory:	1388

This model demonstrates the principle of the endless screw, a component used in many machines. A wooded tripod carries a profiled support holding a horizontal endless screw fitted with a handle. The screw meshes at right angles with a cogwheel equipped with a drum. A cord holding a brass weight is wound around the drum. Provenance: Lorraine collections.

Faraday's net

Setting:	Room XIII
Inventor:	Michael Faraday
Maker:	unknown
Date:	first half 19th cent.
Materials:	cotton, silk, brass, glass
Dimensions:	total length 663 mm, ring diameter 135 mm
Inventory:	387

Cone-shaped cotton net with a silk thread at its point, attached to a glass handle. This arrangement was devised by Michael Faraday to demonstrate that the electrostatic charge resides on the outer surface of a conductor. The net was electrified and, by drawing it inside out with the silk thread, was shown still to be electrified only on its exterior surface. Provenance: Lorraine collections.

First-order lever

Setting: Room XII
Maker: unknown
Date: late 18th cent.
Materials: wood, brass
Dimensions: 690x220x610 mm
Inventory: 1007

First-order lever, very similar to lever inv. 1002. The apparatus consists of a profiled wooden base supporting a turned column that holds the moving beam. The latter has two notches for shifting the position of the fulcrum. One end of the beam carries a counterweight; the other end holds a cord to which a small weight is attached. The instrument reproduces a lever illustrated by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). Provenance: Lorraine collections.

First-order lever

Setting: Room XII
Maker: unknown
Date: late 18th cent.
Materials: wood, brass, lead
Dimensions: 460x190x400 mm
Inventory: 1002

This first-order lever, of nearly the same design as item inv. 1007, was probably used to show the action of an oblique effort. There is a beam with two notches and twelve small equidistant nails indicating the points where the effort could be applied. The weight that served as effort was applied to the lever by means of an oblique cord passing over a pulley fixed to a table. The instrument reproduces a lever illustrated by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). Provenance: Lorraine collections.

First-order lever as balance beam

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass
Dimensions: max. length 660 mm, height 590 mm
Inventory: 1383

This first-order lever demonstrates how the center of gravity of a balance beam should be positioned for maximum weighing sensitivity.
A wooden base holds a column with a small brass frame. The balance beam rests on a steel knife-edge supported by the frame. The beam is fitted at both ends with strips from which two small weights are suspended by cords. There are three pairs of holes in each strip to change the points of application of the weights. The fulcrum is fitted with a small dial for vertical adjustment. Through suitable changes in its position, one can show that the balance beam is most sensitive when its center of gravity lies slightly below its rotation axis. If the center coincides with the axis, the balance would be in indifferent equilibrium: every beam position is stable provided the weights are equal. When, instead, the center of gravity lies above the rotation axis, even a slight change of weight causes the beam to swing sharply. This mechanism was illustrated in 1795 by Sigaud De La Fond with a similar apparatus. Provenance: Lorraine collections.

Lens with mount

Setting: Room XIII
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: lens diameter 65 mm, height 385 mm
Inventory: 764

Biconvex converging lens mounted in a wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Resembles lenses inv. 761 and inv. 760.

Lens with mount

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood
Dimensions:	267x203x545 mm
Inventory:	749

The rectangular wooden base carries two vertical supports on which two adjustable arms are fixed by means of wing nuts,. On them is hinged a small platform holding a converging plano-convex lens (called a "bull's eye").

Lens with mount

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	lens diameter 137 mm, height 360 mm
Inventory:	760

Biconvex converging lens mounted in a wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Resembles lenses inv. 761 and inv. 764.

Lens with stand

Setting: Room XIII
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: lens diameter 110 mm, height 320 mm
Inventory: 761

Biconvex converging lens mounted in a wooden ring. The ring is hinged on a brass fork fixed to a turned wooden base. Resembles inv. 764 and inv. 760.

Lever suspended at both ends

Setting: Room XII
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass, iron
Dimensions: 510x140x330 mm
Inventory: 1409, 3755

The apparatus resembles a model first described by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). Its purpose is to demonstrate the conditions for placing a suspended lever in equilibrium.
A wooden base carries two turned pedestals, each holding a pillar with a pulley at its top. Over each pulley passes a cord carrying a counterweight at one end and fixed to either end of an iron bar on which are engraved 15 evenly spaced notches. The bar is suspended in horizontal equilibrium. If a weight W is applied to the center of the bar, the equilibrium will be maintained by adding two weights of W/2 each to the existing counterweights. If W is applied not at the center but at a point dividing the bar into two unequal segments, the added weights must be inversely proportional to the lengths of the corresponding segments of the bar in order to preserve the equilibrium. Provenance: Lorraine collections.

Machine for experiments on the centrifugal force

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	iron, wood, brass, glass
Dimensions:	length 1300 mm, width 1300 mm, height with table 1805 mm
Inventory:	1027

Rotating machine that can be fitted with accessories to illustrate the effects of centrifugal force. The apparatus, described by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748), is mounted on a triangular table.
A vertical column held in place with fastening screws carries a frame holding a spoked wheel fitted with a handle. The wheel groove carries a cord that, guided by five sheaves, imparts a rotating motion to a pair of disks placed horizontally on the table. The cord tension can be adjusted by vertical shifts in the frame holding the wheel. Various accessories used for the experiments (carriages, oblique tubes, cords with small spheres) are screwed onto the disks. For example, a glass cylinder is placed at the center of a profiled board with two branching oblique tubes connected to two flasks at either end of the instrument. When the cylinder is filled with water and the apparatus is rotated, the centrifugal force drives the liquid up the tubes and fills the flasks. Provenance: Lorraine collections.

Magnetic cabinet

Setting:	Room XIII
Maker:	George Adams junior
Place:	London
Date:	ca. 1780
Materials:	mahogany, brass, iron, steel
Dimensions:	box 243x171x60 mm
Inventory:	3753

Polished mahogany box containing a kit for magnetic experiments assembled by George Adams Junior, who described them in his *An Essay on Electricity* (London, 1784) and *Lectures on Natural and Experimental Philosophy* (London, 1794). The kit is not complete, but the following items are included: steel horseshoe magnet with steel suspension ring; small magnetic dip needle on brass base; brass pivot with scale to show magnetic declination; several brass pivots for small magnetic needles; turned ebony box with iron filings to show the lines of force by scattering the filings on a sheet of paper or glass plate with the magnet placed beneath. There are also several bar magnets. Provenance: Lorraine collections.

Model illustrating the human arm as third-order lever

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, lead, brass, silk
Dimensions:	725x180x510 mm
Inventory:	1010

This rare and unusual mechanical apparatus illustrates the analogy between the human arm and a third-order lever: the fulcrum is the elbow, the effort is provided by the muscle attached to the forearm, and the load consists of a weight held in the hand. The wooden skeleton of the arm, forearm, and hand is attached to a marbled wooden table. The shifts in the weights suspended from the arm show the arm's movement. When the weights descend, the hand rises. Provenance: Lorraine collections.

Model of Archimedean screw or cochlea

Setting:	Room XIII
Inventor:	Archimedes
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass, glass
Dimensions:	height 750 mm, base 800x210 mm
Inventory:	999

The machine is built on the same principle as item inv. 998 and, like the latter, is known as an *Archimedean screw*, after the scientist who first designed such a device. A brass plate is hinged to a wooden base and its tilt can be adjusted by means of a sliding brass stirrup. The plate holds a glass tube closed at both ends by two brass stoppers and fitted with a handle. The stoppers carry small elastic strips holding a helical glass tube. Water is raised through the tube by rotating the handle. Provenance: Lorraine collections.

Model of hydraulic pump with alterations by Sisson

Setting:	Room XIII
Maker:	unknown
Place:	English?
Date:	second half 18th cent.
Materials:	wood, brass, ivory
Dimensions:	310x290x880 mm
Inventory:	978/a, 3775

The most distinctive feature of this hydraulic pump is the handle system for operating the piston. The arrangement was intended to transform the rotary motion of the handle into the to-and-fro linear motion of the piston more efficiently. It was invented by Jeremiah Sisson, in 1758, to improve the performance of conventional suction pumps for raising liquids. The connecting rod attached to the barrel carries a brass fitting with two perpendicular slits forming a cross; it is reinforced with a brass ring. A cursor, connected to the handle that operates the machine, moves back and forth through the horizontal slit. When the piston rises, the water is sucked though a valve in the base of the pump. When the piston falls, the valve remains shut, while a second valve at the center of the piston opens, letting the water flow over it. In the next upward stroke, the water raised by the piston fills a crown placed on the top of the pump and spills out of a beak. This demonstration model represents the type of pump long used in many houses to draw water. Provenance: Lorraine collections.

Model of Oersted's version of Schweigger's multiplier

Setting:	Room XIII
Inventor:	Johann Salomon Christian Schweigger, Hans Christian Oersted
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass, copper, steel, glass
Dimensions:	total height 350 mm, base diameter 118 mm
Inventory:	1194

A wooden base with support for a rectangular coil with wire. The wire ends of the coil terminate in two short glass tubes clamped to a small pedestal secured to the base. The coil is penetrated centrally by a glass tube containing a thin copper rod at whose ends are attached two flat magnetic needles, one inside and the other above the coil. The needles are suspended by a curved brass rod. The first multiplier by Johann Salomon Christopher Schweigger was very primitive. This model is based on Hans Christian Oersted's 1832 version of Schweigger's multiplier. The Museum's specimen carries no scale but, more importantly, has a pair of astatic needles, while the original instrument had a single magnetic needle. Provenance: Lorraine collections.

Model winch

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass
Dimensions:	500x525x1274 mm
Inventory:	1504

This model of a winch, a machine with a horizontal axle for lifting heavy weights, is of the type illustrated by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis* *confirmata* (3rd ed., Leiden, 1742). A wooden table carries two columns on which is mounted a horizontal axle with a wheel equipped with twelve radial handles. A cord holding a weight is wound around the axle and passes through the slot cut in the table for that purpose. The wheel has four grooves of different diameters for lodging cords bearing different weights. The winch is in equilibrium when the product of the load (weight) times the axle radius equals the product of the force applied (effort) times the wheel radius. The winch can be regarded as a first-order lever. Provenance: Lorraine collections.

Multi-groove pulley

Setting:	Room XII
Maker:	unknown
Date:	late 18th cent.
Materials:	wood, lead
Dimensions:	base diameter 190 mm, height 410 mm
Inventory:	992

A turned wooden base supports a three-groove multiple pulley revolving on a horizontal axle. A lead weight is suspended by a cord from each groove. This simple machine, which also illustrates the operating principle of the winch, demonstrates that equilibrium is attained when the sum of the mechanical couples is null. The apparatus was illustrated by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris, 1743-1748). Provenance: Lorraine collections.

Multi-lever apparatus

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, brass
Dimensions:	1250x305x450 mm
Inventory:	1005

The apparatus shows the combined effect of three first-order levers. The levers, mounted on four turned columns, each carry a brass counterweight to maintain their equilibrium when no effort is applied to them. Brass strips and equidistant nails on the levers show possible application points for loads and efforts. The design is based on a model illustrated by Willem Jacob 's Gravesande in *Physices elementa mathematica, experimentis confirmata* (3rd ed., Leiden, 1742). Provenance: Lorraine collections.

Nobili's electromagnetic kit

Setting:	Room XIII
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1833
Materials:	mahogany, boxwood, elder marrow, brass, copper, zinc, iron, steel
Dimensions:	box 280x206x95 mm
Inventory:	1553

This is the fullest kit of small apparatuses to demonstrate the electromagnetic properties of current available at that time, based on the work of Hans Christian Oersted, André-Marie Ampère, Michael Faraday, Peter Barlow, Auguste De La Rive, and others. It took Leopoldo Nobili nearly nine years to develop this teaching aid. The pieces are not in the same order as those described in Nobili's *Memorie* (Florence, 1834), and two are missing: the box with spout for pouring mercury and the Wollaston battery. This kit, of which very few copies survive, is one of the most fascinating teaching compendia of the nineteenth century. Provenance: Lorraine collections.
The box contains:
I - FLOATING COIL (total height 65 mm). A small solenoid on top of the float of pith of elder is connected to a simple Voltaic cell of small copper and zinc plates. The solenoid will orient along the magnetic meridian when placed in acidified water. Invented by De La Rive.
II - FLOATING CIRCULAR COIL AFTER DE LA RIVE (total height 90 mm). Ring coil on a float, consisting of a few wire strands. Its orientation at right angles to the magnetic meridian is indicated by an "N" and an "S." The coil orientates along the Earth's magnetic field when placed in acidified water. Invented by De La Rive.
III - LARGE FLOATING COIL (diameter 100 mm). Large circular coil of several strands connected to a small copper plate and a small zinc plate. When suspended in acidified water, it orientates along the Earth's magnetic field.
IV - FARADAY'S CONTINOUSLY ROTATING WIRE APPARATUS (total height 68 mm). Nobili's version of Faraday's famous demonstration of 1822, in which a wire carrying a current rotates around a permanent magnet. There are three parts: a boxwood cylinder with a depression to be filled with mercury; a cylindrical magnet pushed into the center of the cylinder, with, at its top, a small cup also for mercury; a rotating conductor made of thin brass wires with a central steel pivot. Three conductors are supplied: a rectangular shape with both its limbs dipping into

the mercury and two (one broken) with only one limb dipping into the mercury, and the other limb, curved upward, acting as a counterbalance. These pivoted conductors rotate around the magnet when carrying an electric current.
V - MAGNETIC CYLINDER (base diameter 32 mm). First of a series of demonstration pieces illustrating the interaction between the magnetic field of an electric current and that of a magnet, or that of another current. The turned boxwood base has a central hole for the cylindrical magnet (missing), which carried the two cups, one at the top, the other half-way down. When the cups formed a circuit with a battery, the mercury poured into them rotated in the opposite direction.
VI - MAGNETIC PEDESTAL (total height 64 mm, base diameter 32 mm). The apparatus demonstrates the interaction between the magnetic field of a current and that of a magnet. At the top of the cylindrical magnet is a depression to be filled with a drop of mercury. The drop rotates in the opposite direction to that of the mercury in the upper cup, when both are connected to an electric battery.
VI BIS - CROWN OF MAGNETIC NEEDLES (total height 69 mm, base diameter 35 mm). Series of small cylindrical magnets forming a crown, placed at the top of a boxwood pedestal. The mercury poured inside the crown will rotate under the effect of electromagnetism, when connected to a circuit that includes an electric battery.
VII - CYLINDRICAL COIL (total height 67 mm, base diameter 39 mm). Upright coil wound on a tortoise-shell cylinder with a cup-shaped depression at the top, resting on a boxwood pedestal. The end of the coil is connected to another cup mounted on a stem clamped in a brass collar. The direction of rotation of the mercury in the cup, which can be raised and lowered, is found to remain unchanged at different heights of the coil (connected to a battery).
VIII - SMALL MAGNETIC CYLINDER (total height 70 mm, base diameter 31 mm). Very thin magnet consisting of a steel bar, suspended by a silk thread for demonstrations. When the two mercury-filled cups are connected to poles of the battery the magnet will rotate on its axis. This demonstration was first performed by Ampère.
IX - APPARATUS DEMONSTRATING ELECTRODYNAMIC ATTRACTION AND REPULSION (total height 70 mm, base 71x66 mm). Wooden rectangular base with three circular depressions for mercury. The base carries a rectangular coil comprising a single wire winding on a bone or tortoise-shell support, and a brass support terminating in a cup, from which pivots a thin brass wire conductor. The pivoting wire is attracted or repelled by the coil depending on the direction of the current, as Ampère observed in his research on what were then known as "angular" currents.
X - BARLOW'S WHEEL (total height 70 mm, wheel base 76x51 mm, diameter of magnet base 32 mm). Made of two parts: a permanent horseshoe magnet, fixed in a horizontal position by a small boxwood cylinder; and a light brass wheel supported by a small fork, whose edge dips into a mercury-filled depression. When a current flows through the wheel, it will start to rotate between the magnet poles. Peter Barlow's original model of 1822 had a star-shaped wheel.
XI - FLOATING MAGNETS (height 42 mm, diameter 32 mm). A cylindrical container holds three small magnets: one in the shape of a tube weighted with a small platinum weight, the other two made up of two thin rods fixed to a platinum disk. Leopoldo Nobili showed the rotation of the magnets by electric currents by floating them in an upright position in the mercury-filled

container. The cup with horizontal and vertical wires is used to demonstrate the mechanical effects of a current flowing through the mercury immersed in a magnetic field.
XI BIS - VASE WITH MAGNETIC BASE (height 71 mm, diameter 35 mm). Small cylindrical boxwood vase with upright magnetic rod terminating in a round head. To this is attached, in an upright position, one of the U-shaped magnetic needles, usually stored in the lid. Used, like item XI, to demonstrate electromagnetic rotation.
XII - SMALL BASIN WITH TWO VERTICAL WIRES (height 17 mm, diameter 39 mm). Boxwood dish with two semicircular brass cups at opposite sides, each connected to an upright wire insulated with sealing wax.
XIII - SMALL BASIN WITH TWO HORIZONTAL WIRES (height 11 mm, diameter 38 mm). Used to demonstrate the reciprocal action of current-carrying wires and magnets. When the wires form part of an electric circuit, the mercury rotates around them; this movement will be affected by a permanent magnet. The same will occur without the magnet, but much more feebly, because of the terrestrial magnetic field.
XIV - SUPPORT WITH EIGHT DIFFERENT ELECTROMAGNETIC COILS (base 123x108x60 mm). Wooden rectangular block with four pointed feet supporting eight coils of different shapes made from copper wire with burgundy-colored silk insulation. Used to demonstrate electromagnetic phenomena produced by coils.
XV - SMALL BOARD WITH THREE FLAT ELECTROMAGNETIC COILS (board 203x111 mm). Small mahogany board stained black, forming the lid of one of the compartments of the box. On the board are three flat coils: a large one in the shape of a circular crown, connected to two mercury contact-cups, one inside the crown, the other outside; and a circular and a rectangular coil, connected to three mercury contact-cups, in such a way that the middle one communicates with these two coils as well. The apparatus was used for electromagnetic experiments.
XVI - MODEL OF AMPÈRE'S THEORY OF THE MAGNETIC FIELD AROUND A CURRENT-CARRYING WIRE (length 75 mm, diameter 15 mm). Wooden rod painted black, from which emanate thin curved rods painted red and carrying small arrows. The ends of the rod are marked "N" and "S" for the magnetic poles. This model of Ampère's theory underlies all the electromagnetic phenomena demonstrated with the kit. It is a model of a wire carrying a current and behaving exactly like a magnet. The arrows at right angles indicate the circular direction of the current; the curved rods show the direction of the lines of force of the magnetic field.
XVII - BOXWOOD CONTAINER FOR MERCURY (height 65 mm, diameter 32 mm). Vessel to hold the mercury needed for floating magnets. The box also contains other items: a floating magnet consisting of two thin magnetized rods secured to a platinum disk; a cork cube with five sides covered by the same red paper as the strip glued to the inside of the box lid; and a piece of folded paper on which is written "Pomice pulv. da spargersi sul mercurio" ["Pumice powd[er] to sprinkle on the mercury"]. The sprinkled powder probably made it easier to observe the movements in the pieces of this kit.

Nobili's flat coil

Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, mahogany, copper, brass
Dimensions: total height 105 mm, base diameter 88 mm
Inventory: 465

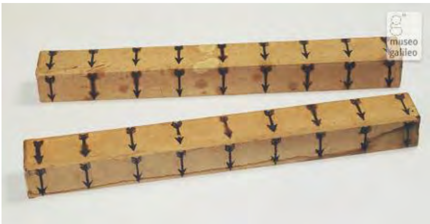
Leopoldo Nobili's flat coil wound in a spiral and set on a mahogany disk supported on a pedestal. The ends of the spiral are connected to two screw-terminals. Provenance: Lorraine collections.

Nobili's model of Ampère's theory of magnetism

Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: brass, wood
Dimensions: length 160 mm
Inventory: 3760

Models made by Leopoldo Nobili to illustrate André-Marie Ampère's theory of magnetism. They are composed of ten disks painted white, with two arrows on the rim. The disks are threaded onto a brass rod terminating in a large ring. This model demonstrates Nobili's conviction that magnetism is generated by the action of electric currents. Provenance: Lorraine collections.

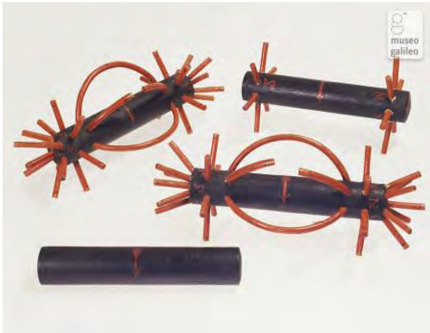
Nobili's models of Ampère's theory of magnetism



Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, paper
Dimensions: 235x25x25 mm
Inventory: 3759

Models made by Leopoldo Nobili to illustrate André-Marie Ampère's theory of magnetism. They are composed of two square-section wooden rods, covered with paper, with arrows drawn at right angles to the length and labeled "N" and "S" in ink. According to Ampère, the arrows indicate the direction of the current when an iron or steel bar is magnetized. They represent the sum of the electromagnetic currents around the molecules composing the bar. Provenance: Lorraine collections.

Nobili's models of magnetic field around an electrified wire



Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood
Dimensions: length 142 mm, diameter 26mm
Inventory: 1179

Four models of increasing complexity, made by Leopoldo Nobili (restored), visualizing Ampère's electrodynamic theory. They consist of wooden rods, painted black with arrows painted red showing the direction of the magnetic field and the lines of force. Provenance: Lorraine collections.

Nobili's rotating electromagnetic coil

Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, copper, brass
Dimensions: total height 135 mm, base diameter 82 mm
Inventory: 377

This electromagnetic coil developed by Leopoldo Nobili consists of a wooden pedestal weighted with a lead ring set in the base supporting two flat coils. The inner coil rotates inside the outer one, its two ends dipping in mercury poured into two small wooden compartments. The electric circuit is completed by connecting one end of the fixed coil to terminals and the other end to one of the two compartments containing mercury. Both coils are activated when the apparatus is connected to a battery and their mutual action will cause the inner coil to rotate on its axis. Provenance: Lorraine collections.

Nobili's version of Barlow's electromagnetic terrella

Setting:	Room XIII
Inventor:	Peter Barlow, Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass, copper
Dimensions:	total height 420 mm, globe diameter 200 mm
Inventory:	413

Model Earth consisting of a wooden globe with copper wire wound in grooves latitudinally around the globe. Supported on a brass pedestal mounted on a wooden base. The globe can be rotated manually and tilted at different angles. When connected to a battery by means of the terminals at the base, it generates a magnetic field that can be detected by a magnetic dip needle, held by a separate support (missing). The globe can thus simulate a miniature Earth, complete with the terrestrial magnetic field affecting compasses.
In 1600, William Gilbert demonstrated magnetic dip with his "terrella," i.e., a spherical lodestone. Leopoldo Nobili conceived this electromagnetic model in 1822, while André-Marie Ampère was formulating the relationship between electricity and magnetism. The instrument is commonly known as the "Barlow globe" after Peter Barlow, who demonstrated his device at the Royal Institution of London in 1824. Provenance: Lorraine collections.

Nobili's version of Faraday's continuously rotating wire apparatus

Setting:	Room XIII
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	boxwood, iron, brass, copper, zinc
Dimensions:	total height 130 mm, diameter 70 mm

Inventory: 373

This apparatus was designed by Leopoldo Nobili to repeat the experiment invented by Michael Faraday on the rotation of conductors. There are two parts: the lower is a Voltaic battery with two funnels at opposite sides for pouring in the electrolyte (acidified water); the upper carries an upright cylindrical magnet. This rests on the battery's zinc electrode, while the mercury poured into the top's surface depression is connected by means of two wires to the copper container forming the second electrode. The thin rotating brass wire is missing.

Nobili's version of Faraday's continuously rotating wire apparatus

Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: boxwood, iron
Dimensions: total height 184 mm, diameter 96 mm
Inventory: 451

A version designed by Leopoldo Nobili of Michael Faraday's rotating conductor apparatus. It consists of a circular coil with several windings connected to a copper plate and a zinc plate. When the coil is suspended with the plates immersed in acidified water, it orientates along the terrestrial magnetic field. Provenance: Lorraine collections.

Nobili's version of Faraday's continuously rotating wire apparatus

Setting: Room XIII
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: boxwood, iron, brass, copper, zinc
Dimensions: total height 62 mm, diameter 55 mm
Inventory: 450

An incomplete specimen of the apparatus designed by Leopoldo Nobili to repeat the experiment invented by Michael Faraday on the rotation of conductors. There are two parts: the lower is a Voltaic battery in which the electrolyte (acidified water) is poured; the upper carried an upright cylindrical magnet with a light mobile conductor (missing). Provenance: Lorraine collections.

Plane with variable inclination

Setting:	Room XII
Maker:	unknown
Place:	German?
Date:	late 18th cent.
Materials:	wood, marble, brass, iron
Dimensions:	530x270x650 mm
Inventory:	1402

This plane with variable inclination was used for many important experiments in classical mechanics. In particular, it allows the study of equilibrium conditions and the attrition of bodies placed on surfaces sloping at different angles.
The wooden base is hinged at one end to a frame holding a marble slab. The slab can be set at an angle ranging between 0° and 45° by means of two toothed brass arcs. A square beam carrying a pulley rests on top of the frame. A cord passing over the pulley connects a lead weight to a stirrup holding a brass cylinder that rests on the marble plane. By changing the angle of the slab and applying different weights to the cylinder, one can examine the changes in the equilibrium conditions and the attrition of the cylinder on the marble surface.
The apparatus, recorded in the inventories of the Lorraine collections, is unsigned. However, some structural details such as the toothed arcs suggest a likely German provenance.

Planetarium

Setting:	Room XII
Maker:	unknown
Date:	after 1877
Materials:	wood, metal, brass
Dimensions:	height 440 mm, width 750 mm
Inventory:	3901

Simple but efficient version of a planetary model of the solar system conforming to Copernican theory. The rotation axis is topped by a figure representing the Sun. Around the axis rotate the globes representing the planets with the satellites that were known at the time of construction:

Mercury, Venus, the Earth and Moon, Mars with two satellites, the asteroid cluster, Jupiter with three moons (one missing), Saturn with its ring and seven satellites, Uranus with three satellites, and Neptune with one satellite. The unequal distances between celestial bodies are intended to show the different distance in the actual solar system. The mechanism can be hand-operated with a set of gears.

Plate electrical machine

Setting: Room XIII
Maker: unknown
Place: English?
Date: second half 18th cent.
Materials: wood, brass, glass
Dimensions: total height 605 mm; disk diameter 455 mm, thickness 5.6 mm
Inventory: 2705

Plate frictional electrical machine. The glass disk is rotated by a simple crank and is rubbed by four small leather cushions slotted into the wooden uprights of the frame. The pressure of the two cushions on the crank side can be adjusted by two brass screws. The brass prime conductor, supported by a pillar, has two curved arms, each terminating in a concave disk with sharp points (the collectors), which end in close proximity to the surface of the glass disk. The amount of charge is controlled by the Lane discharging electrometer with vernier scale on its wooden support. Nearly all the machines of this type seen in European collections are English-made, usually from London. Provenance: Lorraine collections.

Prism with stand

Setting: Room XIII
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: 320x144x240mm, prism side 25 mm
Inventory: 745

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. The prism can be fixed in the desired position with a pair of threaded knobs. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Prism with stand

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	140x100x150 mm, prism side 29 mm
Inventory:	742

Wooden box with two open sides contains an equilateral glass prism fastened by means of a brass ring nut. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Prismatic lens with mount

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood
Dimensions:	diameter 101 mm
Inventory:	2613

Prismatic lens mounted on a turned wooden ring. Prismatic lenses can be used as optical toys because of their ability to multiply images.

Prismatic lens with mount

Setting:	Room XIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood
Dimensions:	diameter 45 mm
Inventory:	2614

Prismatic lens in a short wooden tube. Prismatic lenses can be used as optical toys because of their ability to multiply images.

Puffer for Lichtenberg figures

Setting:	Room XIII
Inventor:	Georg Christoph Lichtenberg
Maker:	unknown
Date:	late 18th cent.
Materials:	leather, boxwood
Dimensions:	length 192 mm
Inventory:	1257

Kid leather or chamois puffer with boxwood knob, containing an orange powder (a mixture of sulfur and red lead). The experiment, invented in 1777 by Georg Christoph Lichtenberg, demonstrates visually the opposite electrical charges of the two coatings of the Leyden jar. First, the brass knob of a charged Leyden jar was drawn over a cake of resin of an electrophorus, and then the operation was repeated on the outer coating, producing a pattern of positive and negative charge on the cake. This pattern then became visible by dusting the cake with the fine orange powder, which became electrically charged through friction as it was expelled from the nozzle. The sulfur settled on to the positive charge, the red lead on the negative charge. This curious experiment illustrates the basic principle of modern photocopiers, in which the toner powder is deposited on electrically charged images.

Screw

Setting:	Room XII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, iron, brass
Dimensions:	height 420 mm, width 550 mm
Inventory:	521

The top of this iron screw is fitted with a handle, the bottom with a brass hook. The screw is wound vertically in a wooden tripod. The model demonstrates the advantage of using a screw to lift heavy weights. The screw is a simple machine that can be viewed as a continuously inclined plane developing around a cylinder. Provenance: Lorraine collections.

Simple microscope, dissecting

Setting:	Room XIII
Maker:	Carl Kellner
Place:	Wetzlar
Date:	1855-1869
Materials:	iron, brass
Dimensions:	height 115 mm, base diameter 69 mm; case 165x94x95 mm
Inventory:	3324

Simple dissecting microscope signed by Carl Kellner. The circular iron base supports a pillar carrying the stage above which is the lens. The mirror is hinged to the middle of the base. The box, which also contains three objectives, carries the initials *Prof. T.T.*, in all likelihood those of the owner, Adolfo Targioni Tozzetti.

Solar microscope

Setting:	Room XIII
Maker:	Peter Dollond
Place:	London
Date:	ca. 1800
Materials:	brass
Dimensions:	plate 122x121 mm, mirror 188x55 mm; box 128x88x40 mm
Inventory:	795

Brass solar microscope built by Peter Dollond, formerly in the Lorraine collections. The plate to be attached to a window shutter carries the adjustable mirror on one side and the body-tube on the other. There is also a box containing six objectives, four condensers, a mount, and other devices for preparing specimens.

Stand with tackles

Setting: Room XII
Inventor: Willem Jacob 's Gravesande
Maker: unknown
Date: second half 18th cent.
Materials: wood, iron, brass
Dimensions: 550x550x1290 mm
Inventory: 984, 1389, 1398, 1399

The tackles are suspended from a 's Gravesande column, named after its inventor. The "column" is an all-purpose stand suitable for a wide range of mechanical and hydrostatic experiments. This specimen resembles item inv. 539, 1401.
There are two tackles consisting of a pair of iron pulley-blocks with eight and twenty-four brass sheaves respectively, interconnected by a cord. A third tackle, all in brass, carries a total of twenty pulleys in two blocks. Provenance: Lorraine collections.

Suardi's graphic pen

Setting: Room XII
Inventor: Giovanni Battista Suardi
Maker: Felice Gori
Place: Florence
Date: 1819
Materials: brass, mahogany
Dimensions: 445x330x95 mm
Inventory: 3719

This instrument, developed by Giovanni Battista Suardi in 1752 and perfected by Felice Gori, is similar to the one depicted by George Adams in his *Geometrical and Graphical Essays* (London, 1791). It is used to trace a large variety of curves generated by combining several rotating motions. A vertical axle with a revolving arm pivots at the center of a tripod support. The revolving arm carries a second pivoting arm fitted with a writing tip. Thanks to a series of gearwheels, the rotation of the two arms generates complex cycloidal curves. The instrument case contains the gearwheels, which can be combined to change the arm-rotation ratios and, consequently, the plotted curves.

Room XIV

The Precision Instrument Industry

Paolo Brenni

In the 18th and 19th centuries the production of precision instruments for astronomy, geodetics, surveying and navigation was concentrated mainly in Britain, France and Germany. The British instrument maker Jesse Ramsden (1735-1800) invented the first machine for precisely dividing graduated scales. In Bavaria, Joseph von Fraunhofer (1787-1826) produced the finest optical-quality glass ever made. In Italy, only Giovanni Battista Amici (1786-1863) was able to design original optical instruments, many of them displayed in this room. They include excellent microscopes and exceptionally long telescopes. These innovations went to improve the instrumentation of the astronomical observatories founded in Italy starting from the first decades of the 18th century. The Florence Observatory (1780-1789), annexed to the Museum of Physics and Natural History, aspired to compete with the great astronomical centres of Greenwich and Paris. It was equipped mainly with instruments of British make.

Amici I telescope

Setting: Room XIV
Maker: Giovanni Battista Amici
Place: Italy
Date: first half 19th cent.
Materials: wood, brass
Dimensions: length 5210 mm
Inventory: 3795

Tube made by the cabinet-maker Ponziani for the objective called Amici I, now preserved at the Arcetri Observatory. Ponziani repeatedly applied to the director of the Museo di Fisica e Storia Naturale of Florence, Vincenzo Antinori, for permission to make the tube in three sections. Giovanni Battista Amici, who was in London at the time, gave his consent and recommended covering the joints between the sections with brass bands to make them more rigid. The conical tube narrows toward the focal plane, where the objective forms the images of the astronomical objects being observed. The plane can accommodate either eyepieces for direct observation, or instruments such as cameras and spectroscopes. The telescope is, in fact, equipped with a spectroscope (inv. 1394). For easier focusing, there is a focusing mechanism to lengthen or shorten the final section of the base.

Amici II telescope

Setting: Room XIV
Maker: Giovanni Battista Amici
Place: Italy
Date: first half 19th cent.
Materials: wood
Dimensions: length 3230 mm
Inventory: 345

Cylindrical tube and altazimuth mount for the objective called Amici II. Giovanni Battista Amici would test the quality of the objectives he produced by using them for observations of double stars or other objects that were particularly difficult to separate. He therefore built this mount, which allowed him to observe a selected star for a brief period. The mount is a wooden frame resting on castors, with mechanisms for adjusting the height of the tube of the astronomical telescope in the vertical plane. To avoid losing sight of the observed object because of the apparent motion of the celestial sphere, the mount is equipped with limited azimuth movements. This system made it possible to observe astronomical objects for a reasonable interval of time (5 minutes) around their meridian passage. As well as a means of testing the quality of objectives, the Amici II telescope was an effective comet-seeking instrument. For this purpose, the observer set the altitude angle and let the sky's motion bring successively into view the sectors of the sky where the search was conducted. The instrument seems to have been the private property of Amici before its transfer to the Arcetri Observatory, where it was used by Ernst Tempel and other astronomers.

Anemometer

Setting:	Room XIV
Maker:	unknown
Date:	first half 19th cent.
Materials:	marble, brass
Dimensions:	height 415 mm, diameters 268 mm
Inventory:	803

Anemometer consisting of a brass wind vane mounted on a cylindrical holder and inserted in a cistern set in a marble base. The mercury, which originally filled the cistern, allows the wind vane to float and move freely. Two pairs of paddle-wheels and a threaded conoid pivot horizontally under the wind vane. On the conoid was originally fixed a thread with a counterweight. The wind turned the conoid, winding the thread in ever-wider coils. At a given point, the force of the wind acting on the paddles exactly counterbalanced the force of the counterweight: the paddles stopped moving and were blocked by a pallet. The maximum velocity reached by the wind could be estimated by observing the counterweight's position. The base carries a metal crown housing a compass and a bubble level, and inscribed with a windrose.

Anemoscope

Setting:	Room XIV
Maker:	unknown
Date:	18th cent.
Materials:	wood, brass
Dimensions:	height 862 mm, base width 335 mm
Inventory:	848

The anemoscope is connected to the wooden support, which carries an octagonal dial with a windrose. A brass rod pivots vertically behind the dial. The rod carries a windvane at the top and a ring gear at the bottom. The gear moves a mechanism connected to the pointer pivoting at the center of the dial. The movements of the wind vane are therefore reproduced by the pointer on the windrose.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	Giovanni Battista Amici
Place:	Modena
Date:	ca. 1827
Materials:	brass
Dimensions:	height 267 mm; box 360x200x147 mm
Inventory:	3203

Compound microscope, similar to microscope inv. 3201, made by Giovanni Battista Amici. The instrument is mounted on a square-sectioned pillar on the box, which can carry the microscope with its accessories. The illumination mirror and the stage (fitted with a micrometer movement) move along the pillar by rackwork. The image is focused by adjusting the position of the stage relative to the body-tube attached horizontally to the pillar. An articulated arm holds a bull's eye lens in front of the body-tube. Some of the accessories were made by Vincent & Charles Chevalier in Paris. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	unknown
Place:	Italian
Date:	1832-1862
Materials:	brass
Dimensions:	height 230 mm; box 315x198x80 mm
Inventory:	2662 (scatola), 3223

This compound microscope, of the type made by Giovanni Battista Amici, is mounted on a tripod in which the illumination mirror is inserted. The limb supporting the body-tube is fastened to the tripod. The stage support fitted with a condenser slides on the limb. Coarse focus is by adjusting the stage vertically by rackwork. Fine focus is by a vertical screw. The body-tube is angled and joined to the support by a total-reflection prism that deflects the rays from the objective into the eyepiece. Two illumination prisms are mounted on articulated arms. The box contains six objectives, an eyepiece, a camera lucida, and other accessories for handling specimens.

Compound microscope

Setting:	Room XIV
Inventor:	Filippo Pacini
Maker:	unknown
Place:	Italian
Date:	1845
Materials:	brass
Dimensions:	height 420 mm, base 222x143 mm
Inventory:	2660

Pacini-type compound microscope matching exactly the one described by Filippo Pacini in his 1845 paper. Made in the workshop of Giovanni Battista Amici. On a semicircular base are inserted two tapered pillars holding an oval stage. Alongside it, a square-sectioned telescopic pillar supports the body-tube; its vertical position is adjusted for focusing with a screw controlled by a knob. A graduated disk controls micrometric motion of the stage plate. Below the stage are the illumination mirror, a condenser lens, and a disk with several diaphragms. The body-tube is inclined and attached to the support by means of a total-reflection prism that deflects the rays from the objective into the eyepiece. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XIV
Inventor:	Filippo Pacini
Maker:	Angiolo Poggiali [attr.]
Place:	Italian
Date:	1860-1880
Materials:	brass
Dimensions:	height 320 mm, base 143x141 mm
Inventory:	2661

Pacini-type compound microscope, named after its inventor, Filippo Pacini. Similar to microscope inv. 3267. A shaped brass plate carries a telescopic pillar, whose height is adjusted by rackwork for coarse focus. The pillar carries the body-tube. Fine focus is by a knob-and-screw assembly below the base. The body-tube is tilted and attached to the support by means of a total-reflection prism that deflects the rays from the objective into the eyepiece. The circular stage carries a revolving disk with diaphragms. It rests on two tapered pillars fixed to the base and is moved by means of a screw fitted with a graduated disk. There is an illumination mirror and a condenser lens. Some technical details suggest that the instrument may have been made by Angiolo Poggiali.

Compound microscope

Setting:	Room XIV
Inventor:	Filippo Pacini
Maker:	unknown
Place:	Italian
Date:	1860-1880
Materials:	brass
Dimensions:	height 340 mm, base 120x99 mm
Inventory:	3267

Pacini-type compound microscope, named after its inventor, Filippo Pacini, similar to microscope inv. 2661. A shaped brass plate carries a telescopic pillar, whose height is adjusted by rackwork for coarse focus. The pillar carries the body-tube. Fine focus is by a knob-and-screw assembly below the base. The body-tube is tilted and attached to the support by means of a total-reflection prism that deflects the rays from the objective into the eyepiece. The circular stage plate, carries a revolving disk with diaphragms. It rests on two tapered pillars fixed to the base and is moved by means of a screw fitted with a graduated disk. There is an illumination mirror and a condenser lens. Belonged to Pietro Marchi.

Compound microscope

Setting:	Room XIV
Inventor:	Filippo Pacini
Maker:	unknown
Place:	Italian
Date:	ca. 1845
Materials:	brass
Dimensions:	height 380 mm, base 226x148 mm; case 426x253x220 mm
Inventory:	3241

Pacini-type compound microscope invented by Filippo Pacini and made in the workshop of Giovanni Battista Amici. On a semicircular base are inserted two tapered pillars holding an oval stage. Alongside it, a square-sectioned telescopic pillar supports the body-tube; its vertical position is adjusted for focusing with a screw controlled by a knob. A graduated disk controls micrometric motion of the stage plate. Below the stage are the illumination mirror and a condenser lens. An Amici prism is fixed on an articulated arm to the front of the stage. The body-tube, which lacks the eyepiece, is tilted and attached to the support by means of a total-reflection prism that deflects the rays from the objective into the eyepiece. The box contains no accessories. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	unknown
Place:	Italian
Date:	1832-1862
Materials:	brass
Dimensions:	height 335 mm, base diameter 98 mm
Inventory:	2663

This compound microscope is of the type made by Giovanni Battista Amici. The square-sectioned pillar supporting the instrument is hinged to round base. The stage, fitted with a micrometer movement, tilts for fine focus. The body-tube has a Huygenian eyepiece and is adjusted for coarse focus by rackwork. Between the stage and the illumination mirror, a condenser lens can be inserted. There are two illumination prisms mounted on two articulated arms.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	unknown
Place:	Italian
Date:	1832-1862
Materials:	brass
Dimensions:	height 357 mm
Inventory:	3385

This compound microscope, of the type made by Giovanni Battista Amici, is mounted on a tripod. The limb supporting the illumination mirror, stage, and body-tube is fixed to the tripod by means of a compass joint. The stage is fitted with a micrometer for lateral movement. The stage moves by rackwork for focusing. An articulated arm holds a prism for illumination. The eyepiece is incomplete.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	Giovanni Battista Amici
Place:	Modena
Date:	1827-1831
Materials:	brass
Dimensions:	height 350 mm; box 320x200x111 mm
Inventory:	3201

This compound microscope, similar to microscope inv. 3203, was made by Giovanni Battista Amici. The instrument is mounted on a tripod to which a square-sectioned pillar is fastened. The illumination mirror and the stage move along the pillar by rackwork. The stage is fitted with micrometer screws for X and Y motion. Below it is a circular diaphragm with three holes. Focusing is by adjusting the position of the stage relative to the body-tube attached horizontally to the pillar. An articulated arm holds a bull's eye lens in front of the body-tube. The body-tube can be removed and replaced by a support for holding a simple objective. The box contains many items including four eyepieces, a lieberkuhn, two camera lucidas, and accessories for handling specimens. Probable provenance: Lorraine collections.

Compound microscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	unknown
Place:	Italian
Date:	1832-1862
Materials:	brass
Dimensions:	height 180 mm; base cylinder: height 88 mm, diameter 90 mm
Inventory:	3238

Possibly made by Giovanni Battista Amici in his Florence period. The base of this compound microscope consists of a cylindrical box to which the illumination mirror is fixed by a swivel joint. The body-tube is supported by an arm with rackwork for focusing. A bull's eye lens is inserted on an articulated arm. Belonged to the Gabinetto degli Invertebrati of the Istituto di Studi Superiori of Florence.

Compound microscope

Setting:	Room XIV
Maker:	unknown
Place:	Italian
Date:	1832-1862
Materials:	brass
Dimensions:	height 370 mm, base diameter 87 mm
Inventory:	2649

This compound microscope has a round base on which a square-sectioned pillar is mounted. The pillar hold the illumination mirror and the stage, whose position is adjusted for focusing by rackwork. Under the stage are a condenser and a diaphragm. A bull's eye lens is supported by an articulated arm. The eyepiece contains a Nicol prism.

Compound microscope, binocular

Setting: Room XIV
Inventor: Filippo Pacini
Maker: unknown
Place: Italian
Date: ca. 1855
Materials: brass
Dimensions: height 330 mm, base 140x110 mm
Inventory: 2659

Binocular compound microscope mounted on a horseshoe base. Two tapered pillars inserted in the base hold the tilting stage to which is attached the telescopic tube carrying the illumination mirror and binocular body-tube, which provides three-dimensional viewing. Under the stage are two revolving disks with filters, diaphragms, and condenser lenses. Coarse focus is by rackwork. Fine focus is by a knob. There is a second binocular body-tube. This instrument may be connected with the experiments with binocular microscopes by Filippo Pacini in 1853-54.

Compound microscope, inverted

Setting: Room XIV
Inventor: Filippo Pacini
Maker: Angiolo Poggiali
Place: Italian
Date: ca. 1868
Materials: brass
Dimensions: height 300 mm, base 120x120 mm
Inventory: 2655 bis

Inverted microscope, called "photographic and chemical" microscope, invented by Filippo Pacini and built by Angiolo Poggiali. The brass base carries a brass box containing a total-reflection prism. In the box are inserted the mobile stage and the inclined body-tube, fitted with a Huygenian eyepiece. Coarse focus is by moving the stage by rackwork. Fine focus is by adjusting the stage tilt with a knob. Two tapered pillars inserted in the base support the illumination mirror and a condenser lens. There are also a body-tube carrying a prism and a negative lens. This body-tube was probably used with a photographic camera.

Container for Landriani's "Chronohyometer"

Setting:	Room XIV
Inventor:	Marsilio Landriani
Maker:	unknown
Place:	Italian
Date:	late 18th cent.
Materials:	zinc, glass, ivory
Dimensions:	height 480 mm
Inventory:	3926

This is a part of the "chronohyometer" invented by Marsilio Landriani c. 1780. The instrument was originally a pluviograph (rain gauge). It consisted of an open-air collector that conveyed the rainwater into a small funnel connected to a moving lever. The filling of the funnel caused the lowering of the lever. This, in turn, actuated a white pencil that left a mark on a blackened disk, driven by clockwork., The funnel was periodically emptied through a small glass siphon into the rain-gauge container. This consisted of a cylinder closed at the bottom and fitted with a faucet and vertical tube. The quantity of rain was measured in the container. A series of small glass siphons, used to empty the funnel, has survived.

Dipleidoscope

Setting:	Room XIV
Inventor:	Giovanni Battista Amici
Maker:	Giovanni Battista Amici
Place:	Italy
Date:	first half 19th cent.
Materials:	stone, brass
Dimensions:	height 375 mm
Inventory:	595

Dipleidoscope designed by Giovanni Battista Amici to determine true noon. It consists of a small telescope mounted on a cylindrical stone pedestal with a prism system in front of the objective. The prisms double the solar image when the Sun is not on the optical axis of the telescope. The observer will see the images positioned symmetrically to the center of the field of view. When the Sun approaches the center of the field of view, the two images converge. When the Sun is on the instrument's optical axis, they will coincide. If the axis has been placed beforehand on the north-south vertical plane (the meridian plane), the instant when the images overlap is the locality's true noon. If correctly placed on the meridian, the instrument determines true noon to within 5-10 seconds.

Dividing engine

Setting:	Room XIV
Maker:	unknown
Place:	Florence
Date:	first half 19th cent.
Materials:	marble, brass
Dimensions:	920x920x1380 mm
Inventory:	3457

Dividing engine used to engrave the graduated circles of astronomical instruments. The machine basically consists of a revolving circular platform 160 mm in diameter. Its toothed edge meshes with an endless screw, which is turned by a handle with a graduated drum. Every turn of the endless screw rotates the platform by 10'. Since the graduated drum, which is integral with the endless screw, is divided into 300 parts, a turn of the screw by an angle equal to one division of the drum translates into a 2" turn of the platform. The operator attached the circle to be divided on the platform, making sure that the circle was concentric with the platform. The operator engraved one line for every fraction of a turn of the endless screw moving the platform. The engraving was done with a burin on the outer surface of the circle—which was usually silvered—or on the edge. The burin was integral with the engine stand. This machine was made at the workshop of the Museo di Fisica e Storia Naturale of Florence at the behest of Giovanni Battista Amici.

Hair hygrometer

Setting:	Room XIV
Maker:	unknown
Place:	Italian?
Date:	late 19th cent.
Materials:	iron, brass
Dimensions:	height 415 mm, width 89 mm
Inventory:	3708

This instrument is similar to the hygrometer described by Horace-Bénédict de Saussure c. 1780. It consists of a brass frame set on an iron base. The hygroscopic substance is a single hair. Its length varies slightly with the change in air humidity, actuating a pointer. There is also a mercury thermometer with a centigrade scale. Resembles item inv. 2033.

Maiocchi's tension hygrometer

Setting:	Room XIV
Inventor:	Giovanni Alessandro Maiocchi
Maker:	unknown
Date:	ca. 1845
Materials:	brass, glass, iron
Dimensions:	height 280 mm, base diameter 92 mm
Inventory:	1381

"Vapor tension" hygrometer invented by Giovanni Alessandro Maiocchi. The apparatus measures the value of the tension of water vapor needed to reach saturation tension. It consists of a glass tube closed at the bottom by an iron faucet, to which is connected a second, vertical, open tube of smaller diameter. At the top, the larger tube is closed by a pair of faucets fitted with a small funnel. A reference ring slides along the larger tube. The ring carries a millimeter scale and a vernier that slides along the smaller tube. The tubes are filled with mercury. By regulating the faucets, part of the mercury can be made to flow out from the bottom of the hygrometer, sucking into the larger tube the air whose degree of humidity has to be measured. After setting the reference ring and the scale so as to coincide with the mercury level in the tubes, a few drops of water are introduced into the larger tube. This establishes the saturated-vapor pressure, which causes the mercury to rise in the small communicating tube fitted with a scale. This increment is equal to the vapor tension needed to reach saturation tension at that temperature. The relative humidity of the air is thus obtained.

Mobile mount for eyepiece

Setting:	Room XIV
Maker:	Giovanni Battista Amici
Place:	Modena
Date:	before 1831
Materials:	brass
Dimensions:	length 170 mm
Inventory:	3218

This device, signed by Giovanni Battista Amici, served to move the eyepiece on the focal plane of the telescope by means of a slide and rack mechanism. The mount enabled the observer to explore the sky with controlled movements, or to track an object when it was escaping from view because of the apparent motion of the celestial sphere. The mount could also rotate on an axis parallel to the optical axis of the telescope so as to orient the eyepiece in the direction required by the observation.

Newtonian telescope

Setting:	Room XIV
Maker:	Leto Guidi
Place:	Italy
Date:	18th cent.
Materials:	wood, brass
Dimensions:	length 2270 mm
Inventory:	2707

Reflecting telescope of the Newtonian type with an octagonal wooden tube blackened internally. Made by Leto Guidi, it closely resembles the telescope illustrated by Jean-Antoine Nollet in *Leçons de physique expérimentale* (Paris 1743-1748). The instrument is fixed by means of a brass horizontal shaft to an artistically designed three-legged wooden table with a revolving surface. As the telescope can be tilted at different angles to the horizontal, the arrangement effectively constitutes an altazimuth mount. The mirror has a diameter of 170 mm and a focal length of 1,960 mm. There is a finder with cross-wires. A telescope made by Leto Guidi in 1766 was also preserved at the Ximenian Observatory in Florence, as shown by an inventory of 1786, compiled the day after the death of Leonardo Ximenes.

Newtonian telescope

Setting:	Room XIV
Maker:	unknown
Date:	18th cent.
Materials:	wood, brass
Dimensions:	length 2500 mm
Inventory:	2709

Reflecting telescope of the Newtonian type with an octagonal wooden tube blackened internally. The telescope can perform altitude and azimuth movements by means of metal arcs. The wooden stand has four legs with castors. The focusing mirror, the secondary 45-degree mirror, the eyepiece and the finder are missing.

Newtonian telescope

Setting:	Room XIV
Maker:	unknown
Date:	18th cent.
Materials:	wood, brass
Dimensions:	length 1750 mm
Inventory:	2710

Reflecting telescope of the Newtonian type with a cylindrical wooden tube blackened internally, moving in altitude by means of a rope and a conical wooden pulley. There is a wooden chest of drawers for accessories. The primary mirror has a diameter of 200 mm and a focal length of 1,600 mm. The instrument is mounted on a stand with four legs fitted with castors. The 45-degree secondary mirror, the eyepiece and the finder are missing.

Objective lens

Setting:	Room XIV
Maker:	Giovanni Battista Amici [attr.]
Place:	Italy
Date:	first half 19th cent.
Materials:	glass, brass
Dimensions:	diameter 170 mm
Inventory:	3397

Objective probably made by Giovanni Battista Amici, who produced several astronomical objectives both for the Museo di Fisica e Storia Naturale of Florence and for his personal use, c. 1840. This may have been one of the lenses made for his private observatory and bequeathed to the Specola.

Portable barometer

Setting: Room XIV
Inventor: Giovanni Battista Amici
Maker: Galgano Gori
Place: Florence
Date: 1846
Materials: brass, glass
Dimensions: height 1058 mm
Inventory: 1131

According to the inventories of the Museo di Fisica e Storia Naturale, this barometer was invented by Giovanni Battista Amici and made by Galgano Gori. It is enclosed in a brass tube fitted with a tripod. The sliding barometric scale is integral with a cursor to be aligned with the lower mercury level. The readings are taken by means of a vernier. This instrument, which allows the determination of very low pressure values, was used for altitude measurements during mountain-climbing. There is also a mercury thermometer with a centigrade scale.

Portrait of Giovanni Battista Amici

Setting: Room XIV
Author: Michele Gordigiani
Date: 1874
Materials: oil on canvas
Inventory: Dep. GAM, Firenze

Portait of Giovanni Battista Amici made by the Florentine painter Michele Gordigiani in 1874.

Psychrometer - wet and dry bulb thermometer

Setting: Room XIV
Maker: unknown
Date: second half 19th cent.
Materials: brass, glass
Dimensions: height 440 mm, width 116 mm
Inventory: 3467

This psychrometer measures atmospheric humidity with two thermometers. The frame is fixed on a round brass base. The two mercury thermometers with Réaumur scales are placed on a glass plate. The bulb of one thermometer (called "wet") is wrapped in gauze connected to a wick soaking in a cylindrical vessel filled with water. This arrangement keeps the "wet" thermometer bulb constantly damp. The velocity of evaporation of the water that wets the wick is inversely proportional to the quantity of water vapor present in the atmosphere: the drier the air, the quicker the evaporation. The wet thermometer is cooled by evaporation, which extracts heat. It therefore indicates a temperature lower than (or equal to) that of the other, "dry" thermometer. Knowing the two temperatures, we can determine the relative humidity of the air by means of a table.

Reflecting microscope

Setting: Room XIV
Inventor: Giovanni Battista Amici
Maker: Giovanni Battista Amici
Place: Modena
Date: 1815-1825
Materials: brass
Dimensions: height 260 mm; box 360x206x130 mm
Inventory: 3200

Nearly identical to microscope inv. 3171, this reflecting microscope was invented by Giovanni Battista Amici. The instrument is mounted on a square-sectioned pillar on the box, which can carry the microscope with its accessories. The illumination mirror and the stage move along the pillar by rackwork. The image is focused by adjusting the position of the stage relative to the body-tube attached horizontally to the pillar. Accessories include four eyepieces, a lieberkuhn, and some items for handling specimens.

Reflecting microscope

Setting: Room XIV
Inventor: Giovanni Battista Amici
Maker: Giovanni Battista Amici
Place: Modena
Date: 1815-1825
Materials: brass
Dimensions: height 262 mm; box 365x214x134 mm
Inventory: 3171

Nearly identical to microscope inv. 3200, this reflecting microscope was invented by Giovanni Battista Amici. The instrument is mounted on a square-sectioned pillar on the box, which can carry the microscope with its accessories. The illumination mirror and the stage move along the pillar by rackwork. The image is focused by adjusting the position of the stage relative to the body-tube attached horizontally to the pillar. Accessories include five eyepieces and some items for handling specimens. Provenance: Lorraine collections.

Reflecting microscope

Setting: Room XIV
Inventor: Giovanni Battista Amici [attr.]
Maker: Giovanni Battista Amici [attr.]
Place: Italian
Date: 1815-1825
Materials: brass
Dimensions: height 300 mm
Inventory: 3209

Reflecting microscope invented by Giovanni Battista Amici. This instrument is mounted on a tripod to which a square-sectioned pillar is fastened. The illumination mirror is attached to the pillar. The stage slides on the pillar by rackwork. The image is focused by adjusting the position of the stage relative to the body-tube attached horizontally to the pillar. The Huygenian eyepiece has a low magnification power. Probable provenance: Lorraine collections.

Repeating circle

Setting: Room XIV
Maker: Georg Friedrich von Reichenbach
Place: Munich
Date: first half 19th cent.
Materials: brass, bronze
Dimensions: length 1330 mm
Inventory: 576

Instrument made in the workshop of Georg Friedrich von Reichenbach with an objective signed by Fraunhofer. It consists of a telescope rotating on the horizontal and vertical axes. The angles of rotation on the horizontal axis (altitude angles) can be measured with high precision (1/10 of a minute) by means of the repetition system. The instrument is supported by a bronze column rotating freely on its vertical axis. The lower end of the column rests on the base. The upper end moves in a socket fixed to a supporting beam. In this particular instrument, the upper beam rests on two wooden pillars. The angles of rotation on the vertical axis were measured by means of a graduated circle, still complete, while the system for reading the graduations on the circle is missing. The pillar carries a vertical brass circle engraved with a finely graduated scale for measuring the altitude angle, but the system is incomplete. To facilitate measurements, the telescope is fitted with an eyepiece allowing lateral observation. There are also two counterweights and a set of lever systems to offset the bending of the tube under its own weight.

Saussure hair hygrometer

Setting: Room XIV
Inventor: Horace-Bénédict de Saussure
Maker: Jaques Paul [attr.]
Place: Geneva
Date: late 18th cent.
Materials: brass, silvered copper
Dimensions: width 98 mm, height 325 mm
Inventory: 2033

Instrument identical to the hygrometer described by Horace-Bénédict de Saussure c. 1780. It consists of a brass frame on which is stretched a bundle of hair (originally, a single hair was called for) secured by small jaws and passing over a pulley with a pointer. A counterweight, connected to the pulley, kept the bundle taut. The hair, which functions as a hygroscopic substance, varies in length with air humidity. The changes can be read on a semicircular silvered scale registering the positions of the pointer. This instrument, attributed to the maker Jaques Paul, is similar to item inv. 3708.

Spectroscope

Setting: Room XIV
Maker: Giovanni Battista Amici
Place: Italy
Date: first half 19th cent.
Materials: brass
Dimensions: height 545 mm
Inventory: 1394

Direct-vision spectroscope produced by Giovanni Battista Amici. It is made of brass and painted black. It was one of the devices that could be applied to the focal plane of the Amici I telescope (inv. 3795).

Spectroscope

Setting: Room XIV
Maker: unknown
Date: 19th cent.
Materials: brass
Dimensions: length 395 mm
Inventory: 1395

This spectroscope was used to observe the spectrum of light from an astronomical or laboratory source. The dispersion of incident light was achieved with a series of five prisms. The mount consists of three brass tubes and a shaped box containing the prisms. The first tube was connected directly to the telescope. The second, mounted parallel to the first, but not on the same axis, was used to observe the spectrum of the incident radiation by means of a suitable eyepiece. The third tube carried a lamp (now missing)—probably an alcohol lamp—that illuminated a scale used to measure the positions of the absorption bands. The image of the scale was reflected toward the observer by the face of the last prism closest to the eyepiece. The tube with the lamp and the tube carrying the eyepiece can rotate c. 20° on an axis that is perpendicular to the instrument's optical plane and passes through the center of the last prism.

Universal theodolite

Setting:	Room XIV
Maker:	Repsold firm
Place:	Hamburg
Date:	1839
Materials:	brass
Dimensions:	height 635 mm, base diameter 360 mm, telescope length 360 mm
Inventory:	3796

This theodolite is a portable instrument, suitable for surveying and astronomical measurements. It basically consists of a telescope rotating on the horizontal and vertical axes. The angles of rotation on the horizontal axis (altitude angles) can be measured with a precision of about 1/2'. The base has three leveling screws. The construction is very rigid. For easier use, the optical design includes a total-reflection prism, which allows observations in the direction of the horizontal-rotation axis. The position circles can be read with appropriate optical systems. The instrument was used in 1913-1914 by the expedition of Filippo de Filippi in the Karakorum and also in Florence to determine the deviation of the meridian line of the church of Santa Maria del Fiore from the north-south axis. Made by Repsold.

Windrose

Setting:	Room XIV
Maker:	unknown
Date:	late 18th cent.
Materials:	scagliola
Dimensions:	diameter 800 mm
Inventory:	3728

Polychrome scagliola disk with a windrose subdivided into 32 directions. The division is based on the eight principal winds.

Rooms XV and XVI

Measuring Natural Phenomena

Paolo Brenni

The triumph of the experimental method in the 17th century and the development of new instruments led to rapid progress in the study of natural processes, demonstrating the laws that governed them and revealing phenomena imperceptible to the senses. The first room contains instruments used for atmospheric measurements, for studying the phenomena of light, and for microscopy. Barometers and thermometers allowed increasingly precise measurements, while microscopes vastly enhanced the powers of vision, revealing amazing aspects of the microcosm. In the 18th century new instruments were invented, not only to observe nature, but also to act on it, creating new phenomena. Electrostatic machines attracted enormous interest, opening new horizons to scientific research. Then in 1800 the invention of the electric battery heralded the age of electrodynamics and electrochemistry. In the next room are displayed numerous instruments used to study electric current and its effects. Within a few decades, this study led to crucial discoveries, giving birth to electromagnetism, whose practical applications were to trigger a new industrial revolution.

Accessories for an optical bench

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass
Dimensions: support with accessories 490x190x290 mm
Inventory: 782/bis

Supports for elements used on an optical bench for experiments with light. They consist of hinged rods, elbow-joints, supporting rods placed on a rack, round and threaded clamping screws with brass ring nuts, and small brass columns (one with an adjustable platform). There are also two wooden columns, which may not have belonged to the same set of accessories.

Adjustable slit

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: wood, brass
Dimensions: 177x215 mm
Inventory: 2569

The wooden frame holds a decorated brass plate with a rectangular aperture in its lower section. A rotating disk, pivoting at the center of the plate, controls a brass blade that moves across the aperture to adjust its height.

Adjustable slit

Setting: Room XV
Maker: Gaspero Mazzeranghi
Place: Florence
Date: second half 18th cent.
Materials: wood, brass, iron
Dimensions: 240x140x230 mm
Inventory: 3199

A brass plate with a square aperture is fixed to the center of a small shaped wooden board. Two iron blades, placed opposite the aperture, form a vertical slit. By means of a screw with a return spring, it is possible to slide one of the blades and thus adjust the width of the slit. The device was made by Gaspero Mazzeranghi.

Air pump, 's Gravesande type

Setting:	Room XV
Maker:	Nicolas Fortin
Place:	Paris
Date:	1780
Materials:	mahogany, brass, iron, glass
Dimensions:	total height 1670 mm; box 305x135x430 mm, base 750x500 mm
Inventory:	1532

This pump, with twin upright barrels, was made by Nicolas Fortin. The mechanism is contained in a wooden box standing on four legs. There are two unusual features: first, the mechanism is turned upside down; second, the racks—which are connected to the pistons and operated by a crank with three handles—project from the base rather than from the top of the pump. The stop-cocks at the base of the cylinders are automatically opened and closed by the moving crank. The box carries the bell-jar plate. A side-tube was originally connected to a mercury pressure-gauge or manometer. A fairly similar design (but with the mechanism reversed) was developed by Willem Jacob 's Gravesande c. 1720. Provenance: Lorraine collections.

Astatic galvanometer, Nobili pattern

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	T. Gourjon
Place:	Paris
Date:	1840
Materials:	brass, glass, steel
Dimensions:	height 235 mm, diameter 160 mm
Inventory:	1417

Nobili - pattern galvanometer composed of a brass base with three leveling screws carrying a glass cylinder. The system of astatic needles is secured at the top of the cylinder. The coil has many windings of thin wire and carries a paper scale. It is rotated by a handle. The base ring carries the name of the maker—T. Gourjon, about whom we have little information—and the words "Galvanometro del Matteucci / 1840 / Corrente Muscolare" ["Matteucci's Galvanometer / 1840 / Muscle Current"]. Carlo Matteucci used this instrument in his studies of currents in wounded muscle fibers. Provenance: Lorraine collections.

Azimuth compass

Setting:	Room XVI
Maker:	George Wright
Place:	London
Date:	ca. 1785
Materials:	mahogany, brass, steel, paper
Dimensions:	total height 350 mm, base 310x310 mm
Inventory:	3374

Azimuth compass consisting of a brass bowl with a silvered scale on its rim, a paper windrose, and a pair of sights with magnifying glass. Mounted on gimbals in a wooden box painted blue. Made by George Wright. Provenance: Lorraine collections.

Barometer

Setting: Room XV
Maker: unknown
Date: late 18th cent.
Materials: brass, glass, ivory
Dimensions: height 982 mm
Inventory: 1134

Barometer mounted on a shaped base with three leveling screws. The barometric tube is inserted into a brass square box fitted with an ivory tap and surmounted by a cistern, also made of ivory. The barometric scale, in Paris inches, is engraved on a brass tube protecting the glass tube. The readings are taken by means of a rack vernier. A bubble level ensures that the base of the instrument is horizontal.

Barometer

Setting: Room XV
Maker: unknown
Date: first half 19th cent.
Materials: wood, glass, brass
Dimensions: height 1010 mm, width 100 mm
Inventory: 1153

The barometric tube is fixed to a wooden board and runs down into a vessel serving as a cistern for the barometer. There is a screw for vertical adjustment of the vessel. An ivory indicator determines the height that needs to be reached by the mercury in the vessel to take correct readings. The barometric scale is divided into millimeters and engraved on the glass tube. It has a small sliding metal tube serving as a vernier. The top part of the tube holds a container, possibly for ice to minimize the pressure of the mercury vapor. The thermometers that originally came with the instrument are missing.

Bifilar suspension electrometer, Palmieri pattern

Setting: Room XVI
Inventor: Luigi Palmieri
Maker: G. Caputo
Place: Naples
Date: 1887
Materials: glass, brass, mahogany, aluminum
Dimensions: total height 525 mm, diameter 110 mm
Inventory: 1411

Electrometer invented by Luigi Palmieri consisting of a base with three leveling screws and a glass cylindrical case, with, at its base, a small vessel for sulfuric acid, used to dry the air inside the instrument. A light aluminum index is suspended from a bifilar silk fiber housed in a long glass tube. The index is repelled by a horizontal brass rod insulated from the base. The rotation angle is read on a scale engraved on the glass. The charge was introduced by a small sliding probe. The instrument, mainly used to measure atmospheric electricity, was common in Italian meteorological observatories. This specimen was made by G. Caputo.

Box with mercury thermometer

Setting: Room XV
Maker: John Troughton
Place: London
Date: 1782-1800
Materials: wood (box); silvered brass (base plate for thermometer), glass
Dimensions: box 567x78x32 mm, thermometer length 55 mm
Inventory: 1718

The wooden box contained four thermometers. Inside the box cover is written the name of the maker, John Troughton. Only two identical mercury thermometers have survived (the other is inv. 941). They are mounted on a silvered brass plate. Both have Réaumur and Fahrenheit scales.

Burning mirror

Setting:	Room XV
Maker:	unknown
Date:	18th cent.
Materials:	metal, wood
Dimensions:	height 860 mm, mirror diameter 385 mm, width 720 mm
Inventory:	3727

Adjustable mirror mounted on a tooled wooden support. It was used for experiments on the reflection of light. It also served to heat or calcinate various substances. These were placed in the point where the solar rays reflected by the mirror were concentrated, producing very high temperatures.

Camera lucida

Setting:	Room XV
Maker:	Nachet firm
Place:	Paris
Date:	after 1880
Materials:	brass
Dimensions:	40x37 mm; box 70x55x49 mm
Inventory:	3325

Contained in a box covered in black paper, this camera lucida is of the prism type described in the Nachet catalogues from 1856 onward. Mounted on the microscope eyepiece, it allowed a simultaneous observation of the field of view and the sheet on which the images of the microscopic specimens were drawn. Belonged to the Gabinetto degli Invertebrati of the Istituto di Studi Superiori of Florence.

Compound and simple microscope

Setting:	Room XV
Maker:	Andrew Pritchard
Place:	London
Date:	ca. 1835
Materials:	brass
Dimensions:	height 230 mm; box 278x200x74 mm
Inventory:	2664, 3217

This instrument, built by Andrew Pritchard, can be used as either a compound microscope or a simple microscope. A pillar set on a tripod holds a tilting limb carrying the mirror, converging lens, body-tube and stage. The image is focused by rackwork, inserted in the tilting limb that supports the body-tube. The eyepiece is Huygenian. The arm supporting the body-tube carries a collar in which a lens can be inserted when the instrument is used as simple microscope. There are objectives, a micrometer, and accessories for handling specimens.

Compound and simple microscope, chest type

Setting:	Room XV
Inventor:	Edward Nairne
Maker:	James Ayscough
Place:	London
Date:	second half 18th cent.
Materials:	brass; box: wood
Dimensions:	max. height 360 mm; chest 305x141x125 mm
Inventory:	3210

Chest-type compound and simple microscope made by James Ayscough, based on a characteristic John Cuff model. Held by a pillar to the side of the chest. The body-tube, now lost, was inserted in the collar fixed to the top of the pillar; focusing was by turning a knob screw. The stage is fixed and the instrument could be used as either a compound microscope or a simple microscope. The chest-type microscope was invented by Edward Nairne c. 1765. The case contains many items, including six objectives for the compound microscope and three for the simple microscope, along with many accessories for preparing specimens. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XV
Maker:	Georg Friedrich Brander
Place:	Augsburg
Date:	ca. 1765
Materials:	wood, brass, lignum vitae
Dimensions:	height 320 mm, box base 135x132x45 mm
Inventory:	3205

Compound microscope built by Georg Friedrich Brander. The instrument is mounted on wooden box containing the accessories. The side-pillar is attached to the box, which also carries the adjustable illumination mirror. The stage inserted in the pillar is fitted with a sophisticated micrometer for moving specimens laterally. Focusing is performed by turning a knob screw that slides the body-tube vertically. The wooden tube is partly covered with rayskin. The field lens is present in the eyepiece; there is also a micrometer, consisting of a point advanced by means of an iron screw. Provenance: Lorraine collections.

Compound microscope

Setting:	Room XV
Maker:	Edmund Hartnack
Place:	Potsdam
Date:	ca. 1880
Materials:	brass
Dimensions:	height 290 mm
Inventory:	3268

Compound microscope built by Edmund Hartnack. The mirror and stage are placed above a ball-and-socket joint holding the pillar with the body-tube. Coarse focus is by sliding the body-tube in its metal sleeve; fine focus is by a screw and knob. A bull's eye lens is mounted on an articulated arm that fits over the sleeve. There are three objectives. Belonged to Pietro Marchi.

Compound microscope

Setting: Room XV
Maker: Nachet & Fils firm
Place: Paris
Date: ca. 1870
Materials: brass
Dimensions: height 370 mm; base 158x111; box 355x233x151 mm
Inventory: 3283

This compound microscope was made by Nachet & Fils. The horseshoe base supports two tapered pillars to which the instrument's tilting body tube is fixed by a swivel joint. The circular stage carries large clips for holding specimens. Below it is the mirror. The instrument is fitted with a condenser. The body-tube is held by a collar mounted on a pillar whose position is adjusted by turning a focusing knob. The tube is fitted with a revolving objective changer. The box contains various accessories including four eyepieces, six objectives, a camera lucida, two Nicol prisms, and a micrometer. Belonged to the Gabinetto degli Invertebrati of the Istituto di Studi Superiori of Florence.

Compound microscope

Setting: Room XV
Maker: Smith, Beck & Beck firm
Place: London
Date: ca. 1858
Materials: brass
Dimensions: height 305 mm, base diameter 137 mm; box 164x156x310 mm
Inventory: 3259

Compound microscope signed by Smith Beck & Beck. The base consists of a brass collar holding the adjustable pillar that supports the square-sectioned body-tube. Focusing is by a side wheel and a fusee chain drive (now lost). The instrument, fitted with mirror and a stage with bull's eye lens, comes with three objectives and other accessories for handling microscopy specimens. The design is deliberately simple in order to produce the most inexpensive instrument possible.

Compound microscope

Setting:	Room XV
Maker:	unknown
Place:	French?
Date:	mid-19th cent.
Materials:	brass
Dimensions:	height 380 mm, box 310x180x85 mm
Inventory:	3447

Compound microscope, probably French. Some details of construction and the box suggest a French production. A tripod supports a square-sectioned pillar on which are inserted the mirror, the stage, and the body-tube. Focus is by rackwork. Fitted with a Huygenian eyepiece. Accessories include four objectives.

Compound microscope

Setting:	Room XV
Maker:	G. & S. Merz firm
Place:	Munich
Date:	ca. 1870
Materials:	brass, iron
Dimensions:	height 300 mm; box 240x165x160
Inventory:	3327

The compound microscopes of this type, made by Merz, are almost all identical. The horseshoe base is painted black and has a rectangular pillar carrying the stage. Behind it is a triangular sleeve, carrying a prism fitted with an arm that supports the body-tube. Focusing is by turning a knob under the prism. There are four eyepieces and three objectives.

Compound microscope, binocular

Setting:	Room XV
Maker:	R. & J. Beck firm
Place:	London
Date:	ca. 1865
Materials:	brass
Dimensions:	height 400 mm, base 183x125; box 400x153x173 mm
Inventory:	3258

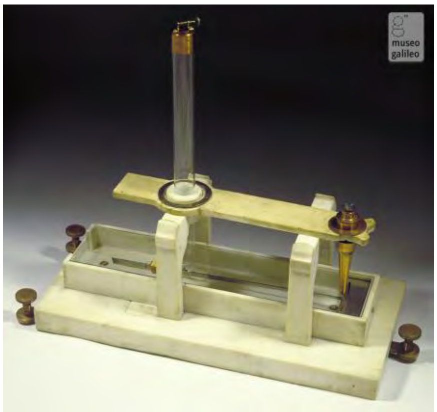
Binocular compound microscope mounted on a triangular base; the limb, which supports the double body-tube, the circular stage, and the mirror, can be placed at five different angles. Coarse focus is by rackwork. Fine focus is by a knob screw. The numerous accessories include four objectives, two eyepieces, and two Nicol prisms. The instrument was built by R.& J. Beck.

Compound microscope, dissecting

Setting:	Room XV
Inventor:	Charles-Philippe Robin
Maker:	Nachet & Fils firm
Place:	Paris
Date:	ca. 1875
Materials:	brass
Dimensions:	height 280 mm, base 180x155 mm
Inventory:	2648

Compound dissecting microscope mounted on a thick brass plate carrying a pillar with an arm that supports the vertical body-tube. Focusing is by rackwork. The eyepiece is probably not the original, while the objective is missing. This microscope has a long focal length and a wide field. It was invented in 1847 by Charles-Philippe Robin and built by Nachet & Fils.

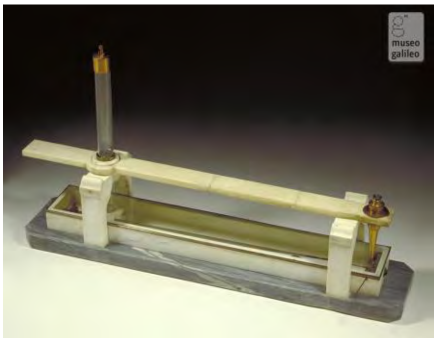
Coulomb magnetic declination compass



Setting:	Room XVI
Inventor:	Charles Augustin Coulomb
Maker:	Giovanni Fortini
Place:	Florence
Date:	1786
Materials:	marble, brass, copper, steel
Dimensions:	base 690x320 mm, length 490 mm (needle), suspension tube height 500 mm
Inventory:	918

The massive marble base with leveling screws has a rectangular trough containing a long asymmetric magnetic needle. The trough is surmounted by two profiled marble arches connected at the top by a marble cross-piece with two openings. Through one of the openings passes a glass tube with brass finishings. The other opening is empty and accommodates the microscope currently associated with item inv 924. This type of inclinometer is fairly similar to those described by Charles-Augustin Coulomb in 1785. The wire suspension made the instrument highly sensitive, while its massive structure made it extremely stable. In the instruments he designed, Coulomb exploited the results of his detailed research on wire torsion and magnetization. This specimen was made by Giovanni Fortini for the Museo di Fisica e Storia Naturale of Florence, and was thus formerly in the Lorraine collections.

Coulomb magnetic declination compass



Setting:	Room XVI
Inventor:	Charles Augustin Coulomb
Maker:	unknown
Date:	ca. 1786
Materials:	marble, brass, copper, steel
Dimensions:	base 1180x230 mm, length 950 mm (needle), suspension tube height 500 mm
Inventory:	924

The gray marble rectangular base rests directly on the ground. The base carries a smaller rectangular trough of white marble for the long asymmetric magnetic needle. The trough is surmounted by two profiled marble arches connected at the top by a marble strip, with two openings. Through one of the openings passes a glass tube terminating in a brass cap. The other opening accommodates a microscope used for accurately determining the needle's movement (the microscope also fits in the opening of item inv. 918). This type of inclinometer is fairly similar to those described by Charles-Augustin Coulomb in 1785. The wire suspension made the instrument highly sensitive, while its massive structure made it extremely stable. In the instruments he designed, Coulomb exploited the results of his detailed research on wire torsion and magnetization. This specimen was made by the Museo di Fisica e Storia Naturale of Florence, and was thus formerly in the Lorraine collections.

De Luc barometer

Setting:	Room XV
Inventor:	Jean-André De Luc
Maker:	unknown
Date:	ca. 1760
Materials:	wood, ivory, glass
Dimensions:	height 1025 mm, width 110 mm
Inventory:	1150

Portable barometer of the type invented by Jean-André de Luc. The instrument is enclosed in a wooden box with opening front. In transport, the mercury was moved to the longer arm of the barometric tube, where it was closed by means of a tap. The shorter tube is fitted with a small ivory cover. The barometric scales, drawn on paper, are in Paris inches. There is a plumb bob for checking verticality. The box also contains two mercury thermometers, with Fahrenheit and Réaumur thermometric scales, used to determine the barometric corrections made necessary by temperature variations. One of the two thermometers, designed to measure room temperature, can be removed from the box.

De Luc barometer

Setting:	Room XV
Inventor:	Jean-André De Luc
Maker:	unknown
Date:	late 18th cent.
Materials:	wood, ivory, glass
Dimensions:	height 960 mm, width 100 mm
Inventory:	1556

Portable barometer of the type invented by Jean-André de Luc. The instrument is enclosed in a wooden box with opening front. The two arms of the barometric tube are connected by a metal container fitted with a tap. In transport, the mercury was moved into the longer arm of the barometric tube. The barometric scales are printed on paper and divided into Paris inches. The instrument is fitted with a plumb bob to check its vertical position and a mercury thermometer with Fahrenheit and Réaumur thermometric scales.

Demonstration model of astatic galvanometer

Setting:	Room XVI
Maker:	unknown
Date:	second half 19th cent.
Materials:	mahogany, brass
Dimensions:	total height 525 mm, base 615x403 mm
Inventory:	541

Demonstration model of astatic galvanometer consisting of a mahogany base with three large leveling screws, a brass frame for a thick copper wire coil with black silk insulation, and a simple suspension for the astatic needles. The instrument is housed in a six-sided mahogany frame with six glass panels. The scale is a large ring brass graduated in four quadrants of 0°-90°, and the coil is connected to two brass terminals with clamps.

Double barometer

Setting:	Room XV
Inventor:	Felice Fontana [attr.]
Maker:	unknown
Place:	Italian
Date:	second half 18th cent.
Materials:	wood, brass, iron
Dimensions:	height 1000 mm, width 239 mm
Inventory:	1155

This double barometer is mounted on a wooden and brass support. It consists of two connected tubes, one ending in a bulb, the other fitted with an ivory gudgeon pin. Both tubes are inserted into a single iron container. A tap allows communication between the tubes; the height of the mercury in the tubes is regulated by two screw knobs that compress leather membranes. The barometric scales, divided into Paris inches, are fitted with sliding verniers. The instrument was probably used for laboratory experiments. Its invention is attributed to Felice Fontana.

Double diaphragm

Setting:	Room XV
Maker:	unknown
Date:	second half 18th cent.
Materials:	brass
Dimensions:	140x204 mm
Inventory:	738

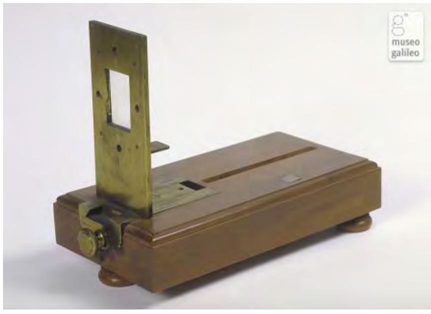
The rectangular plate, with two holes, carries two rotating diaphragms: one is circular, and has 8 round, 2 oval, 3 triangular, and 2 rectangular apertures; the other is semicircular, with 4 pairs of holes and 3 round apertures of different diameters.

Duc de Chaulnes's depth gauge

Setting: Room XV
Inventor: Michel-Ferdinand d'Albert d'Ailly, Duc de Chaulnes
Maker: unknown
Date: ca. 1770
Materials: brass
Dimensions: 250x135 mm
Inventory: 3170

The brass bar carries a scale divided into inches and lines. A double square equipped with a vernier slides friction-tight along the bar. The arms of the square were placed on the edges of an opening. The sliding bar would be lowered inside the cavity until it touched bottom. The depth would then be measured with precision. This instrument was invented by the Duc de Chaulnes.

Duc de Chaulnes's focometer



Setting: Room XV
Inventor: Michel-Ferdinand d'Albert d'Ailly, Duc de Chaulnes
Maker: unknown
Date: ca. 1770
Materials: wood, brass, glass
Dimensions: 210x110x175 mm
Inventory: 3169

One of the micrometers mounted on microscope inv. 3202 can be fitted to the guide of a brass frame. To the micrometer was fixed a second vertical frame bearing a small glass plate covered with powder obtained from butterfly wings. A brass plate with a small hole was set up in parallel with the glass plate. The lens to be examined was placed in front of the small hole. Through the lens, the observer could see the powder deposited on the glass plate. The plate's position could be adjusted by means of the micrometer, until a perfect focus was obtained. The focal length of the lens was then read on the micrometric scale.

Duc de Chaulnes's microscope

Setting:	Room XV
Inventor:	Michel-Ferdinand d'Albert d'Ailly, Duc de Chaulnes
Maker:	unknown
Date:	ca. 1770
Materials:	brass, glass
Dimensions:	270x180x365 mm
Inventory:	3202

This microscope was invented by Michel-Ferdinand d'Albert d'Ailly, Duc de Chaulnes. The optics were not particularly innovative by comparison with contemporary microscopes. The most interesting feature is the set of three micrometers with graduated disks. Two of the micrometers are fixed to the stage at right angles to each other. They allow a precision movement of the specimen under observation. The third is an eyepiece micrometer mounted crosswise on the tube. The microscope, originally equipped with numerous accessories, is similar to those installed on the dividing engines also invented by de Chaulnes. This instrument was minutely described by the inventor in the small volume *Description d'un microscope et de différents micromètres destinés à mesurer des parties circulaires ou droites avec la plus grande précision* (Paris, 1768).

Electric motor after Botto

Setting:	Room XVI
Inventor:	Giuseppe Domenico Botto
Maker:	unknown
Date:	ca. 1840
Materials:	wood, brass, copper, iron, glass
Dimensions:	total height 620 mm, base 507x173x133 mm
Inventory:	1412

Beautiful model of an early electric motor fairly similar to the one invented by Giuseppe Domenico Botto and described by him in *Notizia sopra l'applicazione dell'elettromagnetismo alla meccanica* (Turin, c. 1834). The base has a drawer with 14 glass compartments for the electro-chemical battery (whose elements are missing). The rocking motion of a mobile coil between two fixed coils is transmitted to a large brass wheel on a wooden frame by a small pulley and crank. The to-and-fro motion is maintained by a commutator consisting of two rocking brass arms dipping into mercury contact cups. This arrangement alternates the direction of the current in the fixed coils. The earliest electromagnetic engines and motors converted electrical energy into mechanical energy by imitating the rocking motion of the steam engine, the pressure of the steam being replaced by the attraction of an electromagnet or armature. Provenance: Lorraine collections.

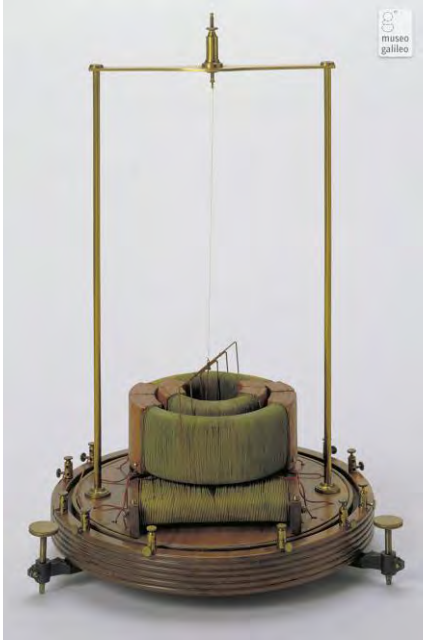
Electric motor by Pacinotti

Setting: Room XVI
Inventor: Antonio Pacinotti
Maker: unknown
Date: ca. 1863
Materials: mahogany, brass, iron
Dimensions: total height 280 mm, base 448x250 mm
Inventory: 3768

Prototype of one of the first efficient electric motor/generators. The ring armature consists of a toothed wheel comprising a very large number of iron laminations. Between its teeth are wound the coils, in 16 separate sections. The coils are activated in turn by a commutator mounted on the vertical spindle above the armature. The ring lay in the magnetic field of the two upright fixed electromagnets and the current passed through the 16 coils around the ring. The apparatus was heavily restored after the 1966 flood.

Antonio Pacinotti described his continuous-current motor in 1863, which was then taken up and series-produced by Zénobe-Théophile Gramme c. 1870. By replacing the field electromagnets with permanent ones, Pacinotti found that his engine became a generator (dynamo). A copper plaque carries the words: "Macchinetta elettromagnetica / Donata da Antonio Pacinotti" ["Small electromagnetic machine / Donated by Antonio Pacinotti"].

Galvanometer, Magrini pattern



Setting: Room XVI
Inventor: Luigi Magrini
Maker: unknown
Date: ca. 1850
Materials: mahogany, brass
Dimensions: total height 450 mm, base diameter 265 mm
Inventory: 872

Incomplete version of differential galvanometer invented by Luigi Magrini. The mahogany base has three brass leveling screws. The coil and needle arrangement is complex. Below is a conventional galvanometer with magnetic needle; above are two concentric coils of fine wire and a needle suspended from six limbs between the two coils. The glass dome is missing. Provenance: Lorraine collections.

Gaulard and Gibbs secondary generator

Setting: Room XVI
Inventor: Lucien Gaulard, John Gibbs
Maker: Lucien Gaulard, John Gibbs
Date: 1884
Materials: mahogany, iron, brass, copper, waxed paper
Dimensions: total height 460 mm, base 205x200 mm
Inventory: 394

Early electrical transformer consisting of a mahogany base and mahogany top with four steel rods enclosing a stack of copper disks separated by waxed paper. Each disk has a projecting metal tag alternatively painted black or red. The black tags and red tags are connected together, forming two electrical circuits. There is a central sliding core of iron terminating in a large nickel-plated knob. Lucien Gaulard and John Dixon Gibbs (about whom we have no information) patented an electrical distribution system c. 1880 in which an alternating current flowing through a primary circuit of the transformer produced an induced current in a secondary circuit. They arranged the transformers in a series, placed at set intervals in a long circuit (some tens of kilometers of wire long), to obtain the local secondary current for incandescent lamps. In the late nineteenth century, transformers began to play a crucial role in distribution systems for alternating current, which came to replace direct current during the twentieth century.

Gold-leaf electroscope

Setting:	Room XVI
Inventor:	Abraham Bennet
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass, glass, gold leaf strips
Dimensions:	height 210 mm, base diameter 150 mm
Inventory:	441

Gold-leaf electroscope. The instrument, invented in 1786 by Abraham Bennet, consists of an upright brass rod whose lower end holds two very thin gold-leaf strips and whose upper end is fitted with a ball. A glass bell-jar encloses the lower part of the rod and the gold-leaf strips, preventing them from being moved by air currents.
When the conductor is not charged, the strips will align vertically because of gravity. When, instead, the ball is touched by an electrically charged body, part of the charge is diffused throughout the conductor. The strips become identically charged and repel each other, forming an angle proportional to the charge. The phenomenon is based on one of the fundamental properties of electrostatics: bodies with electrical charges of the same sign repel each other, while those with opposite electrical charges attract each other. The two tin-foil strips at opposite sides of the dome will leak the excess charge to ground. Provenance: Lorraine collections.

Hair hygrometer

Setting: Room XV
Maker: Nairne & Blunt firm
Place: London
Date: late 18th cent.
Materials: brass, glass
Dimensions: height 444 mm, dial diameter 85 mm
Inventory: 2442

Hygrometer consisting of a glass tube that connects a brass dial to a small plate. The plate carries a mobile clamp whose position can be adjusted with a screw. The hygroscopic fiber (not original) is held by the clamp and winds on a pulley that pivots in a box fixed to the back of the dial. A spring, also connected to the pulley, keeps the fiber taut. A pointer indicates the changes in humidity on the dial scale. Made by Nairne & Blunt.

Hair hygrometer

Setting: Room XV
Maker: unknown
Place: Italian
Date: ca. 1850
Materials: slate, brass
Dimensions: 337x97x50mm
Inventory: 2032

This hygrometer consists of a plate of slate with three small feet. Under the plate is a bundle of hair, used as hygroscopic substance The hair is attached to a pulley kept taut by a spring. The pulley is integral with a pointer pivoting at the center of a semicircular scale placed on the instrument.

Hot stage

Setting:	Room XV
Maker:	Carl Reichert
Place:	Vienna
Date:	after 1885
Materials:	metal
Dimensions:	stage 109x47x6 mm; box 185x115x40 mm
Inventory:	3307

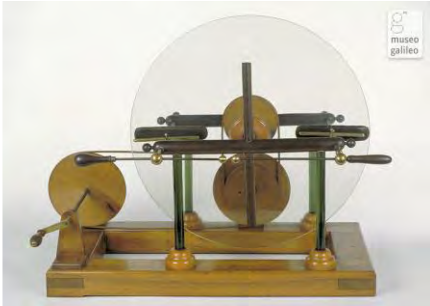
The stage was heated by the passage of hot water through small tubes inserted in a metal box. Served to raise the temperature of the samples observed under the microscope. The temperatures are controlled by a thermometer mounted on the instrument. Built by Carl Reichert. Belonged to the Gabinetto degli Invertebrati of the Istituto di Studi Superiori of Florence.

Kit of magneto-electric machine, Clarke pattern

Setting:	Room XVI
Inventor:	Edward Marmaduke Clarke
Maker:	unknown
Date:	ca. 1840
Materials:	mahogany, brass, iron, steel, glass
Dimensions:	box 270x180x365 mm, base 360x180 mm
Inventory:	515

Well-made kit including a Clarke-pattern generator, an additional coil with commutator, a glass voltameter, and other accessories, not all complete. The maker Edward Marmaduke Clarke improved Pixii's machine with this arrangement, which includes a pair of coils rotating near the poles of an upright permanent magnet. His generator had two pairs of coils (as does this kit), one of fine wire for high voltage, the other of coarse wire for large currents. His commutator provided unidirectional current. This magneto-electric machine, widely used in laboratories, was the first to be employed in electrotherapy. A small glass with electrodes connected to the generator poles demonstrated that the current from the generator could decompose water. Provenance: Lorraine collections.

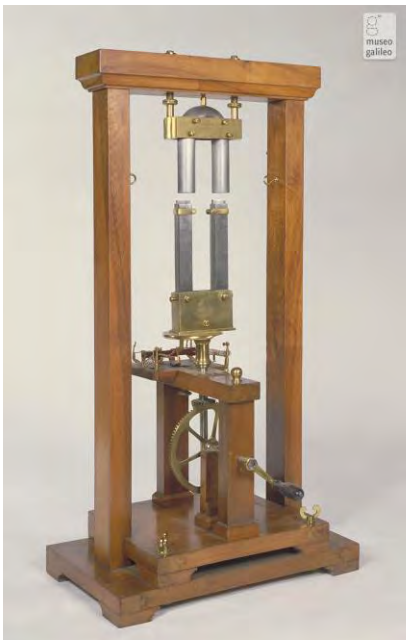
Kundt and Cantoni electrical machine



Setting:	Room XVI
Inventor:	August Adolph Kundt, Giovanni Cantoni
Maker:	unknown
Date:	ca. 1870
Materials:	mahogany, brass, ebonite, glass
Dimensions:	total height 603 mm, base 705x335 mm, glass disk diameter 545 mm, thickness 3.9 mm
Inventory:	507

This incomplete and restored generator is probably based on the pattern invented by August Adolph Kundt in 1868 and modified by the physicist Giovanni Cantoni in 1869.
The machine combines induction and friction. The single glass disk is rotated rapidly by a system of pulley wheels and is rubbed on one side by two leather cushions on ebonite supports. Situated directly opposite the cushions, at the other side of the glass, are two brass collecting combs. The other two combs placed vertically (one at the top and the other at the bottom of the disk) are likely missing. There are two sliding electrodes at the front of the machine.

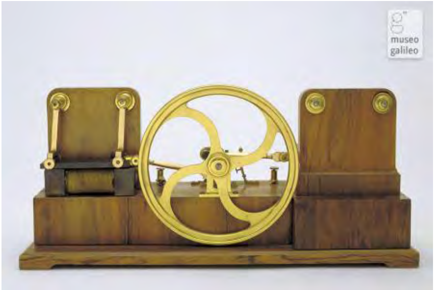
Magneto-electric machine by Pixii



Setting:	Room XVI
Inventor:	Hippolyte Pixii
Maker:	Hippolyte Pixii
Place:	Paris
Date:	ca. 1832
Materials:	mahogany, brass, iron, steel
Dimensions:	total height 1180 mm, base 610x380 mm
Inventory:	552

One of the earliest magneto-electric generators for producing electric current. A mahogany frame supports a horseshoe electromagnet suspended from the upper cross-piece (today only the electromagnet's iron core survives; the coils are missing). The rest of the machine is mounted on a separate base, secured to the base of the frame by means of large butterfly screws. A horseshoe permanent magnet is rotated by means of a geared handle under the poles of the suspended electromagnet. This produces an induced alternating current that is rectified by Ampère's rocking commutator, actuated by a cam on the axis of the armature. Hippolyte Pixii made instruments for Jean-François-Dominique Arago and André-Marie Ampère and, with Ampère's help, developed this machine in 1832. Although basically a laboratory apparatus, this generator was a landmark in the transformation of mechanical energy into electricity.

Magrini's electric motor



Setting:	Room XVI
Inventor:	Luigi Magrini
Maker:	unknown
Date:	ca. 1840
Materials:	wood, brass, iron
Dimensions:	total height 280 mm, base 615x180 mm
Inventory:	916

Electric motor probably made for the physicist Luigi Magrini. It is mounted on a wooden block attached to the base. The large brass wheel is rotated by a double crank, also linked to the commutator. Two electromagnets are energized in turn, each one attracting a steel plate (armature) suspended by two rocking arms hinged to a wooden upright. A brass rod connects the system to one of the two cranks. The motion thus resembles that of steam-engine pistons. Provenance: Lorraine collections.

Maiocchi's universal galvanometer

Setting:	Room XVI
Inventor:	Giovanni Alessandro Maiocchi
Maker:	Carlo Dell'Acqua
Place:	Milan
Date:	second half 19th cent.
Materials:	wood, brass, steel, paper
Dimensions:	height 230 mm
Inventory:	1166

The wooden base, with three leveling screws and lead inset, carries a pedestal for the glass galvanometer housing. The galvanometer comprises a paper scale, a single magnetic needle, and a coil. A brass screw raises and lowers the needle; another rotates the upper part of the galvanometer. This instrument, made by Carlo Dell'Acqua, was invented by the Italian physicist Giovanni Alessandro Maiocchi.

Mercury thermometer

Setting: Room XV
Maker: unknown
Place: Italian
Date: second half 18th cent.
Materials: wood, glass, brass
Dimensions: height 380 mm, width 50 mm
Inventory: 1792

Mercury thermometer (the mercury is missing) mounted on a silvered brass plate and housed in a wooden case with glass windows. The instrument has a concave bulb and a Réaumur scale engraved on the brass plate.

Mercury thermometer

Setting: Room XV
Maker: John Troughton
Place: London
Date: 1782-1800
Materials: silvered brass, glass
Dimensions: length 55 mm
Inventory: 941

Mercury thermometer mounted on a silvered brass plate. There are Réaumur and Fahrenheit scales. Was probably housed in box inv. 1718. Made by John Troughton.

Mercury thermometer

Setting:	Room XV
Maker:	unknown
Date:	late 18th cent.
Materials:	brass, glass
Dimensions:	height 285 mm, width 37 mm
Inventory:	407

Mercury thermometer with a Réaumur scale mounted at the center of a brass frame. There is a vernier for the readings, adjusted by means of a screw ending in a knurled knob.

Metal maximum and minimum thermometer

Setting:	Room XV
Maker:	unknown
Place:	Italian?
Date:	first half 19th cent.
Materials:	slate, glass, brass
Dimensions:	height 1110 mm , width 245 mm
Inventory:	1895

Metal thermometer operated by the thermal expansion and contraction of a metal rod (probably made of lead). The rod is housed in a glass tube and mounted on a slate base with an inverted T shape. The lower part of the rod acts on a pair of identical mechanisms consisting of two pointers, moved by toothed wheels meshing with racks. The pointers are placed in such a way that one of them indicates, on a thermometric scale, the maximum temperature reached (corresponding to the minimum length of the rod), while the other records the minimum temperature. The pointers, scales, and transmission mechanisms are enclosed in a brass box with a glass front.

Microspectroscope

Setting: Room XV
Maker: unknown
Place: German
Date: ca. 1885
Materials: brass
Dimensions: length 105 mm, body diameter 24 mm; box 115x89x51 mm
Inventory: 3292

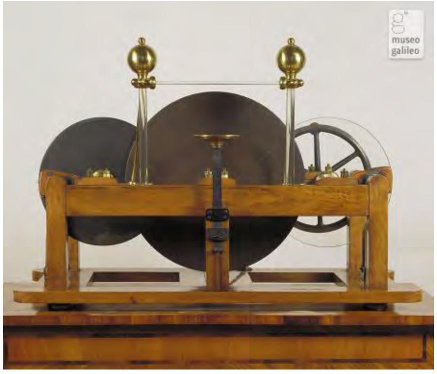
Spectroscope designed to replace the eyepiece in a microscope. The instrument, which analyzes light decomposed by a prism train, was used for the spectroscopic analysis of microscopic specimens such as blood samples. The sample was placed in a phial. Its spectrum, produced by a small additional prism, was projected in the field of view and served as the reference spectrum. The box contains a label with the name of Hartnack. Belonged to the Gabinetto degli Invertebrati of the Istituto di Studi Superiori of Florence.

Mobile diaphragm

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: brass, wood
Dimensions: 265x234 mm
Inventory: 2568

The wooden frame carries a decorated brass plate with two holes. Facing the holes are two shutters, hinged on the plate. Each shutter has a diaphragm with three round holes of different diameters. Through a system of levers, the shutters are moved simultaneously, increasing or reducing the distance between the diaphragms and the corresponding holes. A rotating brass fork can hide one of the two holes.

Modified Carré electrical machine



Setting: Room XVI
Inventor: Ferdinand-Philippe Carré
Maker: unknown
Place: Turin
Date: ca. 1890
Materials: mahogany, brass, iron, ebonite, glass
Dimensions: total height with table 715 mm, base 1070x448 mm, glass disk diameter 360 mm, thickness 7 mm, ebonite disk diameters 500 and 360 mm, thicknesses 7 and 9.4 mm
Inventory: Dep. LV, Torino

This is a kind of double Carré machine combining friction and induction. There is a large ebonite disk at the center that receives the charges from a pair of disks placed on the sides. One is a glass disk, rubbed by a silk cushion, the other an ebonite disk, rubbed by a fur cushion. The charges are induced by two brass collectors set at the edges of the disks, where they overlap with the central disk. The charges are then collected by two brass spheres—one for the positive charge, the other for the negative charge—connected by a glass tube secured to a brass support. This type of generator is exceptionally rare.

Nobili-Melloni radiant-heat thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili, Macedonio Melloni
Maker: unknown
Date: ca. 1831
Materials: bismuth, antimony, brass
Dimensions: ring diameter 55 mm
Inventory: 1237

Incomplete version of the Nobili - Melloni thermopile originally fitted with the brass cone-shaped tubes to collect radiant heat. Provenance: Lorraine collections.

Nobili-Melloni radiant-heat thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili, Macedonio Melloni
Maker: Giuseppe Caldini
Place: Florence
Date: ca. 1880
Materials: brass, cast iron, bismuth, antimony
Dimensions: total height 430 mm, base diameter 131 mm
Inventory: 3758

Radiant-heat thermopile, Nobili - Melloni pattern. Comprises a brass box with 120 elements and a large brass cone hinged to an adjustable support with cast-iron base. The back cover is missing. Made by Giuseppe Caldini, about whom we have no information.

Nobili's battery for his metalochromic apparatus

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, copper, zinc, glass
Dimensions: box 135x105x90 mm
Inventory: 3761

Battery consisting of 12 elements in a wooden box crudely coated with sealing-wax varnish. The elements are alternating copper and zinc plates (electrodes), secured to a wooden rod resting on the box. They are separated by glass plates set in grooves. This simple type of battery, probably used by Leopoldo Nobili for making metalochromes, was based on William Cruickshank's "trough battery." Provenance: Lorraine collections.

Nobili's box thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: bismuth, antimony, brass
Dimensions: height 63 mm, diameter 81 mm
Inventory: 1231

Nobili's thermopile with 100 antimony and bismuth elements. Nobili's "box" thermopile was used as a source of thermoelectricity and not as a detector for studying the properties of radiant heat. Provenance: Lorraine collections.

Nobili's box thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: Tecnomasio Italiano firm [attr.]
Place: Milan
Date: ca. 1870
Materials: boxwood, bismuth, antimony, brass
Dimensions: height 48 mm, diameter 58 mm
Inventory: 1230

Thermopile in a boxwood box, perhaps made by Tecnomasio Italiano in Milan on the pattern invented by Leopoldo Nobili. There are 25 antimony and bismuth elements. Provenance: Lorraine collections.

Nobili's constant-current thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1829
Materials: bismuth, antimony, brass
Dimensions: height 78 mm, diameter 62 mm
Inventory: 1227

Consists of a brass ring carrying 25 elements (antimony and bismuth couples), with removable top and bottom, the whole forming a cylindrical box. An important application of the thermopile was as a constant source of electric current, long before reference voltages could be supplied by stable standard cells. At the same time as he was developing the thermopile as a differential thermometer for studying radiant heat, Leopoldo Nobili also made this version to supply a constant current for his differential galvanometer. Provenance: Lorraine collections.

Nobili's differential galvanometer

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1829
Materials: wood, brass, steel
Dimensions: total height 280 mm, base 310x215 mm
Inventory: 1185

Differential galvanometer invented by Leopoldo Nobili, mounted on a wooden base carrying a slender pillar from which the needle system is suspended. The glass protection dome is missing. The brass scale is divided into four quadrants. There are four independent coils of silk-covered wire, each connected to two brass terminals. Different currents could be circulated in the coils. If the currents circulated in opposite directions, the needle indicated the effect produced by their differential—hence the name of the instrument. A differential galvanometer was already developed by Antoine-César Becquerel in 1826. Provenance: Lorraine collections.

Nobili's disk-pattern radiant-heat thermopile

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: bismuth, antimony, brass
Dimensions: diameter 55 mm
Inventory: 1236

There is a flat round brass box with 11 elements (incomplete), arranged in triangles in such a way that the tips project from an aperture in the housing. Even this small Nobili thermopile was used for experiments on the refraction, diffraction, and polarization properties of radiant heat. Provenance: Lorraine collections.

Nobili's double sparking magnet

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	Corrado Wolf
Place:	Florence
Date:	1835
Materials:	mahogany, iron, steel, brass
Dimensions:	height at top of magnets 240 mm, length (without crank) 700 mm, base width 143 mm
Inventory:	1273

Double sparking magnet on the Nobili pattern. Two permanent horseshoe magnets, held together by brass brackets, are placed on a large wooden base. The coil is oscillated rapidly between the magnet poles by a crank-operated mechanism. Whenever the circuit consisting of the magnet and the flexible contact strip is broken, an electric spark is produced by the induced current due to the opening and closing of the circuit. The alternating current generated in this way can be collected by the commutator attached to the base. Direct current can be produced by removing one of the contacts.
Nobili's commutator may have been inspired by the one developed by Hippolyte Pixii for his magneto-electric machine (inv. 552).
This instrument was made by Corrado Wolf, about whom Nobili wrote in his *Memorie* (Florence, 1834): "The compound magnets are very finely made; like most of my other apparatuses, they are produced in the workshop of a highly skilled machine-maker, Mr. Wolf, who works for me to my full satisfaction and to the genuine benefit of science." Provenance: Lorraine collections.

Nobili's hydroelectric galvanometer

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass, glass, paper
Dimensions:	total height 200 mm, base 150 mm
Inventory:	366

The black wooden base of this galvanometer carried a lead stabilizing ring (missing). A cylindrical glass cover carries the suspension for the astatic needles. The coil, wound on a boxwood bobbin, has many windings of fine wire, probably silver, covered with silk. This version of Nobili's galvanometer was used to measure "hydroelectric" currents generated by chemical action. Provenance: Lorraine collections.

Nobili's instantaneous-current galvanometer

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, brass, lead, glass, steel
Dimensions: total height 200 mm, base (with ring) 168 mm
Inventory: 1274

The black wooden base of this galvanometer carries a lead stabilizing ring painted red. A cylindrical glass cover carries the suspension for the astatic needles. The coil, wound on a boxwood bobbin, has many windings of fine wire, probably silver, covered with silk. This version of Nobili's galvanometer was used to measure currents of very brief duration. Provenance: Lorraine collections.

Nobili's large astatic galvanometer

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: 1826
Materials: wood, brass, iron, glass, silk
Dimensions: total height 460 mm, base 520x315 mm
Inventory: 1324

Large galvanometer designed by Leopoldo Nobili c. 1825. The instrument is mounted on a wooden base carrying a slender suspension pillar. A pair of astatic needles is suspended from the fine silk wire attached to a torsion mechanism at the top of the pillar. The needles can be raised or lowered by means of a complex screw-operated scissors-type mechanism. The lower needle passes through a slit into a flat coil of insulated silk wire, wound on a wooden bobbin; the upper needle indicates the deflections on a semicircular graduated brass scale, divided into two quadrants. The magnetic compass on the base of the instrument can be replaced by a small

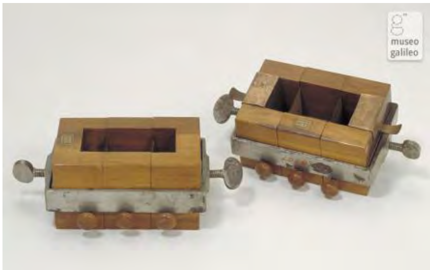
porcelain dish for measuring the current produced by different metals; or, using another attachment consisting of a wire held above a compass needle, the compass can be used to give a rough measure of the current produced by electrochemical batteries. The black wooden base contains two drawers with accessories. In this and other galvanometers, Nobili cleverly combined elements—such as the suspension, the "multiplying" coil, and astatic needles—already used in other instruments, to produce a highly efficient device for measuring currents.
The instrument, heavily restored after the 1966 Arno flood, is now incomplete. The glass bell-jar is lost. Provenance: Lorraine collections.

Nobili's large membrane cell

Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: iron, wood
Dimensions: length 390 mm, width 79 mm, height 65 mm
Inventory: 1238

Wooden vessel comprising 12 compartments originally divided by thin metal sheets or animal membranes. The compartments are held together by means of a large iron clamp. Leopoldo Nobili used this type of apparatus to study electrochemical phenomena relating to batteries. Provenance: Lorraine collections.

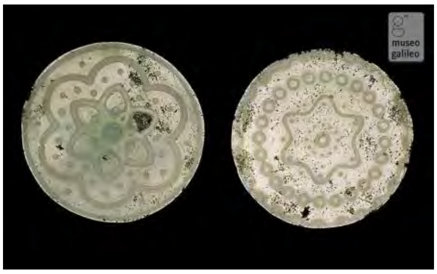
Nobili's membrane cells



Setting: Room XVI
Inventor: Leopoldo Nobili
Maker: unknown
Date: ca. 1830
Materials: wood, iron, copper, brass
Dimensions: length 124 mm, width 80 mm, height 65 mm
Inventory: 1172, 1239

These two instruments consists of three varnished wooden compartments, separated by two thin brass sheets and clamped together by means of a rectangular iron frame with a butterfly screw at each end. Each compartment has a hole in the side closed by a hardwood plug. One of the units has copper sheets bent into and over the walls of the two external compartments and two contact strips projecting above the butterfly screws. Leopoldo Nobili called these cells *strettoi* because of their narrowness. The compartments were separated by thin sheets of metal, such as brass, and could be filled with various solutions to study, for example, the flow of current through different substances. Replacing the metal sheets with organic membranes, Nobili studied phenomena pertaining to the decomposition of the electrolytes. Provenance: Lorraine collections.

Nobili's metalochromes



Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	steel
Dimensions:	diameter 70 mm
Inventory:	1234

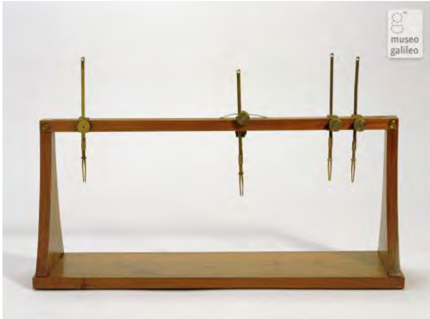
These metalochromes consist of polished steel disks with iridescent patterns produced by a thin film of lead oxide deposited electrochemically. The color of the patterns varies according to the thickness of the film through which the light is reflected by the polished steel surface.
Leopoldo Nobili first observed this phenomenon in 1828. The steel disk was immersed in a bath containing an electrolytic solution of lead acetate (he later also used other solutions) and was connected to the positive pole of a Voltaic battery by means of one of the platinum points of his *apparecchio a punte* ["points apparatus"] (inv. 1271 - inv. 1241 - inv. 1242). The negative pole of the battery connected to the other point was slightly above the disk. The thickness of the film was varied by lowering or raising the points. Complex patterns could be made in this way, or by placing a card with a cut-out shape on the steel disk, followed by a copper disk that was slightly curved so that its distance from the steel varied. The metalochromic technique was fairly popular in the nineteenth century and was used to decorate small items such as snuff boxes and clock cases. Provenance: Lorraine collections.

Nobili's metalochromic apparatus

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass
Dimensions:	249x162 mm
Inventory:	1271

Apparatus invented by Leopoldo Nobili. Consists of a black wooden base with a pillar from which project two brass arms, hinged at the middle. To each arm is secured a brass electrode that, by means of a toothed pinion and rack, can be raised or lowered in the vessel containing the lead acetate solution and the disk for metalochromes. Each electrode terminates in a clamp for the platinum point used to produce the metalochromes. Provenance: Lorraine collections.

Nobili's metalochromic apparatus



Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	brass, mahogany
Dimensions:	height 250 mm, base 450x125x250 mm
Inventory:	1242

A mahogany frame with a millimeter scale on the upper cross-piece carries four brass electrodes with rackwork and ending in pinchers. The two internal electrodes can also be adjusted sideways using the scale. With this apparatus for producing metalochromes, the physicist Leopoldo Nobili could compare the electrochemical deposition produced by two currents of the same or unequal strengths by having two pairs of electrodes in a common bath. Provenance: Lorraine collections.

Nobili's portable galvanometer for "hydroelectricity"

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass, iron, lead, paper
Dimensions:	total height 190 mm, base (with ring) 165 mm
Inventory:	1276

The black wooden base carries a lead stabilizing ring painted red. A cylindrical glass cover carries the suspension for the astatic needles. The coil, wound on a boxwood bobbin, has many windings of fine wire, probably silver, covered with silk. The number of windings and the diameter of the coil wire depended on the use of the galvanometer: measurement of thermoelectric currents (produced by thermoelectric couples or piles), magneto-electric currents produced in magnetic experiments, or "hydroelectric" currents generated by chemical action. In this laboratory version of Nobili's galvanometer, many features of the large galvanometer (inv. 1324) were stripped down. Provenance: Lorraine collections.

Nobili's prototype thermopile

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1829
Materials:	bismuth, antimony, brass
Dimensions:	height 84 mm, diameter 62 mm
Inventory:	1233

Prototype of the thermopile invented by Nobili. Consists of twelve large bismuth and antimony elements, set in mastic, arranged in a circle and protruding from their wooden cylindrical container with screw-on base. The elements were not protected by a lid. They were placed upright in a brass ring secured to an adjustable support, and were screened by a wooden disk with a 15-mm central aperture. Provenance: Lorraine collections.

Nobili's sparking magnet

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1832
Materials:	wood, iron, steel, brass
Dimensions:	total height 160 mm, base 175x150x70 mm
Inventory:	1270

First version of Leopoldo Nobili's sparking magnet. The wooden base carries a permanent horseshoe magnet. A crude coil with a flexible contact strip is attached to a swiveling brass arm with mahogany handle. When the circuit consisting of the magnet and the contact strip is broken, or quickly restored by a rapid to-and-fro movement of the bobbin, a tiny electric spark is produced between the contact strip and the magnet. It is generated by the induced current due to the opening and closing of the circuit. Nobili and the director of the Museo di Fisica e Storia Naturale of Florence, Vincenzo Antinori, were inspired to develop the sparking magnet after reading an account of how Michael Faraday had obtained a spark from an electromagnet in 1831. All the experiments made with sparks produced by electrical machines were thus repeated with this type of instrument. Provenance: Lorraine collections.

Nobili's sparking magnet

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	1832
Materials:	wood, iron, steel, brass
Dimensions:	total height 385 mm, base 420x260x300 mm
Inventory:	1272

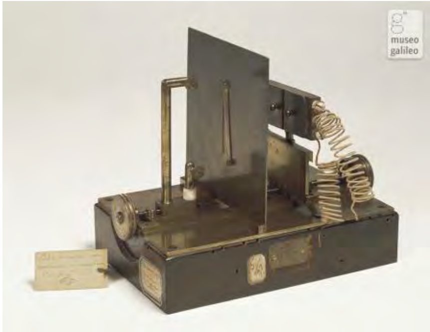
Large sparking magnet on the Nobili pattern. The compound permanent magnet is held together by a brass bracket and fits into a deep slit in the wooden base. The purpose of the second brass bracket with collar attached to the top of the magnet is unclear. When the circuit consisting of the magnet and the contact strip is broken, or quickly restored by a rapid to-and-fro movement of the bobbin, a tiny electric spark is produced between the contact strip and the magnet. It is generated by the induced current due to the opening and closing of the circuit. A small brass plaque is engraved with the words: "Sotto gli auspicii di Leopoldo II. Diede la prima scintilla. Il 30. Gennaio 1832. A.L. Nobili & V. Antinori" ["Under the auspices of Leopold II. Produced the first spark. The 30th… January 1832. A.L. Nobili & V. Antinori"]. A nearly identical instrument with the same plaque is in the Museo Civico of Reggio Emilia. Provenance: Lorraine collections.

Nobili's static-electricity galvanometer

Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1830
Materials:	wood, brass, paper, lead, steel, glass
Dimensions:	total height 210 mm, base (with ring) 168 mm
Inventory:	372

Galvanometer used by Nobili to measure static electricity, i.e., produced by electrostatic generators and Leyden jars. The 130-140 windings are extra-insulated with black varnished taffeta. The silvered brass scale is divided into two quadrants. Provenance: Lorraine collections.

Nobili's thermopile with micrometers



Setting:	Room XVI
Inventor:	Leopoldo Nobili
Maker:	unknown
Date:	ca. 1834
Materials:	ebony, brass, bismuth, antimony
Dimensions:	total height 133 mm, base 150x97x30 mm
Inventory:	1224

Experimental arrangement devised by Leopoldo Nobili to study the interference pattern of heat rays. An ebony base carries a thick brass plate to which the other components are fixed. In the middle is a brass screen with two thin slits that can be covered by a sliding brass strip. On one side of the screen is the heat source, which consists of two clamps, probably for holding a glowing wire heated by electrical current. This heating arrangement is controlled by a micrometer screw. A similar arrangement on the other side of the screen supports a second micrometer, to which is secured a rectangular thermopile in a small flat box. The pile has a narrow central slit on one side and two sliding panels forming an aperture of variable width on the other side. The two micrometers allow accurate determination of both the longitudinal and lateral movements of the thermopile. Provenance: Lorraine collections.

Optical compendium

Setting:	Room XV
Maker:	Robert Banks
Place:	London
Date:	ca. 1811
Materials:	brass, wood
Dimensions:	solar microscope: plate 190x191 mm, mirror 352x123 mm; lucernal microscope: height 470 mm, length of support 545 mm; compound microscope height 490 mm; box 402x133x80 mm; preparation box 382x246x127 mm
Inventory:	2681, 2682, 2683, 2684

This optical compendium is signed by Robert Banks and includes a solar microscope, a lucernal microscope, and a compound microscope.
The solar microscope, similar to microscope inv. 795, comprises two parts: a mirror holder with a mobile mirror, and a body-tube in which projection lenses with different powers can be

inserted. Focusing is by rackwork. Also present are a fitting to screw onto the mirror holder for observing opaque objects.
The lucernal microscope, similar to microscope inv. 502, 1457, 3222, 3243, consists of a projection box and a mobile stage mounted on a pillar placed on a tripod support. The box contains lenses, objectives, and accessories for preparing specimens.
The compound microscope, mounted on a pillar resting on a tripod, comprises a tilting limb carrying the mirror, a converging lens, the stage, and the body-tube. The instrument fits into a box containing many accessories including seven objectives, a lieberkuhn, and two lenses that, when substituted for the body-tube, turn the device into a simple microscope.
There is also a box containing many glass slides, as well as various substances and specimens.

Pair of framed prisms

Setting:	Room XV
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass, wood, brass
Dimensions:	500x175x115 mm
Inventory:	741

Two equilateral glass prisms are hinged horizontally in a wooden frame by means of brass ring nuts. The upper prism can be raised or lowered by turning a screw that makes it slide in the frame. A pointer shows the upper prism's inclination on a graduated brass scale (40° - 0° - 40°). The frame also carries two jointed brass arms, which probably supported other accessories. The frame itself is fitted to an elbow-joint for positioning the apparatus on an optical bench. The two combined prisms produced two light spectra simultaneously, which could be superposed to create color blends. Isaac Newton used a combination of several prisms for his famous experiments on the separation of white light into a polychromatic spectrum.

Paper-disk hygrometer

Setting:	Room XV
Inventor:	John Coventry
Maker:	Adams
Place:	London
Date:	second half 18th cent.
Materials:	ebony, brass, paper, ivory
Dimensions:	height 337 mm, width ca. 300 mm
Inventory:	4, 411

This hygrometer was invented by John Coventry and made by an Adams (it cannot be established whether the signature is that of George Adams Senior or Junior). The instrument is mounted on a small ebony column, fixed to a turned base and bearing an arm with an ivory scale. A balance mechanism is hinged to a support. A pile of paper disks—serving as a hygroscopic substance—is placed on one side of the mechanism; a long pointer extending to the scale is placed on the other. On the section of the arm carrying the pointer is a brass cursor that slides along a scale. The variations in atmospheric humidity cause the weight of the paper disks to change. This alters the position of the mobile arm, which can be returned to equilibrium by shifting the cursor.

Portable barometer

Setting:	Room XV
Maker:	unknown
Date:	first half 19th cent.
Materials:	wood, brass, glass
Dimensions:	height 997 mm
Inventory:	1146

Barometer enclosed in an opening mahogany cylinder, with two windows for observing the mercury level in the two arms of the siphon barometric tube. The barometric scales are in Paris inches and the readings are taken by means of a vernier. The instrument carries the names of twenty-two mountains with the average mercury levels at their respective altitudes. There is a mercury thermometer.

Prism with stand

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: 185x74x89 mm, prism side 33 mm
Inventory: 748

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. The base has two holes for inserting the pins of a support (blocked by the small plate) to position the prism on an optical bench or other fixture. Closely resembles prism inv. 746. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Prism with stand

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: glass, wood, brass
Dimensions: 186x92x202 mm, prism side 26 mm
Inventory: 773

The wooden base holds two supports between which an equilateral glass prism is hinged by means of a brass ring nut. Two threaded knobs are used to fix the position of the prism. Resembles prism inv. 774. Isaac Newton used instruments of this type for his famous experiments on the separation of white light into a polychromatic spectrum.

Reis telephone transmitter

Setting: Room XVI
Inventor: Johann Phillipp Reis
Maker: unknown
Date: ca. 1870
Materials: mahogany, brass
Dimensions: total height 106 mm, base 116x116 mm
Inventory: 447

At the top of a mahogany box is stretched a diaphragm of bladder that is set in vibration by sounds from a brass mouthpiece stained black. The vibrations cause an intermittent contact between a small platinum disk at the center of the diaphragm, and a light brass lever in contact with an electromagnet. The brass contact key at the side of the instrument is to activate the call bell. The receiver (missing) consisted of a needle placed inside a coil mounted in a wooden box acting as a resonator. The modulated current in the telephone line caused the needle to vibrate at the same rate as the diaphragm. There was considerable debate whether this system, invented by Johann Phillipp Reis, was capable of reproducing speech. However, the Reis transmitter, reproduced by many makers, remained essentially a demonstration instrument without significant practical applications.

Rotating diaphragm

Setting: Room XV
Maker: unknown
Date: second half 18th cent.
Materials: brass, wood
Dimensions: 177x214 mm
Inventory: 2567

The wooden frame holds a decorated brass plate with a central aperture. Inside the aperture is set a rotating disk with a rectangular slit, which acts as a diaphragm.

Simple microscope, aquatic

Setting:	Room XV
Inventor:	Christiaan Huygens
Maker:	Chapotot
Place:	Paris
Date:	ca. 1700
Materials:	brass
Dimensions:	length 93 mm; box max. 112x50 mm
Inventory:	3098

Simple aquatic microscope consisting of two profiled brass plates joined at their ends; between the plates is a hinged cross stage that rotates into position in front of the aperture formerly containing a lens, now missing. The microscope is fitted with a rotating disk with four round apertures, in front of which a forceps or spike can hold the specimen for observation. The instrument is housed in a wooden case covered in black leather and lined with velvet. There are a few accessories, including a slide carrier and a forceps. This type of microscope was invented by Christiaan Huygens. The instrument is signed *Chapotot*, not enough evidence to establish whether it was made by Louis Chapotot or his son.

Simple microscope, dissecting

Setting:	Room XV
Maker:	Peter Dollond (microscope), John Cuff (micrometer)
Place:	London
Date:	ca. 1760-1770
Materials:	brass; box: wood
Dimensions:	height 150 mm; box 167x108x42 mm
Inventory:	3212

Simple dissecting microscope mounted on a wooden case covered with fishskin. On the box is inserted a pillar that carries the lens-holder collar, the stage, and the illumination mirror. There are three lenses, a lieberkuhn, tweezers, and some specimens. The single lens can be replaced by a tube with a stage for use with more powerful lenses. The entire instrument can be taken apart and put back in the box foot. The microscope was made by Peter Dollond. Also present is a micrometer, made by John Cuff, consisting of a cross-mesh of silver wire. Provenance: Lorraine collections.

Siphon and cistern barometer

Setting: Room XV
Maker: unknown
Date: mid-19th cent.
Materials: brass
Dimensions: height 1055 mm
Inventory: 1132

Siphon and cistern barometer mounted on a tripod with leveling screws. The cistern has a screw that, acting on its leather bottom, adjusts the level of the mercury in a small tube forming the shorter arm of the siphon. The barometric tube is enclosed in a brass tube with windows for reading the mercury level. The brass tube is engraved with four different barometric scales. The readings are taken with a vernier. A mercury thermometer with centigrade and Réaumur scales is also fixed on the brass tube.

Stereometric barometer

Setting: Room XV
Inventor: Marsilio Landriani
Maker: unknown
Date: late 18th cent.
Materials: brass, glass, ivory
Dimensions: height 980 mm
Inventory: 1137

Stereometric barometer mounted on a shaped base with three leveling screws, similar to the device invented by Marsilio Landriani. The instrument basically consists of a barometric tube inserted in a brass container. The latter is fitted with a large glass tap and surmounted by an ivory cistern. A screw piston adjusts the mercury level. The barometric scale, in Paris inches, is engraved on a brass tube enclosing the glass barometric tube. The readings are taken by means of a rack vernier. The instrument can also be used as a normal barometer.

Straw electrometer, Volta type

Setting:	Room XVI
Inventor:	Alessandro Volta
Maker:	unknown
Date:	late 18th cent.
Materials:	brass, glass
Dimensions:	height 170 mm, base 80x75 mm
Inventory:	1197

Straw electrometer designed by Alessandro Volta. The two long straws are suspended to the brass rod, which terminates in a small ball at the top. A glass jar encloses the lower part of the rod and the straws, preventing them from being moved by air currents. When the conductor is not charged, the straws will align vertically because of gravity. When, instead, the ball is touched by an electrically charged body, part of the charge is diffused throughout the conductor. The straws become identically charged and repel each other, forming an angle proportional to the charge. The phenomenon is based on one of the fundamental properties of electrostatics: bodies with electrical charges of the same sign repel each other, while those with opposite electrical charges attract each other. The straws' divergence is indicated on a scale engraved directly on the glass.
Although Abraham Bennet's gold-leaf electroscope was more sensitive, the instrument, first described by Alessandro Volta in 1787, had the advantage of giving readings almost directly proportional to the electrical voltage being measured, provided that the straws did not diverge by more than c. 25°. Provenance: Lorraine collections.

Wheatstone rheostat

Setting:	Room XVI
Inventor:	Charles Wheatstone
Maker:	Filippo de Palma
Place:	Naples
Date:	1865
Materials:	mahogany, brass
Dimensions:	height 150 mm, base 310x230 mm
Inventory:	1408

Variable resistance made by Filippo de Palma and described in 1843 by Charles Wheatstone. A mahogany base carries a mahogany cylinder and a brass cylinder, each turned by a crank (missing). An uninsulated conductor wire is wound around the two cylinders. The more the windings on the mahogany cylinder, the greater the resistance of the rheostat. If the wire is wound on the brass cylinder instead, it is short-circuited and the overall resistance decreases. Two silvered dials indicate the length of wire wound on the cylinders.

Wheatstone's A.B.C. telegraph transmitter

Setting:	Room XVI
Inventor:	Charles Wheatstone
Maker:	Charles Wheatstone
Date:	ca. 1840
Materials:	mahogany, brass, iron
Dimensions:	total height 290 mm, base 439x312 mm
Inventory:	545

Wheatstone's telegraph transmitter. Rotating a brass wheel with its letters and numerals moves a large brass gear wheel on the same axis. This causes twin coils to rotate over the poles of a horseshoe permanent magnet and a commutator with two flexible leaf-spring contacts to the screw-terminals. This magneto-electric machine of the Clarke pattern produces a variable number of pulses of current according to the letter sent down the telegraph line. At the receiving station, the pulses released a clock escapement, allowing a pointer to turn until the transmitted letter was indicated. Provenance: Lorraine collections.

Room XVII

Chemistry and the Public Usefulness of Science

Marco Beretta

Starting in the second half of the 15th century, the Medici Court attracted many alchemists to Florence, providing them with avant-garde factories and laboratories. Of the immense Medicean collection of alchemists' instrumentation, very little has survived: only a few glass vessels used by the Accademia del Cimento (1657-1667), and the great burning lens donated by Benedetto Bregans in 1697 to Cosimo III (1642-1723) to experiment with the combustion of gemstones, displayed here on the stand at the centre of the room. On the wall behind it hangs the "table of chemical affinities", emblematic testimony to the Lorraine dynasty's interest in pharmaceutical chemistry. The numerous instruments used in theoretical and experimental chemistry also come from the Lorraine collection. Atmospheric chemistry especially, with the discovery of hydrogen and a method for determining the amounts of oxygen and other gases present in the atmosphere, favoured the development of new measuring instruments, such as Alessandro Volta's (1745-1827) electric pistol and hydrogen lamp, Felice Fontana's (1730-1805) *evaerometro*, and Marsilio Landriani's (1751-1815) eudiometer.

Alcohol thermometer

Setting:	Room XVII
Maker:	M. Gallonde
Place:	Paris
Date:	late 18th cent.
Materials:	wood, glass
Dimensions:	height 591 mm, width 87 mm
Inventory:	2040

Alcohol thermometer mounted on a small wooden board. The cylindrical bulb is placed crosswise to the tube. There is a Réaumur scale on paper. The instrument bears the name of its maker, M. Gallonde, and dates from around the mid-eighteenth century. Used by chemists for the precise measurement of temperature changes caused by reactions.

Alembic dome

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	length 100 mm
Inventory:	3782

Like items inv. 3779, inv. 3780 and inv. 3781, this is a part of an instrument for distillation, one of the fundamental operations in alchemy and chemistry. The dome (or hat) is the upper part of the alembic, serving as a cover and collecting the vapors produced by distillation. This specimen dates from the eighteenth century. Provenance: Lorraine collections.

Alembic domes

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	430x100 mm, 500x180 mm, 380x180 mm
Inventory:	3779, 3780, 3781

Parts of instruments for distillation, one of the fundamental operations in alchemy and chemistry. They date from the eighteenth century. Like item inv. 3782, they form the upper part of the alembic, designed to collect the vapors produced by distillation. Provenance: Lorraine collections.

Alkalimeter

Setting:	Room XVII
Inventor:	Francois Antoine Henri Descroizilles
Maker:	unknown
Date:	early 19th cent.
Materials:	glass
Dimensions:	height 230 mm, diameter 55 mm
Inventory:	3911

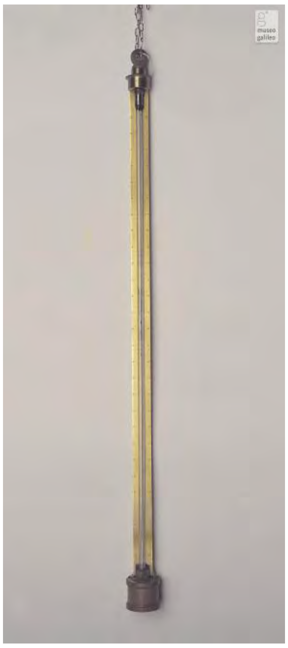
The Berthollimeter (in French: *berthollimètre*) is an analytical-chemistry instrument named after the French chemist Claude-Louis Berthollet. Invented by François-Antoine-Henri Descroizilles in 1791, the original device served to measure the quantity of chlorine in dyes used in the dyeing art. Descroizilles built a new version in 1806. Closely resembling the original, it soon enjoyed commercial success. As it allowed the measurement of the quantity of alkaline substances in fluids, Descroizilles gave it the more explicit name of "alkalimeter" (*alcalimètre*). The specimen exhibited is composed of a graduated glass test tube with a beak, resting on a large flat base. One side bears the inscription "Bertholli-mètre," the other "Alcali-mètre de Descroizilles."

Balance

Setting:	Room XVII
Maker:	unknown
Date:	19th cent.
Materials:	marble, brass, jade
Dimensions:	670x515 mm, pan diameters 210 mm
Inventory:	565

The balance has jade knife-edges, a marble pillar, and brass pans. Housed in a glass case, now missing. Provenance: Lorraine collections.

Barometer



Setting:	Room XVII
Maker:	Nicolas Fortin
Place:	France
Date:	1793
Materials:	brass, wood, glass
Dimensions:	lenght 936 mm, diameter 35 mm
Inventory:	1152

Barometer built in 1793 by the famous Paris instrument-maker Nicolas Fortin. The mercury is missing. The instrument is fixed to a semi-spherical brass plate with graduations in French inches. The cistern is made of boxwood. Appreciated for its robustness, Fortin's barometer was used, together with the thermometer, in late eighteenth-century laboratories for accurately measuring the "atmospheric" conditions of experimental processes. Once the chemically active role of air had been recognized, chemists understood that changes in pressure and temperature could influence the results of chemical reactions.

Barometer

Setting: Room XVII
Inventor: Louis Joseph Gay-Lussac
Maker: unknown
Date: first half 19th cent.
Materials: wood, glass
Dimensions: lenght 1200 mm, width 122 mm
Inventory: 1143

This new type of siphon barometer was invented in 1816 by the French chemist Joseph-Louis Gay-Lussac. The present specimen dates from the first half of the nineteenth century. The barometric tube containing mercury is fixed to a wooden board with a frame. The lower arm of the tube is broken. The instrument was noteworthy for its precision and transportability, achieved thanks to the capillary tube connecting the two branches. It was used in meteorology and in chemistry laboratories.

Bell-jar

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: height 200 mm, diameter 115 mm
Inventory: 1053

Glass bell-jars were very common in the eighteenth century and had a variety of applications. They were often used in pneumatic experiments and, more generally, to illustrate the effects of vacuum produced artificially inside them. With the discovery of gases in the mid-eighteenth century, they were also used in chemistry for studying and storing aeriform substances. Other specimens of bell-jars include items inv. 1047, inv. 1048 and inv. 3792, all from the Lorraine collections.

Bell-jar

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: diameter 95 mm, height 180 mm
Inventory: 3792

Glass bell-jars were very common in the eighteenth century and had a variety of applications. They were often used in pneumatic experiments and, more generally, to illustrate the effects of vacuum produced artificially inside them. With the discovery of gases in the mid-eighteenth century, they were also used in chemistry for studying and storing aeriform substances. This small specimen has a side spout and dome cover. Other specimens of bell-jars include items inv. 1053, inv. 1047 and inv. 1048, all from the Lorraine collections.

Bell-jars

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: 150x330 mm; 150x300 mm
Inventory: 1047, 1048

Glass bell-jars were very common in the eighteenth century and had a variety of applications. They were often used in pneumatic experiments and, more generally, to illustrate the effects of vacuum produced artificially inside them. With the discovery of gases in the mid-eighteenth century, they were also used in chemistry for studying and storing aeriform substances. Other specimens of bell-jars include items inv. 1053 and inv. 3792, all from the Lorraine collections.

Bottle

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	height 235 mm
Inventory:	1834 bis

Empty bottle, lacking a stopper, with late eighteenth-century label identifying the original contents as "microcosmic salt" [sic]. The term generally denoted the crystallized salts found in human urine. Given Grand Duke Peter Leopold's keen interest in the chemical analysis of these salts, the bottle probably came from his private laboratory.

Bottle

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	height ca. 195 mm
Inventory:	1875

Glass bottle with cork stopper containing partly pulverized copper salts.

Bottle

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: height ca. 260 mm
Inventory: 1712

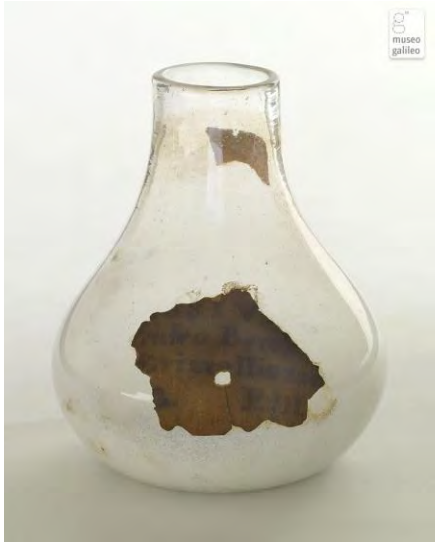
Glass bottle containing white salts, from the collection of chemical preparations in Grand Duke Peter Leopold's private laboratory.

Bottle

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: height ca. 220 mm
Inventory: 1834

Glass bottle with cork stopper containing lava stone.

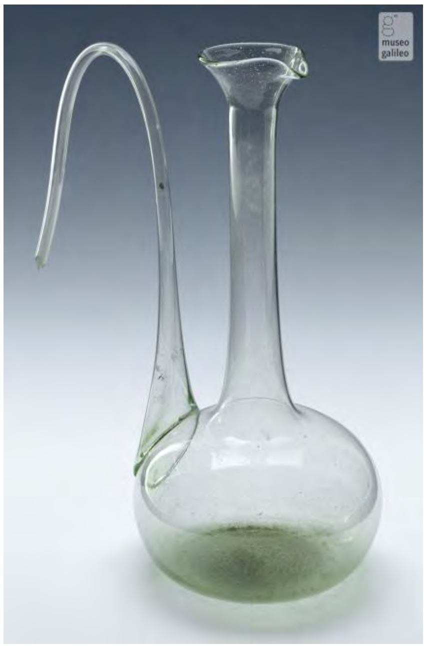
Bottle



Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	height ca. 115 mm
Inventory:	1876

Glass bottle, lacking a stopper, with residues of crystallized substances. Carries an illegible eighteenth-century label that identified the contents. Probably from Grand Duke Peter Leopold's private laboratory.

Bottle with curved pouring pipe



Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	160x310 mm
Inventory:	3786

Clear glass bottle with curved pouring pipe and a mouth with pouring lip. Contains an unidentified substance (contents altered by 1966 Arno flood). The curved pouring pipe facilitated the use of glass apparatus (glass being an easily malleable material) for chemical or spagyric operations such as distillation and cohobation. Provenance: Lorraine collections.

Bottle with serpentine neck

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: height 200 mm
Inventory: 1941

The bottle's serpentine neck increased the purity of the distilled liquid. There is also a thin pipe for introducing the substances to be distilled. Provenance: Lorraine collections.

Bottle with side spout

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: length 200 mm
Inventory: 1649

Green glass bottle, generally used for solutions of substances in liquids. The side spout made the bottle similar—in shape and use—to a carafe. Provenance: Lorraine collections.

Bottles

Setting:	Room XVII
Maker:	unknown
Date:	18th-19th cent.
Materials:	glass
Dimensions:	260 mm; 280 mm
Inventory:	3892, 3894

Two white glass bottles. One has a truncated-conic neck, the other is tall-necked with an opening near the bottom. Bottles have always been essential to chemical analysis, either as vessels for substances, or as accessories for instruments in different experiments.

Bottles

Setting:	Room XVII
Maker:	unknown
Date:	18th-19th cent.
Materials:	glass
Dimensions:	128 mm; 123 mm
Inventory:	3891, 3893

Two glass bottles, one green, flat-bottomed, and tall-necked, the other white, pyriform (pear-shaped), and with a very wide short neck. Bottles have always been essential to chemical analysis, either as vessels for substances, or as accessories for instruments in different experiments.

Chemical apparatus

Setting: Room XVII
Maker: unknown
Date: 18th cent.
Materials: glass
Dimensions: length 150 mm
Inventory: 1714

Two small elongated glass balls, joined by their slightly curved necks. Each ball has a small lateral glass bump. In the eighteenth century glass vessels were used to prepare combinations whose great variety reflected the growing complexity of chemical operations. Provenance: Lorraine collections.

Compound microscope

Setting: Room XVII
Maker: George Adams senior
Place: London
Date: ca. 1770
Materials: brass; box: wood
Dimensions: height 470 mm, box 444x253x91 mm
Inventory: 1223

Rare example of the sophisticated compound microscope made by George Adams Senior, which he described as a *variable microscope*. The instrument is mounted on a toothed wheel, which enables its inclination to be varied on a pillar resting on a tripod. On the wheel is fastened a rod carrying the mirror, the stage, and the body-tube. Focusing is by turning a threaded rod. The microscope has an eyepiece with two lenses, a field lens, and an additional lens, all converging. Below the eyepiece is inserted a micrometer moved by rackwork, followed by a screw for micrometric adjustment. The instrument can be taken apart and put back in the wooden box, which contains many accessories including three series of objectives, a brass compressor with glass disks, and various objects for holding specimens. Also present is a lamp fitted with a converging lens to concentrate light on the specimens. Provenance: Lorraine collections.

Electric pistol, Volta type

Setting:	Room XVII
Inventor:	Alessandro Volta
Maker:	unknown
Date:	ca. 1780
Materials:	brass, glass
Dimensions:	total length 120 mm, max. diameter 60 mm, tube diameter at mouth 22 mm
Inventory:	897

Green glass instrument in the shape of a spherical flask with a long neck. Two electrodes protruding from opposite sides are secured with sealing wax. Internally they terminated in sharp points (forming a spark gap) and externally they carried small rings. The pistol would be filled with hydrogen from a rubber bag (missing). The gas was exploded by a spark from a Leyden jar. The detonation caused the violent expulsion of the barrel stopper.
In 1776, Alessandro Volta began a series of experiments in which he used an electric spark to ignite methane (which he observed and collected in swamps) and detonate a mixture of hydrogen and air. These experiments led him to invent his electric pistol, hydrogen lamp, and eudiometer. Provenance: Lorraine collections.

Electric pistol, Volta type

Setting:	Room XVII
Inventor:	Alessandro Volta
Maker:	unknown
Date:	ca. 1780
Materials:	brass, glass
Dimensions:	total length 145 mm, max. diameter 45 mm, tube diameter at mouth 25 mm
Inventory:	898

Glass bottle fitted with electrodes. The pistol would be filled with hydrogen from a rubber bag (missing). The gas was exploded by a spark from a Leyden jar. The detonation caused the violent expulsion of the barrel stopper.
In 1776, Alessandro Volta began a series of experiments in which he used an electric spark to ignite methane (which he observed and collected in swamps) and detonate a mixture of hydrogen and air. These experiments led him to invent his electric pistol, hydrogen lamp, and eudiometer. Provenance: Lorraine collections.

Eudiometer

Setting:	Room XVII
Inventor:	Marsilio Landriani
Maker:	unknown
Date:	1776
Materials:	wood, ivory, glass; box: wood
Dimensions:	700x75 mm; box 830x110x100 mm
Inventory:	1371

The instrument is signed not only by Marsilio Landriani but also by Saruggia, a craftsman frequently mentioned in Alessandro Volta's writings. The eudiometer served to measure the quantity of oxygen in the atmosphere, and Landriani therefore regarded it as suitable for measuring air purity. Although dated 1776, this model displays some variants with respect to the eudiometer described by Landriani in his *Ricerche fisiche intorno alla salubrità dell'aria* (Milan, 1775). In keeping with his diagram, an ivory thermometer with a graduated scale has been placed alongside the tube CD. The scale conforms to the parameters defined by Réaumur. The graduated scale on the glass tube is divided into 23 parts rather than 12, each subdivided into 12 parts. Even the dimensions of the small crystal flask differ from the ones of the flask illustrated in the text (however, the requirement that the volume of the flask should be identical to that of the tube CD seems to be met). The lower end is slightly different, but complies with Landriani's principles and instructions. Provenance: Lorraine collections.

Eudiometer

Setting:	Room XVII
Maker:	George Adams junior
Place:	London
Date:	late 18th cent.
Materials:	brass, glass
Dimensions:	height 530 mm, diameter 120 mm
Inventory:	930/a

Round-bottomed glass eudiometer built in the late eighteenth century on the model designed by Alessandro Volta. The top end carries a small hollow brass cylinder with slits and three radiating pointed rods. A glass cylinder is attached to the brass cylinder. A swiveling brass ring is fastened to to the top. The instrument, signed "G. Adams London," is the work of the famous English naturalist and instrument-maker George Adams. The eudiometer was used to measure the quantity of carbon dioxide in atmospheric air within a confined space.

Eudiometer

Setting:	Room XVII
Maker:	Benjamin Martin
Place:	London
Date:	ca. 1780
Materials:	brass, glass
Dimensions:	height 560 mm, diameter 120 mm
Inventory:	930/b

Round-bottomed glass eudiometer. The top end carries a small hollow brass cylinder with slits and three radiating pointed rods. A glass cylinder, in a brass mount graduated from 0 to 100, is attached to the brass cylinder. A swiveling brass ring is fastened to the top. The instrument bears the inscription "Euderometro Fontanian Made by Martin London." It was built by the famous

English natural philosopher Benjamin Martin, presumably around 1780. It is a reconstruction of Felice Fontana's eudiometer, of which no specimens survive. The eudiometer was used to measure the quantity of carbon dioxide in atmospheric air within a confined space.

Evaerometro

Setting: Room XVII
Inventor: Felice Fontana
Maker: Felice Fontana
Date: 18th cent.
Materials: wood, glass
Dimensions: 240x75x115 mm
Inventory: 3913

In 1775, Felice Fontana, director of the Museo di Fisica e Storia Naturale of Florence, published in Florence a work entitled *Descrizione e usi di alcuni stromenti per misurare la salubrità dell'aria.* One of the instruments he describes is this eudiometer—which he calls *evaerometro*—for measuring the purity of air. It was long believed that the instruments invented by Fontana had been lost, or even that they had been only designed and never built. This instrument, found in an incomplete state in the storerooms of the Istituto e Museo di Storia della Scienza of Florence, demonstrates the opposite.

Furnace

Setting: Room XVII
Maker: unknown
Date: second half 18th cent.
Materials: fireclay, iron
Dimensions: height 170 mm, max. diameter 200 mm
Inventory: 3916

Fireclay vase with iron armatures used as a furnace. There are two small openings to control fusion and two lateral protuberances serving as handles. This type of furnace was used in the second half of the eighteenth century to melt metals at low temperature. The workmanship resembles that of the tripod-mounted furnace catalogued as inv. 3914

Glass polyhedron

Setting:	Room XVII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass
Dimensions:	45x45x45 mm
Inventory:	2623

Glass polyhedron with 18 faces (6 squares and 12 hexagons). Regular solids were used to demonstrate optical and geometrical principles. From Plato onward, they also inspired a new vision of the ultimate structure of matter. In the second century C.E., the early alchemists identified earth with the cube, fire with the tetrahedron, water with the icosahedron, air with the octahedron, and the Quintessence with the dodecahedron. With the rise of chemical and mineralogical crystallography in the late Renaissance, polyhedrons took on a new function and significance.

Glass polyhedron

Setting:	Room XVII
Maker:	unknown
Date:	second half 18th cent.
Materials:	glass
Dimensions:	50x50x50 mm
Inventory:	3181

Pentadodecahedron or regular dodecahedron (regular polyhedron, with 12 pentagonal faces). Regular solids were used to demonstrate optical and geometrical principles. From Plato onward, they also inspired a new vision of the ultimate structure of matter. In the second century C.E., the early alchemists identified earth with the cube, fire with the tetrahedron, water with the icosahedron, air with the octahedron, and the Quintessence with the dodecahedron. With the rise of chemical and mineralogical crystallography in the late Renaissance, polyhedrons took on a new function and significance.

Glass polyhedron

Setting: Room XVII
Maker: unknown
Date: second half 18th cent.
Materials: glass
Dimensions: 50x50x50 mm
Inventory: 2622

Icosahedron (regular polyhedron, with 20 regular triangular faces). Regular solids were used to demonstrate optical and geometrical principles. From Plato onward, they also inspired a new vision of the ultimate structure of matter. In the second century C.E., the early alchemists identified earth with the cube, fire with the tetrahedron, water with the icosahedron, air with the octahedron, and the Quintessence with the dodecahedron. With the rise of chemical and mineralogical crystallography in the late Renaissance, polyhedrons took on a new function and significance.

Hydrometer

Setting: Room XVII
Maker: Barthélemy
Place: Montpellier
Date: 18th cent.
Materials: silver; case: wood
Dimensions: 237x75x45 mm
Inventory: 2023

Hydrometer housed in a wooden box with a series of weights and a wooden thermometric scale (the thermometric tube is missing). Inside the lid is a label with the name of the maker, Barthélemy.

This instrument was used to measure the specific gravity (density) of liquids. It comprises a spherical silver float whose underside is fitted with a small shaft on which the weights can be screwed. A graduated rod is attached to the top side.

The specific gravity of the liquid in which the instrument was partially immersed was determined from the portion of the graduated rod emerging from the liquid itself.

Lens

Setting:	Room XVII
Maker:	Benedetto Bregans (lens), Francesco Spighi, Gaspero Mazzeranghi (mount)
Place:	Lens: Dresden / Mount: Florence
Date:	Lens: 1690 / Mount: 1767
Materials:	lens: glass, wood / mount: brass, iron, wood
Dimensions:	lens diameter 450 mm
Inventory:	2545, 2710/bis

A large lens, mounted in a gilt wooden frame, with a focal length of 1,580 mm. Another smaller lens acts as a condenser and can be positioned by means of a sliding mechanism along a supporting track. Beyond the condenser is a small adjustable metal plate for holding specimens. The wooden mount on a small table fitted with castors, dated 1767, is the work of the Florentine artisan Francesco Spighi; the metal parts are signed by Gaspero Mazzeranghi. The maker of the lens, Benedetto Bregans, about whom we have no certain information, donated it to Grand Duke Cosimo III de' Medici in 1697. The instrument was used some time later by Giuseppe Averani and Cipriano Targioni for experiments on the combustion of diamonds and other precious stones. In 1814, Humphrey Davy — on a visit to Florence with Michael Faraday — used the lens to repeat Averani's experiments. In 1860, Giovanni Battista Donati mounted the lens on a tube (inv. 582) for use as a starlight condenser to observe the absorption bands of stellar spectra.

Long-necked matrass

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	height 430 mm
Inventory:	1920

Glass matrass. The instrument's special shape made it easier to prepare solutions of salts. It has traces of an unidentified substance at the bottom (contents altered by 1966 Arno flood). Provenance: Lorraine collections.

Matrass

Setting:	Room XVII
Maker:	unknown
Date:	18th-19th cent.
Materials:	glass
Dimensions:	height 280 mm
Inventory:	1922

White glass matrass, spherical, and flared, with internal frosting. The instrument's special shape made it easier to prepare solutions of salts. It has traces of an unidentified substance at the bottom (contents altered by 1966 Arno flood). Provenance: Lorraine collections.

Matrass with descending still

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	height 330 mm, diameter 50 mm
Inventory:	1650

The matrass is fitted with a descending still to obtain reactions with volatile substances. Contains unidentified substances (contents altered by 1966 Arno flood). Provenance: Lorraine collections.

Mercury thermometer

Setting:	Room XVII
Maker:	Felice Fontana [attr.]
Place:	Italian
Date:	second half 18th cent.
Materials:	wood, glass
Dimensions:	length 581 mm
Inventory:	2038

Mercury thermometer probably built by Felice Fontana, comprising a pear-shaped bulb and a long broken tube, mounted on a wooden board with the scale marked on paper. The board is hinged and folds flat when the clasp is released.
On the back are the following notations in Fontana's handwriting: "*a*, *a*, indicates the degree of frost found in June 1784, whence it appears that the mercury falls lower in summer than in winter. This observation is confirmed by the two Sample Therm[ometers] divided into 500 on the glass plate" And also: "The zero indicates frozen water compared with the perfect Therm[ometer]. The no. 4. over the freezing mark indicates 4 degrees above frozen water measured with the perfect Therm[ometer] in 1783 in the July summer." Fontana's studies on cold were certainly inspired by the research conducted shortly beforehand by the French chemist Antoine-Laurent Lavoisier.

"Monesiglio" bottle

Setting:	Room XVII
Inventor:	Giuseppe Angelo Saluzzo, Count of Monesiglio
Maker:	unknown
Place:	Italian
Date:	18th cent.
Materials:	brass, glass
Dimensions:	height 365 mm, diameter base 170 mm
Inventory:	356

Clear glass bottle with flat base, three necks at the top, and a brass faucet at the bottom. Generally referred to as a "Monesiglio" bottle after its inventor, Giuseppe Angelo Saluzzo, conte di Monesiglio. One of the first Italian scientists to explore the chemistry of gases, Monesiglio designed many chemical apparatuses in Turin, including this vessel, for the study of carbon dioxide.

Mortar

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	porphyry, metal, wood
Dimensions:	height c. 180 mm, opening diameter 150 mm
Inventory:	2060

Porphyry mortar with porphyry pestle and wooden handle joined by a metal band with two large screws. Used to macerate plants and prepare remedies derived from plants. Provenance: Lorraine collections.

Mortars

Setting:	Room XVII
Maker:	Alessandro Tognozzi (founder)
Date:	1764
Materials:	bronze
Dimensions:	height 500 mm, opening diameter 480 mm
Inventory:	3600

Two large bronze mortars, only one of which has a pestle. They are decorated with floral motifs and reliefs of Saints Cosmas and Damian. They also carry the name of the bronze-founder engraved in Latin: "Alexander Tognozzi Joannis Dominici Moreni Nepos Fundit, Anno MDCCLXIV" [Cast by Alessandro Tognozzi nephew of Giovanni Domenico Moreni, year 1764]. We have no information on Tognozzi. Provenance: Lorraine collections.

Portable pharmacy

Setting: Room XVII
Maker: unknown
Place: Tuscany
Date: 18th cent.
Materials: wood, leather, crystal, silver
Dimensions: 350x100x150 mm
Inventory: 3820

Tuscan-made portable pharmacy consisting of a box covered in red morocco with gold tooling. Contains a set of small items: crystal bottles with caps and silver trimmings, a drinking glass, a funnel, and a wooden spoon. The base has a small secret compartment and the inside of the lid carries the original mirror. There is a gold-plated key. The box is adorned with brass plates and studs.

Precision balance

Setting: Room XVII
Maker: unknown
Date: 19th cent.
Materials: steel, brass; case: wood, glass
Dimensions: 490x290x555 mm
Inventory: 1332

Precision balance of the pillar type, housed in a glass case with three drawers. The hanger in which the balance beam pivots is suspended from a small bar that can be raised or lowered by means of a threaded handle on the front of the balance and a cord passing on pulleys. By turning the handle, one can therefore raise the balance from rest position and ready it for weighing.

Precision balance

Setting: Room XVII
Maker: unknown
Date: 19th cent.
Materials: iron, brass, marble
Dimensions: 1120x868 mm, pan diameters 390 mm
Inventory: 997

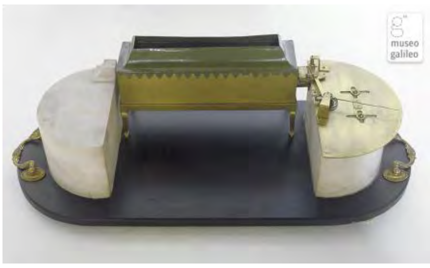
The balance is supported by a marble pillar with an internal stop mechanism, a screw-controlled lever, two bubble levels at the top of the pillar, with brass adjustment screws. There are an iron cross-beam and brass pans, with their suspension cords. The 1807 inventory lists the item as belonging to the Chemistry Laboratory of Museo di Fisica e Storia Naturale. Consequent provenance: Lorraine collections.

Pressure receiver or de Morveau's disinfection apparatus

Setting: Room XVII
Inventor: Louis-Bernard Guyton de Morveau
Maker: unknown
Date: early 19th cent.
Materials: mahogany, glass
Dimensions: total height 405 mm, base 240x147 mm
Inventory: 3778

Thick-walled glass vessel housed in a wooden frame. A large screw holds a wooden cap on the vessel. Such devices were typically used to demonstrate phenomena due to air compression. This particular vessel, however, was used to prepare chlorine gas from a reaction involving manganese dioxide, common salt, and sulfuric acid. The gas was kept under moderate pressure. When the screw was loosened, the cover rose and the chlorine escaped into the room, disinfecting it. The operation could be repeated several times without having to "recharge" the vessel. This disinfection system, invented by Guyton de Morveau in the early nineteenth century, was widely used in hospitals between c. 1805 and 1820. A similar instrument was built by the instrument-maker Dumotiez and the pharmacist Boullay, about whom we have little information. Provenance: Lorraine collections.

Pyrometer or dilatometer



Setting: Room XVII
Inventor: Petrus van Musschenbroek
Maker: unknown
Date: second half 18th cent.
Materials: slate, marble, iron, brass
Dimensions: height 230 mm, base 760 x 320 mm
Inventory: 573

The apparatus was used to measure the dilation of metal rods when heated. It rests on a slate base with white marble uprights. The test metal rod (in this case, an iron rod) is heated by immersion in a brass vessel containing hot water. When the rod expands, it pushes a brass lever that moves a pointer on a graduated scale. The pointer is connected to a helical spring, allowing it to move in either direction. The instrument was designed in 1731 by Petrus van Musschenbroek, who called it "pyrometer"; today, the term "dilatometer" is preferred. In Musschenbroek's model, the test rod was heated by a row of flames from spirit lamps. Later, baths of hot liquid were used. Provenance: Lorraine collections.

Replica of the 14th c. bas relief from Giotto's bell tower illustrating a medical scene

Setting:	Room XVII
Author:	unknown
Date:	20th cent.
Materials:	chalk
Dimensions:	690x830 mm
Inventory:	3751

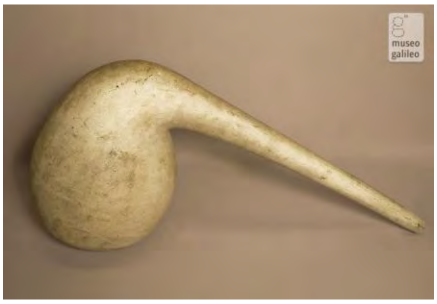
Copy of a panel of the first set of reliefs decorating the base of Giotto's Campanile. The panel shows a medieval *ambulatorium* or medical dispensary: several women are waiting to hand the doctor a urine glass with the urine to be analyzed. The original bas-relief, now housed in the Museo dell'Opera del Duomo, was sculpted between 1334 and 1336 by Andrea Pisano and his assistant(s), or by his son Nino. The work was long attributed to Andrea Pisano.

Retort

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	length 350 mm
Inventory:	3787

Unlike the fireclay items inv. 1752 and inv. 1753, this retort is made of glass and also has a small open beak. Used for distillation. Provenance: Lorraine collections.

Retort



Setting: Room XVII
Maker: Josiah Wedgwood
Place: England
Date: second half 18th cent.
Materials: fireclay
Dimensions: length 530 mm, height 265 mm
Inventory: 1755

Fireclay retort signed "Wedgwood" on the beak, from the workshop of Josiah Wedgwood, the famous potter and instrument-maker. The Museo di Fisica e Storia Naturale of Florence purchased 13 retorts in April 1793 to increase the capabilities of the chemistry laboratory, which already possessed instruments and other items from the English factory. Wedgwood's retorts were appreciated by chemists across Europe for their resistance to temperature swings.

Retort

Setting: Room XVII
Maker: Josiah Wedgwood
Place: England
Date: second half 18th cent.
Materials: fireclay
Dimensions: length 620 mm, height 300 mm
Inventory: 1756

Fireclay retort signed "Wedgwood" on the beak, from the workshop of Josiah Wedgwood, the famous potter and instrument-maker. The Museo di Fisica e Storia Naturale of Florence purchased 13 retorts in April 1793 to increase the capabilities of the chemistry laboratory, which already possessed instruments and other items from the English factory. Wedgwood's retorts were appreciated by chemists across Europe for their resistance to temperature swings.

Retort

Setting: Room XVII
Maker: Josiah Wedgwood
Place: England
Date: second half 18th cent.
Materials: fireclay
Dimensions: length 500 mm, height 215 mm

Inventory: 1754

Fireclay retort signed "Wedgwood" on the beak, from the workshop of Josiah Wedgwood, the famous potter and instrument-maker. The Museo di Fisica e Storia Naturale of Florence purchased 13 retorts in April 1793 to increase the capabilities of the chemistry laboratory, which already possessed instruments and other items from the English factory. Wedgwood's retorts were appreciated by chemists across Europe for their resistance to temperature swings.

Retort

Setting: Room XVII
Maker: unknown
Date: second half 18th cent.
Materials: fireclay
Dimensions: height 320 mm
Inventory: 3915

Fireclay retort with neck and curved side beak, probably made in the second half of the eighteenth century.

Retorts

Setting: Room XVII
Maker: Josiah Wedgwood
Date: second half 18th cent.
Materials: fireclay
Dimensions: 400x140 mm
Inventory: 1752, 1753

As standard distillation devices, retorts were invariably included in pharmaceutical equipment sets. Most retorts were made of fireclay and could thus withstand wide temperature swings. A glass retort is also on display at the Museo (inv. 3787). Provenance: Lorraine collections.

Rumford's thermoscope

Setting: Room XVII
Inventor: Benjamin Thompson, Count Rumford
Maker: unknown
Date: first half 19th cent.
Materials: wood, glass
Dimensions: lenght 317 mm, height 225 mm
Inventory: 1774

The thermoscope — or differential thermometer — was invented in the very early nineteenth century by the physicial and chemist Benjamin Thompson, Count Rumford. It was an ingenious instrument for measuring the transmission of heat. The U-shaped glass tube containing a drop of liquid is attached to a wooden board, graduated on its horizontal side. When the temperature in one bulb exceeds that of the other, the air in it expands, causing the drop of liquid to move inside the tube.

Standard meter

Setting: Room XVII
Maker: Henri-Prudence Gambey
Place: Paris
Date: first half 19th cent.
Materials: steel; case: wood
Dimensions: 1042x83x58 mm
Inventory: 1362

Steel meter housed in a walnut case with two locks and two keys. The length of this specimen measured from end to end slightly exceeded the official standard value — showing how difficult it was to manufacture metric bars to the exact desired length. The construction of the meter was assigned to French chemists in 1789. By applying the findings accumulated in a significant series of experiments on the dilatation of metals, they succeeded in obtaining a result that approximated the intended standard. This meter was probably acquired from France in 1798 during the international metrology congress in Paris, attended by Giovanni Fabbroni, deputy director of the Museo di Fisica e Storia Naturale of Florence.

Tabula affinitatum

Setting:	Room XVII
Inventor:	Étienne-François Geoffroy
Author:	Franz Huber Hoefer [attr.]
Date:	ca. 1766
Materials:	oil on canvas
Dimensions:	1540x1300 mm
Inventory:	1899

Table of chemical affinities between substances. Commissioned around 1766 by the pharmacist Franz Huber Hoefer for the apothecary's shop of the Grand Duke of Florence, this large table of chemical substances was designed to guide the preparer of pharmaceutical remedies in identifying the compounds most likely to combine with one another. The table is modeled on Étienne-François Geoffroy's *Table des differents Rapports observés entre differentes substances* (Paris, 1718), from which it differs by adding a seventeenth column. The substances are identified by traditional alchemical symbols and the symbolic language in use in the seventeenth and early eighteenth centuries. The Florentine table does not, however, include the symbol of air. This means that it was compiled in a period when there was not yet a full awareness of the function of air as a chemically active substance, hence capable of combining with solids and liquids. A similar table is found among the plates of Diderot and d'Alembert's *Grande Encyclopédie*.

Tripod-mounted furnace

Setting:	Room XVII
Maker:	unknown
Date:	second half 18th cent.
Materials:	fireclay, iron
Dimensions:	height 340 mm, max. diameter 205 mm
Inventory:	3914

Fireclay furnace with two openings resting on an iron tripod. This type of furnace, built in the second half of the eighteenth century, was used for many chemical operations. By placing a crucible over it, one could cast lead, tin, bismuth, and — generally speaking — all substances that did not require high temperatures to melt. Alternatively, by placing a basin or vase on top of it, one could calcinate metals. An identical furnace is described in the third section of Antoine-Laurent Lavoisier's *Traité élémentaire de chimie* (Paris, 1789).

Tubes terminating in bubbles

Setting:	Room XVII
Maker:	unknown
Date:	18th cent.
Materials:	glass
Dimensions:	length 1200 mm, 1120 mm
Inventory:	1938, 1940

Two glass tubes, both terminating in a round bulge at one end. Typically used for solutions of salts in water. Provenance: Lorraine collections.

Volta hydrogen lamp

Setting:	Room XVII
Inventor:	Alessandro Volta
Maker:	unknown
Date:	ca. 1790
Materials:	glass, brass
Dimensions:	total height 733 mm, globe diameter 190 mm
Inventory:	1243

Hydrogen lamp invented by Alessandro Volta. Consists of a glass globe with a brass base and brass collar with stop-cock. Above the latter projects sideways a bent tube terminating in a nozzle. Next to it are two electrodes forming a spark gap and a small brass tube for holding a waxed taper. A vase-shaped glass reservoir is fitted to a brass collar above the stop-cock. The hydrogen in the globe was expelled from the nozzle by the pressure of the water pouring from the reservoir. The gas, ignited by the small spark from an electrophorus, lit the taper. Provenance: Lorraine collections.

Voltaic detonating-gas eudiometer

Setting: Room XVII
Inventor: Alessandro Volta
Maker: unknown
Date: ca. 1790
Materials: brass, glass
Dimensions: total height 490 mm, tube diameter 20 mm
Inventory: 1627

Eudiometer designed by Volta. Consists of a funnel-shaped brass base to collect gases from a pneumatic trough, a stop-cock, and a tube with, at its top, a brass collar with a spark gap terminating in a brass ball. The instrument resembles Volta's final version of 1790, but the glass tube is not graduated, perhaps because it is a modern replacement. The tube was filled with water and placed upside down in the trough, which was also filled with water. A mixture of air and hydrogen was then introduced, displacing the liquid. The mixture was exploded by an electric spark that made the hydrogen react with the oxygen in the air, producing a small quantity of steam that condensed. After the reaction, the water would rise back up the tube to a given height. From this one could determine the volume of the nitrogen that had not taken part in the reaction but had remained in the tube. Provenance: Lorraine collections.

Wedgwood pyrometer

Setting: Room XVII
Inventor: Josiah Wedgwood
Maker: Josiah Wedgwood
Place: England
Date: late 18th cent.
Materials: wood, fireclay
Dimensions: length 200 mm, width 119 mm, height 73 mm
Inventory: 546

Thanks to its simplicity, the pyrometer designed by Josiah Wedgwood c. 1785 enjoyed immense success in the following decades. The need to introduce physics-based measurement systems into chemistry led Wedgwood to take an instrument originally developed by experimental physicists and adapt it to the requirements of the chemical laboratory. The instrument relies on the property of clay to shrink in proportion to the rise in temperature. It was used to measure the temperature of chemical ovens. The pyrometer consists of a mahogany cabinet with a sliding lid, divided into two compartments. The upper compartment contains four small cylindrical sections and some fifty smaller pieces of dried white clay. The lower compartment contains a drawer carrying a rectangular brass plate to which three rulers are fastened with screws. The rulers are separated by two grooves narrowing at one end and designed so that, if they were placed one after the other, the second would form the extension of the first. The thermometric scale, engraved on both external sides of the two grooves, carries a subdivision into single degrees from 0 to 240° Fahrenheit (i.e., from -17.7° to 115.5° Celsius). The Museo di Fisica e Storia Naturale of Florence acquired Wedgwood's pyrometer between 1790 and 1817.

Room XVIII

Science at home

Paola Bertucci

In this room we can see how, starting in the 18th century, scientific instruments entered the homes of the upper classes. The vogue for experimental science created a new market for instrument makers who, along with one-of-a-kind pieces produced for collectors, introduced a series of standard instruments furnished with kits of accessories. In the large display case, containing an antique vetrine from Lorraine times, are compound microscopes, reflecting telescopes and electrostatic machines, which were used in the domestic sphere for cultural entertainment and self-learning. Some instruments - splendid table clocks, elegant globes, finely decorated barometers and thermometers - became furnishing items, displayed as symbols of cultural and social status. Extravagant objects such as telescopes for ladies equipped with ivory cosmetic boxes, and telescopes for gentlemen disguised as walking sticks, could also be found in upper-class homes.

Astronomical telescope

Setting:	Room XVIII
Maker:	Dollond firm
Place:	London
Date:	19th cent.
Materials:	brass, wood
Dimensions:	length 330 mm
Inventory:	404

Astronomical telescope made by the Dollond firm, consisting of four tubes. Three tubes are made of brass. The fourth, the largest, is made of wood. There is a complete set of lenses. The objective lens is protected by a brass cover.

Balance

Setting:	Room XVIII
Maker:	Giovanni Savoi
Place:	Florence
Date:	1766
Materials:	brass, wood
Dimensions:	270x130x305 mm
Inventory:	816

This special balance is suspended from an upright with a tripod fitted with leveling screws. This assembly rests on a walnut base in the shape of a triangular drawer. The arms are of unequal length. The upright carries a curved graduated scale. The balance beam holds a round pan suspended by three strings at one end, and a rod with two smaller superposed pans at the other end. The base is engraved with the maker's name: "Joannes Savoi Senensis f.[ecit] Florentiae A.[nno] 1766." Provenance: Lorraine collections.

Carriage clock

Setting:	Room XVIII
Maker:	Charles Cabrier II
Place:	London
Date:	ca. 1730
Materials:	silver, brass, leather
Dimensions:	clock diameter 104 mm; thickness (with glass) c. 63 mm; outer-case diameter 118 mm
Inventory:	3867

Carriage clock signed by Charles Cabrier. The silver inner case is richly fretworked. The brass outer case is covered with brown leather. The silver dial displays Roman hour numerals and Arabic five-minute numerals; at the center are two cartouches for the signature and locality. The two burnished steel hands are of the "lily and spear" design. The brass movement has a fusee and a verge escapement. The hours and quarter-hours chime also has a "dumb" (silent) setting. Strokes are repeated by pulling the cord. The movement carries the signature of Isaac Angol of Zamosc, perhaps the Polish reseller or Cabrier's Polish agent.

Carriage odometer

Setting:	Room XVIII
Maker:	Luigi Roverelli, Antonio Quinquernell
Place:	Florence
Date:	second half 18th cent.
Materials:	wood, brass, glass
Dimensions:	360x360x130 mm
Inventory:	678

This instrument, made by Luigi Roverelli and Antonio Quinquernell, measured the distance traveled by a carriage. It is housed in a perforated wooden box. The protruding chain was connected eccentrically to a wheel of the vehicle. The wheel's motion was transmitted to the odometer mechanism. This activated a pair of pointers, which displayed the distance traveled on a double gilt and silvered scale. Provenance: Lorraine collections.

Catgut-rope hygrometer

Setting:	Room XVIII
Maker:	unknown
Place:	French
Date:	18th cent.
Materials:	brass
Dimensions:	diameter 127 mm
Inventory:	2441

Hygrometer consisting of a round brass box whose top carries a dial with a circular scale and several inscriptions, protected by a glass disk. At the center of the disk is a pointer fixed to the hygroscopic substance—a catgut rope—whose end is inserted into a cork. The changes in atmospheric humidity act on the catgut rope, which, in turn, moves the pointer.

Chest type compound microscope

Setting:	Room XVIII
Inventor:	Edward Nairne
Maker:	Peter Dollond
Place:	London
Date:	late 18th cent.
Materials:	brass; box: wood
Dimensions:	max. height 369 mm; case 292x145x153 mm
Inventory:	3230

Cuff-type compound microscope, mounted on a pillar attached to a side of the chest. The body-tube is inserted in a collar fastened to the top of the pillar. Fine focus is by means of a knob screw; coarse focus is by sliding the stage along the pillar. The case contains many accessories including six objectives, a lieberkuhn, tweezers, and some specimens. The chest-type microscope was invented by Edward Nairne c. 1765; the maker of this example is Peter Dollond. Also present is a simple compass microscope, probably Dutch (lenses missing). Provenance of entire set: Lorraine collections.

Clarke medical magneto-electrical machine

Setting: Room XVIII
Inventor: Edward Marmaduke Clarke
Maker: unknown
Date: second half 19th cent.
Materials: gilt brass, steel
Dimensions: total height 142 mm, base magnet 210x85 mm
Inventory: 3547

Magneto-electric generator operating in an altogether similar manner to the machine invented by Edward Marmaduke Clarke (inv. 515). A horseshoe permanent magnet on gilded feet carries two ivory bobbins with windings of silk-covered wire. The bobbins were rotated near the magnet poles by means of a gilded pulley wheel. This compact and easily transportable device was used for electrotherapy, and the current was applied to the patient by means of two electrodes.

Compound microscope

Setting: Room XVIII
Maker: Pietro Patroni [attr.] or François de Baillou [attr.]
Place: Italian
Date: early 18th cent.
Materials: brass, ivory, cardboard, tortoiseshell
Dimensions: height 350 mm, base diameter 109 mm
Inventory: 3248

Compound microscope comprising a cardboard body-tube covered in tortoiseshell; the eyepiece and objective mounts are made of ivory (lenses missing). The instrument is mounted on a round brass base, whose center carries the stage. The latter is pressed by a spring against a ring-shaped plate, which is moved vertically for focusing by turning the octagonal knob at the top of the side pillar. The pillar holding the body-tube is fitted with similar mechanism to allow vertical travel. In order to use this instrument, it was necessary to turn it toward a source of light. The construction features suggest a maker working in Italy, possibly Pietro Patroni or François de Baillou. Provenance: Lorraine collections.

Double-case watch

Setting: Room XVIII
Maker: Daniel Quare
Place: London
Date: late 17th cent.
Materials: gilt brass, lacquered brass, enamel
Dimensions: clock diameter 48 mm; thickness (with glass) c. 30 mm; outer-case diameter 55 mm
Inventory: 3846

The clock has a gilt-brass inner case and a lacquered outer case. The enamel dial displays Roman hour numerals and Arabic five-minute numerals. The hands are of burnished steel. The special feature of this model is the hour and quarter-hour repeater, invented in England a few years earlier. The maker Daniel Quare, whose signature is engraved on the plate, perfected and presented the invention to King James II in 1687, obtaining a patent for it.

Double-case watch

Setting: Room XVIII
Maker: William Sharp
Place: London
Date: early 18th cent.
Materials: silver, tortoiseshell, brass
Dimensions: clock diameter 48 mm; thickness (with glass) c. 29 mm; outer-case diameter 54 mm
Inventory: 3848

Watch with silver inner case and brass outer case covered in red and brown tortoise-shell with silver inlays; the back carries a very delicate silver-line inlay showing a landscape with a house, a tree, and a dog. The scene is enclosed in leaf and flower volutes with a dragon's head. The sides and lunette are studded with silver nails. The hands are of burnished steel. The movement has a chain fusee and verge escapement.

Double-case watch

Setting:	Room XVIII
Maker:	Cheneviere
Place:	London
Date:	early 18th cent.
Materials:	silver
Dimensions:	clock diameter 49.5 mm; thickness (with glass) c. 31 mm; outer-case diameter 56.5 mm
Inventory:	3849

Probably intended for a patrician family, this watch has silver inner and outer cases. The outer one carries embossed Baroque motifs, with four busts on the sides, probably representing the persons who commissioned the watch. On the back is an allegory depicting a naked woman balancing on a wheel, carrying a cornucopia and holding the hand of a cupid with a bow. The silver dial has Roman hour numerals and Arabic five-minute numerals; the graduated minutes ring is in the Dutch mixtilinear style. At the center is a gold allegorical bas-relief composition, with a warrior's head, a lion with crown and scepter, a unicorn, and a flag trophy; below are the signature "Cheneviere, London" and a small round window for the rotating date disk. The hands are of steel. The movement has a chain fusee and verge escapement.

Double-case watch

Setting:	Room XVIII
Maker:	Thomas Mudge, William Dutton
Place:	London
Date:	1788
Materials:	gold, gilt brass, enamel
Dimensions:	inner-case diameter c. 42 mm; outer-case diameter 48 mm; sheath diameter c. 56 mm
Inventory:	3855

Watch signed by Thomas Mudge and William Dutton. Comprises a smooth inner case, an outer case of enamel on a blue background, and a glass-bottomed gilt brass sheath to protect the enamel. The enamel dial has Roman hour numerals. The hands are of gold. The movement has a chain fusee. The escapement, originally a cylinder model, is now an anchor type. The dust cap is removable.

Double-case watch

Setting: Room XVIII
Maker: Josiah Emery
Place: London
Date: ca. 1780
Materials: gilt brass, enamel
Dimensions: clock diameter 49 mm; thickness (with glass) c. 30 mm; outer-case diameter 56 mm
Inventory: 3854

Watch made by Josiah Emery. The smooth outer case encloses the fretworked and decorated inner case. The enamel dial has Roman hour numerals. The gilt hands are pear-shaped: the minutes hand is not original. The movement, complete with removable dust cap, is exceptionally well made, with a chain fusee and cylinder escapement. The hours and quarter-hours are repeated by a bell.

Double-case watch

Setting: Room XVIII
Maker: John Ellicott (watch), Georg-Michael Moser (outer case)
Place: London
Date: ca. 1754
Materials: gold, enamel
Dimensions: clock diameter c. 42 mm; thickness (with glass) c. 27 mm; outer-case diameter 50 mm
Inventory: 3852

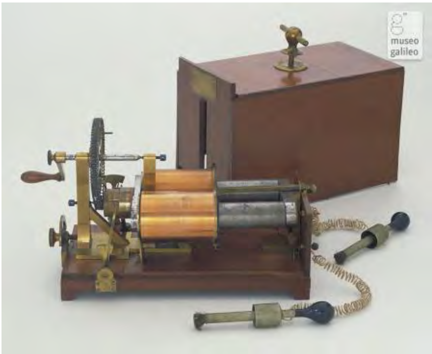
Watch signed by John Ellicott. The gold cases are fretworked. The embossing on the outer case is by Georg-Michael Moser. The back shows a seated woman being crowned by a warrior in Roman costume. The scene is framed by symmetrical baroque volutes. The type of decoration engraved on the back of the case and the serial number engraved near the pendant are recurrent features of Ellicott's watches. The enamel dial has Roman hour numerals and Arabic five-minute numerals. The hands are made of fretworked gold. The movement has a chain fusee and a dust cap. There is a cylinder escapement.

Double-case watch

Setting:	Room XVIII
Maker:	Daniel Delander
Place:	London
Date:	1739
Materials:	gold
Dimensions:	inner-case diameter 43 mm; thickness (with glass) c. 26 mm; outer-case diameter 51 mm
Inventory:	3851

Watch with finely worked inner and outer cases. The inner case has fretworked motifs of plant volutes and dragon's heads; two engraved sectors around the pendant fastening and on the opposite side show a landscape and grotesque mask; the back has a smooth surface with a rosette at the center surrounded by fretworked geometric motifs with leaves. On the embossed outer case is a mythological allegory with a man carrying a spear (perhaps Aeneas), a dog and cupid at his feet, and a seated woman (possibly Dido) at his side. The gold dial has Roman hour numerals and Arabic five-minute numerals. The hands are of blue steel. The movement has a chain fusee and a dust cap. There is a verge escapement. Signed by Daniel Delander. Completed by his son in 1739.

Duchenne's medical magneto-electrical machine



Setting:	Room XVIII
Inventor:	Guillaume Benjamin de Boulogne Duchenne
Maker:	Deleuil firm
Place:	Paris
Date:	ca. 1870
Materials:	mahogany, brass, iron
Dimensions:	box 337x183x230 mm
Inventory:	456

Apparatus for medical applications of electric current described by Guillaume-Benjamin Duchenne de Boulogne. This portable version of his "magneto-Faradic double-current apparatus," made by the Deleuil firm, is housed in a mahogany box with brass carrying-bar. The coils are wound around the poles of a powerful compound permanent magnet. The current is generated by the rotation of the armature by a geared handle. The intensity of the current is regulated by two copper cylinders sliding on the coils, covering them to a greater or lesser extent. To obtain very weak currents, the armature is moved away from the magnet poles. The box for accessories contains two nickel-plated electrodes, into which can be screwed either the electrodes with conical points (which, in use, were covered with chamois leather), or two nickel-plated tubes terminating in metal brushes. These were applied to the patient's body.

Fan

Setting:	Room XVIII
Inventor:	John Theophilus Desaguliers
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, iron, brass
Dimensions:	1080x380x825 mm
Inventory:	1377

This fan (or blower) reproduces a model designed by John Theophilus Desaguliers and presented to the Royal Society in 1734. The apparatus, like other similar ones invented in the eighteenth century, was intended to prevent the build-up of foul air or to circulate hot or cold air in hospitals, prisons, and public places.
The fan, attached to a rectangular wooden base, consists of a profiled and decorated box containing a paddle wheel activated by a handle. The air is sucked up by the moving paddles through a vertical duct leading to the wheel's center, and then expelled through the side outlet. The model provides an example of a machine that harnesses the effect of the centrifugal force. Provenance: Lorraine collections.

Gregorian telescope by Selva

Setting:	Room XVIII
Maker:	Domenico Selva or Lorenzo Selva
Place:	Venice
Date:	18th cent.
Materials:	leather, brass, steel
Dimensions:	length 400 mm
Inventory:	1419

Incomplete reflecting telescope of the Gregorian type. The eyepiece consists of two lenses, one closer to the primary mirror, the other closer to the eye. The primary mirror measures 65 mm in diameter and has a hole 17 mm in diameter. The secondary mirror is missing. Although the instrument is signed by Domenico Selva, the attribution cannot be made with certainty. His son Lorenzo, in a pamphlet of 1761 dedicated to Francesco Algarotti, states that all their instruments—even those that he had made himself—were signed with the name of his father. Lorenzo gives a precise description of this telescope: the secondary mirror was concave and made of metal; by adjusting the small steel bar parallel to the tube, the secondary mirror could be moved closer to or farther from the primary. The secondary mirror received the image of the objects from the primary, which were then magnified by the eyepiece. The telescope was supported by a wooden column (now missing) and could be oriented in any direction thanks to a brass knob attached to the column, "therefore it is practical and equally useful for terrestrial and celestial objects."

Hunter pocket watch

Setting:	Room XVIII
Maker:	James William Benson
Place:	London
Date:	1886
Materials:	gold
Dimensions:	diameter 53 mm; thickness 15.5 mm
Inventory:	3862

Watch with a smooth case. The dial, finely engraved and signed by James William Benson, carries the small seconds dial. The two large superposed hands for the chronograph are attached at the center. They are independent, each with its own start, stop, and reset button. This allows separate and simultaneous timing of two different events. There is a movement of the three-quarter-plate type and a English-lever escapement.

Hunter pocket watch

Setting:	Room XVIII
Maker:	Charles Frodsham
Place:	London
Date:	1900
Materials:	gold, enamel
Dimensions:	diameter 53.5 mm; thickness 17 mm
Inventory:	3863

Watch with smooth case and enamel dial with small seconds dial below and 60-minute counter. The chronograph hands have an arrow-shaped counterweight. There is a three-quarter-plate movement and an anchor escapement. The letters "AD.Fmsz" on the dial are a cryptogram invented by the maker, Charles Frodsham, in 1850.

Japanese watch

Setting:	Room XVIII
Maker:	unknown
Place:	Japan
Date:	mid-19th cent.
Materials:	teak, gilt brass, silver
Dimensions:	51x23x82 mm
Inventory:	3864

Japanese pendant watch made of finely engraved gilt brass. The case has a small holder for the key. The piece is in the shape of the small boxes called *inrô*, used to store personal seals, sealing wax, etc. The dial has twelve silver hour tiles that are shifted manually to compute the diurnal and nocturnal toki. The movement has a fusee, a train comprising four wheels and the contrate wheel, and a verge escapement.

Lady's telescopes

Setting:	Room XVIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	wood, ivory
Dimensions:	150x120x490 mm
Inventory:	3725

Oval ivory box housing cylindrical vases that probably contained beauty creams and powders. The ivory lid supports an ivory and wood column surmounted by a cup. Inside the column is a small telescope. A small ivory column, next to the first, houses another telescope, whose objective lens is missing. Both are low magnification telescopes, one with a diverging eyepiece, the other with a converging one.

Lane electrometer on Leyden jar

Setting:	Room XVIII
Inventor:	Timothy Lane
Maker:	unknown
Date:	late 18th cent.
Materials:	mahogany, brass, glass, tin foil
Dimensions:	total height 315 mm, leyden jar 230x115 mm
Inventory:	446

Simple Lane discharging electrometer fitted to the lid of a Leyden jar to regulate its discharge. The spark gap between the electrode of the electrometer and that of the Leyden jar gives an indication of the quantity of electricity collected in the jar. The instrument was often used in electrical therapies. In such cases, it was also called "bottiglia medica" (medical bottle). Provenance: Lorraine collections.

Mantel clock

Setting:	Room XVIII
Maker:	unknown
Place:	Central Italy
Date:	early 18th cent.
Materials:	wood, glass, brass
Dimensions:	185x110x290 mm; dial 100x950 mm
Inventory:	3584

This mantel clock is housed in a dark-varnished wooden case with glass doors. There is a dial displaying the hours from I to XII, a minute ring with Arabic numerals and, at the center, a small disk for setting the alarm. The hour hand is missing. The going train is driven by a spring with barrel and fusee. There is a verge escapement with a contrate wheel and a small pendulum integral with the latter. The alarm, driven by a spring and contrate wheel, activates the two-headed hammer that strikes the bell from inside above the movement. The case style resembles that of certain English models usually known as *bracket clocks*, and the clock's ease of use made it quite practical for domestic purposes.

Mercury thermometer

Setting:	Room XVIII
Maker:	Dollond firm
Place:	London
Date:	late 18th cent.
Materials:	brass, wood, glass
Dimensions:	height 179 mm, width (box open) 85 mm
Inventory:	2029

Mercury thermometer mounted on a brass plate and housed in a lined wooden case. A Fahrenheit scale is engraved on the brass plate. Made by Dollond.

Mercury thermometer

Setting:	Room XVIII
Maker:	Dollond firm
Place:	London
Date:	late 18th cent.
Materials:	wood, glass, silvered brass
Dimensions:	height 662 mm, width 60 mm
Inventory:	385

Mercury thermometer mounted on a brass plate and housed in a wooden box with a glass front. A Fahrenheit scale is engraved on the brass plate. Made by Dollond.

Mixing faucet

Setting: Room XVIII
Inventor: Giuseppe Leonardi
Maker: Giuseppe Leonardi
Place: Milan
Date: 1824
Materials: brass
Dimensions: height 260 mm, max. length 280 mm
Inventory: 1014

This elegant mixing faucet is a forerunner of the device fitted on most bathtubs today. It consists of two brass tubes converging into a faucet whose rotating handle is adorned by a pair of tritons. A turn of the handle increases the flow of hot water while simultaneously reducing the flow of cold water, or vice versa. A holder between the two tritons contains a small thermometer (partly broken) showing the mix temperature. Considering how few people could enjoy a bath in the early nineteenth century, such a device represented the state-of-the-art of domestic hygiene technology, as well as an extraordinary luxury. Two watercolor drawings illustrate the apparatus and the details of its construction. They carry the following inscriptions "Bathtub designed and built in Milan by Giuseppe Leonardi in 1824. Dr[awn] from real life by Alessandro Dacomo. Made by Giu[seppe] Leonardi" ["Acquario da bagni immaginato ed eseguito in Milano da Giuseppe Leonardi anno 1824 Alessandro Dacomo. Dis[egnò]. dal vero. l'anno 1824 Giù. Leonardi fece"]. We have no information on Giuseppe Leonardi. Provenance: Lorraine collections.

Nuremberg compound microscope

Setting: Room XVIII
Maker: unknown
Place: German
Date: first half 19th cent.
Materials: wood
Dimensions: height 310 mm, base diameter 125 mm; box 188x191x355 mm
Inventory: 3390

Typical compound microscope from Nuremberg, housed in a pyramidal box. The city of Nuremberg was famous for its inexpensive wooden microscopes with tubes covered with decorated paper for domestic use. The body-tube is inserted in a wooden tripod to whose base the mirror is attached. The lenses are missing.

Patented universal clock

Setting:	Room XVIII
Maker:	unknown
Place:	England
Date:	ca. 1906-1910
Materials:	brass, wood, paper
Dimensions:	globe diameter 200 mm, height 395 mm, width 250 mm
Inventory:	3588

A brass pedestal houses the clock and supports the rotating terrestrial globe. The hour is shown at the point where the brass semicircle meets the fixed circle placed on the equator and divided into 24 hours and their fractions. The semicircle can be shifted to any meridian, and the time difference between any location and the preselected one can be found where the other meridians intersect the hour circle. A threaded metal arc is screwed into a support under the terrestrial globe. A small globe representing the Sun can be screwed onto the arc by hand. From one solstice to the next, it moves 23.5° above or below the equator, giving the Sun's seasonal position. The terrestrial globe carries the inscription "Patent 19460 The Empire Clock Cable." The clock movement at the base of the globe is one of the countless variants of the "universal" clock, highly popular in the nineteenth century. Patent no. 19460 was issued to J. H. Overton on August 31, 1906.

Pendant watch

Setting:	Room XVIII
Maker:	Augustin Forfaict
Place:	Sedan
Date:	late 16th cent.
Materials:	brass, silver, gilt brass
Dimensions:	32x42 mm (excluding pendant and knob); thickness 23.5 mm
Inventory:	3843

Watch with a brass case and silver lids hinged at the top; the sides are wrapped in a silver band engraved with reclining figures, leafy volutes, and a spring of water; there is a coat of arms engraved on the front lid and a monogram on the back lid; all the engravings show signs of wear; the lids are gilt on the inside. The pendant is welded to the case and holds a loose round ring; the knob is turned.
The gilt dial is engraved with floral volutes and a winged head facing downward. At the center is a view of a town by a river, probably Sedan (north-east of Reims, on the Moselle), with a fisherman in the foreground. The silver chapter ring is fairly thin, with Roman hour numerals separated by marks. The elegant burnished steel hand is in the shape of a lily.
This oval pendant watch is signed by Augustin Forfaict. Its mechanism is extractable by means of bayonet hooks. The movement has a gut fusee and a verge escapement. The balance lacks a regulator.

"Perpetual motion" clock

Setting:	Room XVIII
Maker:	unknown
Place:	Central Italy
Date:	ca. 1660-1680
Materials:	wood, iron, brass
Dimensions:	620x315x2070 mm
Inventory:	713

The unusual case is of ebonized pearwood, with gilt ornamentation, curlicues, and edges. The pedestal holds an eight-pillared loggia enclosing a light gilt brass structure consisting of curved-line sections imitating three helical spires. Just below the pillars, in a square at the center, is the dial with a silvered hour circle engraved with Roman hour numerals, quarter-hours, and half-hours. The winding hole is above. In 1797, glass panels were fitted to protect the curved brass structure. The machine is housed inside the case level with the dial. It is driven by a weight with rope, a drum, and a train comprising three iron wheels regulated by two brass flywheels. The train is arranged horizontally between two narrow iron plates. The regulation system consists of a small ball (originally, one assumes, of lead or gilt silver), which is dropped from the top of the case and travels down the curved path formed by the thin brass strip with siderails between the pillars of the loggia. The ball then falls into the launch tube and its weight releases the catapult mechanism. It is thus projected upward into the special hole at the top of the case. From there, the ball bounces onto an inclined plane that takes it to the opening at the top of the curved path. There it begins a new descent. Meanwhile, the clock movement reloads the launch mechanism. Each cycle lasts about 30 seconds. The exact duration depends on the ball's specific weight and the tilt of the brass strip.
This clock is described in the 1692 inventory of the Medici Wardrobe (preserved at the Archivio di Stato in Florence) as a "...clock or instrument called perpetual motion..." Inside the pedestal is the inscription "Rassettato tutto nel 1797 a di 2 7mbre Sud.o Il legname da Pasquale Bassetti. Il meccanismo da Fe. Gori" ["All repaired on this day, September 2, 1797, the carpentry by Pasquale Bassetti, the mechanism by Fe[lice] Gori"]. The name "perpetual motion" originates in the seventeenth-century vogue for such contrivances.

Pharmacy jars

Setting:	Room XVIII
Maker:	unknown
Date:	19th cent.
Materials:	glass
Dimensions:	max. height c. 240 mm, opening diameter 110 mm
Inventory:	Dep. OSMN, Firenze

Sixteen white glass pharmacy jars of different sizes, with lids and gold ornamentation. The design is that of the albarello: a spool shape, tapered in the middle, and a lid with a knob and double handle. The content is indicated in a cartouche on the lower part of each jar. Provenance: Ospedale di Santa Maria Nuova in Florence.

Pince-nez spectacles

Setting:	Room XVIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	gilt brass
Dimensions:	length 105 mm, height 60 mm
Inventory:	2581

Gilt brass pince-nez spectacles. The lenses, however, are replaced by two brass disks holding two short cylinders with viewing holes. The disks serve to limit the pupil diameter, thereby improving eyesight in certain conditions. This contrivance was first described in 1677 by Chérubin d'Orléans, but was probably known earlier.

Portable pharmacy

Setting:	Room XVIII
Maker:	unknown
Date:	late 18th cent. - early 19th cent.
Materials:	wood
Dimensions:	470x250x370 mm
Inventory:	3814

This portable pharmacy dates from the second half of the eighteenth century or early nineteenth century. It consists of a small wooden trunk with iron trimmings, complete with a key. There are drawers and doors on the sides. The inside of the lid is decorated. The trunk contains small bottles and metal boxes, as well as minerals and small envelopes filled with various preparations and substances.

Portable pharmacy

Setting:	Room XVIII
Maker:	unknown
Date:	late 18th cent.
Materials:	wood
Dimensions:	190x180x138 mm
Inventory:	3752

Portable pharmacy consisting of a silk-lined inlaid wooden box, containing flasks for medicinal preparations and a small ceramic cup and saucer adorned with floral motifs.

Portable plate electrical machine

Setting:	Room XVIII
Maker:	unknown
Date:	second half 18th cent.
Materials:	mahogany, brass, glass
Dimensions:	total height 220 mm, base (excluding conductor) 185x77 mm, glass disk diameter 140 mm, thickness 2.77 mm
Inventory:	374

Unusually small frictional electrical machine with glass disk. The brass prime conductor, supported by a glass pillar, has two curved arms, each terminating in a concave disk with sharp points (the collectors). These end in close proximity to the surface of the glass disk. The amount of charge is controlled by the Lane discharging electrometer with vernier scale on its wooden support. Provenance: Lorraine collections.

Scale

Setting:	Room XVIII
Maker:	Youngs & Son firm
Place:	London
Date:	19th cent.
Materials:	wood, brass
Dimensions:	910x510x980 mm
Inventory:	3579

A small decorated table carries a compact upholstered armchair connected to a brass steelyard by means of a mobile frame and lever. The steelyard, secured to the table, is supported by a thin pillar and carries a pan and counterpoise. An ornate pointer attached to the steelyard arm is used to determine the equilibrium position against a reference rod. Dates from the second half of the nineteenth century. Made by Youngs & Son.

Scale

Setting:	Room XVIII
Maker:	unknown
Place:	Florence
Date:	18th cent.
Materials:	wood, copper, steel
Dimensions:	1450x1940 mm
Inventory:	1016

A wooden upright supports a special unequal-arm balance. One end of the balance beam carries a wooden cage seating one person; the other end holds a brass pan for the weights. Provenance: Lorraine collections.

Single-hand oignon

Setting:	Room XVIII
Maker:	Nicolas Gribelin [attr.]
Place:	Paris
Date:	late 17th cent.
Materials:	gilt brass, enamel
Dimensions:	diameter 62 mm; thickness (with glass) c. 41 mm
Inventory:	3847

Richly engraved and decorated *oignon* watch [French for "onion," referred to in Italian by the pejorative *cipollone* or "big onion"]. Has a movement with chain fusee and verge escapement. The gilt brass dial has blue Roman hour numerals on white enamel cartouches. The single hand is of burnished steel. Signed "Gribelin à Paris," in all probability the watchmaker Nicolas Gribelin.

Siphon barometer

Setting: Room XVIII
Maker: Giovanni Domenico Tamburini [attr.]
Date: early 18th cent.
Materials: wood, glass, paper
Dimensions: height 990 mm, width 140 mm
Inventory: 1142

Siphon barometer placed in a wooden box with glass front window. The inside is lined with arabesqued paper. The barometric scales are printed on a sheet of paper. They are surmounted by the Medici coat of arms, below which is the inscription "Magnum Barometrum" and some instructions for using the instrument. There is also a thermometer, whose bulb is broken. The instrument is fitted with a recording pointer running on a vertical metal wire. The similarity with the two barometers inv. 3627 and inv. 1141 suggest an attribution to Giovanni Domenico Tamburini, about whom we have no information.

Stick barometer

Setting: Room XVIII
Maker: unknown
Date: late 18th cent.
Materials: wood, brass, ivory
Dimensions: height 1153 mm
Inventory: 697

Walking stick containing a barometer with ivory cistern and metal support. The head carries a magnetic compass. The barometer is extracted by unscrewing the head. The glass parts are lost. A screw under the cistern regulated the bottom inlet, allowing the barometric tube to be completely filled with mercury when the instrument was not in use. The barometric scale is in French inches. There was a thermometer, of which only the thermometric scale survives.

Tavern clock

Setting:	Room XVIII
Maker:	unknown
Place:	England
Date:	ca. 1760-1770
Materials:	wood, brass, steel
Dimensions:	700x210x1330 mm
Inventory:	3731

The varnished and lacquered wooden case is of the English "shield" type. The lower part of the clock has a door decorated with a lacquered Chinese landscape. Opening the door gives access to the pendulum and driving weight. In the compartment behind the dial another door gives access to the movement. The ends of the upper cornice carried two small ornamental vases or knobs, for which the housing holes remain. The large dial originally had a black background with gold numerals and line markings, still visible. The hands are replacements. The winding hole is just under the center. The train comprises four wheels, including the main wheel on the axle of the rope-winding drum and not counting the escapement wheel. The rugged steel escapement is an anchor version. The seconds pendulum has a spring suspension and brass crutch. The rod ends in a hook to which was attached a weight (missing) less cumbersome than the bob. This design is well known. It is often referred to as an "Act of Parliament Clock" because of a misinterpretation of a tax introduced in 1797. Its standard name is "tavern clock" and the size of the dial certainly made it suitable for large public premises. As it could be hung from a safe height and had a short case, it was protected from potential damage from overcrowding in the locale where it was installed.

Terrestrial globe

Setting:	Room XVIII
Author:	Maison Delamarche
Place:	Paris
Date:	1844
Materials:	paper, wood
Dimensions:	sphere diameter 80 mm, height 185 mm, width 113 mm
Inventory:	Dep. SBAS, Firenze

This finely colored terrestrial globe is the smallest in the collection of the Museo Galileo. Published by the Maison Delamarche of Paris, when it was located at 7 Rue du Battoir. An inscription records the slaying of James Cook in 1779 near Hawaii.

Terrestrial telescope

Setting:	Room XVIII
Maker:	unknown
Place:	English or German?
Date:	first half 18th cent.
Materials:	cardboard, paper
Dimensions:	length 1140 mm
Inventory:	2549

Terrestrial telescope consisting of six cardboard tubes, covered with paper of various colors. The largest tube contains the eyepiece, the smallest contains the objective. All the lenses are biconvex. The fourth tube is not original. The instrument's magnification is c. 10. This is a typical telescope of the early eighteenth century, but not of Italian construction.

Terrestrial telescope

Setting:	Room XVIII
Maker:	Leonardo Semitecolo
Place:	Italian
Date:	second half 18th cent.
Materials:	cardboard, leather, horn, brass
Dimensions:	length 615 mm
Inventory:	3339

Terrestrial telescope consisting of four cardboard tubes. The orange leather covering the largest tube bears the signature of the maker, Leonardo Semitecolo, and carries his characteristic tooling. The leather on the other tubes is white. All the tubes have horn rings, one of which has been replaced by a wooden ring. The largest tube houses the biconvex objective, which has an aperture of 11 mm and a focal length of 370 mm. The smallest tube contains the compound eyepiece, consisting of three biconvex lenses. The mounts for the objective and the eyepiece are of horn and brass with sliding brass covers. The instrument's magnification is 9.

Terrestrial telescope

Setting:	Room XVIII
Maker:	unknown
Place:	Italian
Date:	first half 18th cent.
Materials:	cardboard, paper
Dimensions:	length 1050 mm
Inventory:	3549

Terrestrial telescope consisting of five cardboard tubes. The largest is covered with brown (previously white) and gray marbled paper. The other tubes are covered with blue paper carrying white geometrical patterns. One of the tubes is lined with paper with Italian writing. The biconvex objective lens is contained in the largest tube and has a diameter of 33 mm. The compound eyepiece consists of three biconvex lenses. It is housed in a little tube, covered with white paper with floral decorations, that can be inserted into the smaller tube of the telescope. The instrument's magnification is 15.

Two-hand pavilion clock

Setting:	Room XVIII
Maker:	unknown
Place:	Southern Germany
Date:	first half 17th cent.
Materials:	gilt brass, silver, iron
Dimensions:	175x175x334 mm
Inventory:	3865

The smooth case rests on a wide base. The upper part—the "dome"—has fretworked sides through which one can see the chime and alarm bells. The silver dial holds a rotating disk at the center for the alarm. On the back are small dials for controlling the chimes. The lantern-shaped iron movement has three trains: the going train with a five-coil gut fusee and a verge escapement, and two separate chime trains for the hours and quarter-hours.

Two-hand pavilion clock

Setting:	Room XVIII
Maker:	Christoph Miller
Place:	Augsburg
Date:	1640-1650
Materials:	gilt brass, gilt copper
Dimensions:	140x140 mm; height 110 mm
Inventory:	3866

Table clock signed by Christoph Miller. The square case has side-windows to show the movement. The gild brass back is engraved with large floral motifs. The hours and minutes are marked on two separate silvered rings. At the center is a rotating disk for the alarm. The movement has three trains: the going train with a six-coil chain fusee and a verge escapement, and two separate chime trains for the hours and quarter-hours.

Walking stick telescope

Setting:	Room XVIII
Maker:	unknown
Date:	late 17th cent. - first half 18th cent.
Materials:	wood, brass, iron, silver, silk
Dimensions:	length 950 mm
Inventory:	2547

Telescope consisting of a wooden walking stick with brass fittings and a screw top. The objective lens, housed in the bottom end, is exposed when the brass tip is unscrewed. The compound eyepiece is in the top end.

Watch

Setting:	Room XVIII
Maker:	Humphrey Downing
Place:	London
Date:	mid-17th cent.
Materials:	silver
Dimensions:	diameter 46 mm; thickness (with glass) c. 22 mm
Inventory:	3844

Watch with round silver onion case. The silver dial displays Roman hour numerals with a single hand of burnished steel. The movement has a gut fusee and a verge escapement. The balance lacks a regulator. Signed "Humphrey Downing Londini Fecit."

Watch

Setting:	Room XVIII
Maker:	unknown
Place:	France
Date:	ca. 1800
Materials:	gold, enamel
Dimensions:	diameter 57 mm
Inventory:	3857

French watch with a smooth case. The enamel dial is in the lower half, surrounded by a concentric graduated scale, on which the hand with the shining Sun indicates the negative or positive difference in minutes between true solar time and the mean time shown by the watch (this difference is called the time equation). The two small dials on the upper half of the main dial give the dates (left) and months (right). There is a fusee movement and a verge escapement.

Watch

Setting:	Room XVIII
Maker:	Urban Jürgensen
Place:	Copenaghen
Date:	ca. 1810-1820
Materials:	gold, enamel
Dimensions:	diameter 58 mm
Inventory:	3859

Watch signed by Urban Jürgensen. The back of the smooth case is engraved with the monogram "GVH." The enamel dial has Roman hour numerals. The movement has a fixed-barrel time train. The escapement is a two-wheel duplex. The markings are in Danish.

Watch

Setting: Room XVIII
Maker: Christopher Williamson
Place: London
Date: 1838
Materials: gold, silver
Dimensions: diameter 53 mm
Inventory: 3861

Watch signed by Christopher Williamson. The gold case has an engraved back and coat-of-arms at the center with the motto "Vincit Veritas" ["Truth Wins"]. The silver dial has a bas-relief engraving of a flower basket and the seconds in the lower section. There is a movement of the full-plate type and a detent escapement. The balance has a flat spiral. The repeater for the hours, quarter-hours and eighths-of-an-hour has a sliding control.

Watch

Setting: Room XVIII
Maker: unknown
Place: Switzerland
Date: ca. 1800
Materials: gold, enamel
Dimensions: diameter 57 mm
Inventory: 3858

Watch with dead-beat seconds at the center, made in Switzerland for the English market. The case is composed of two glass-covered lunettes surrounded by mounted silver rosettes. The enamel dial, with Roman hour numerals and Arabic 15-minute numerals, carries the seconds hand at the center. The movement has no fusee and the escapement is of the anchor type, a design invented by the Genevan clockmaker Jean-Moisé Pouzait. The large balance is made of silver, with S-shaped arms and studded with rosettes.

Watch

Setting: Room XVIII
Maker: unknown
Place: France
Date: ca. 1795-1800
Materials: gilt brass, enamel
Dimensions: diameter 58 mm
Inventory: 3856

French watch. The case is smooth and the enamel dial has four separate small dials for duodecimal hours (bottom), decimal hours (top), 31-day date (left), and 30-day date of revolutionary month (right). The dial rim displays the days of the French revolutionary calendar (*primidi - duodi - tridi - quartidi - quintidi - sextidi - septidi - octidi - nonodi - décadi*) indicated by the long hand. Some revolutionary symbols are depicted in the space between the dials: square and compass, clasped hands, skull, and cap. The movement has a fusee and verge escapement. The decimal hour and Republican calendar were introduced on October 5, 1793, and were abolished on January 1, 1806.

Watch

Setting: Room XVIII
Maker: Henry Harper
Place: London
Date: ca. 1685
Materials: silver
Dimensions: diameter 46 mm; thickness (with glass) c. 30 mm; outer-case diameter 53 mm
Inventory: 3845

Single-hand watch made by Henry Harper. Round-shaped with silver inner and outer cases. The date pointer is attached to a rotating gilt ring. The folding movement has a chain fusee and a verge escapement. An early example of clock with spiral-spring balance.

Watch

Setting:	Room XVIII
Maker:	Jean-Baptiste Baillon de Fontenay [attr.]
Place:	Paris
Date:	1764
Materials:	gold, brass, enamel
Dimensions:	diameter 50 mm; thickness (with glass) c. 24 mm
Inventory:	3853

The case of this watch carries deeply engraved recurrent motifs around the crystals; the back has radiating grooves to simulate a shining star. The dial is made of enamel. The skeleton movement. The train comprises four wheels, plus the escapement wheel. The position of the first wheel between the fusee and the central wheel provides an eight-day running time. Quite probably made by Jean Baptiste Baillon De Fontanay.

Watch, souscription type

Setting:	Room XVIII
Maker:	Breguet et Fils firm
Place:	Paris
Date:	1816
Materials:	gold, enamel
Dimensions:	diameter 62 mm
Inventory:	3860

Watch with smooth case. The enamel dial has Arabic hour numerals and a single "eye" hand at the center—a typical feature of Breguet watches. The movement has separate bridges with rotating barrel. The escapement is of the ruby-cylinder type. The balance pivots hold the "parachute" suspension designed by the Parisian clockmaker for shock protection. Breguet invented a cheap, simple watch that could be produced in small runs thanks to a subscription and down-payment system, hence the name *souscription*. The secret signature—invented by Breguet as a protection from imitators and counterfeiters—was etched on the dial with a diamond tip guided by a pantograph.

Watch with "Sun and Moon" dial

Setting:	Room XVIII
Maker:	James Markwick
Place:	London
Date:	early 18th cent.
Materials:	gilt brass, silver, leather
Dimensions:	diameter 52.5 mm
Inventory:	3850

Watch with leather-covered gilt brass case. The silver dial has a semicircular aperture. Below it is a rotating burnished disk with the symbols of the Sun, Moon, and stars. These serve as hands, indicating the diurnal and nocturnal hours on the upper semicircle divided into twelve hours in Roman numerals. A rotating steel hand shows the minutes along the entire rim, engraved with Arabic five-minute numerals. The dial and movement are signed "Markwick, London."

Wheel barometer

Setting:	Room XVIII
Maker:	Santino Donegani
Place:	Italian
Date:	late 18th cent.
Materials:	wood, glass
Dimensions:	height 955 mm, width 270 mm
Inventory:	1140

Wheel barometer mounted on a green-varnished wooden base with gilt tooling. The barometric scale is divided into Paris inches. Above the dial is inserted an alcohol thermometer with a Réaumur scale. Made by Santino Donegani, about whom we have no information.

Index