Sundials

A rare example of the tiny number of surviving portable sundials from the Roman era. These two dials, the cousin tombs, are both examples in the largest. This adjustment allows the measurement in a very short time of latitude, according to the rule on the larger dial, in the range from 25° to 45° N. The smaller dial, which has been cut down to a smaller scale and gradient, is marked in the area that crosses the shadow. This is set for data taken during the summer months, when the sun is high. There are two plates, one of which is of silver, and the other of brass, both in the form of a rete or net, incorporating the positions of prominent stars.

The spherical astrolabe is used for the same set of astronomical calculations as the more common planispheric model but is less common because it can be made of wood and less robust. It is thought to be an Islamic invention and there are two versions on the instrument by al-Bīrūnī (c. 973-1048) and al-Bīrūnī (c. 1070-1098).

The instrument is signed ‘Work of Arabesque Year 888 (= A.D. 1480)’ and from the style of lettering and the number of remarks used, it is understood to have been made in Eastern Islam. The spheres of lines are engraved and engraved lines demonstrated in silver. While the remaining work is of brass, interspersed with silver in the equatorial and equatorial circles and in the vertical quadrant, the superscription piece is of silver. The sphere has two plates for ‘10 degrees’ and ‘all above the ecliptic’, and the astrolabe can be adjusted for use in any latitude.

Inventory no. 49821

THE SPHERICAL ASTROLABE

Astrolabes generally present the stars and the path of the sun on a flat surface using a planispheric projection, in the manner of a map of the world. This is the only complete example of an astrolabe, where the heavens retain the spheric form they are assumed to have in traditional astronomy. The solid sphere carries co-ordinate lines based on the horizon, while the great circle forms a ‘pole’ on which the sphere is fixed. The inner circle is fixed to the sphere and is used to show the relative positions of the sun and the moon, and the phases of the moon.

The astrolabe is made in brass and damascened with silver and gold. The highly decorated and pictorial representations of the signs of the zodiac, the astrological symbols, for use in latitudes 30° and 32°; 36° and 40°.

Inventory no. 49821

Oxford in FLORENCE

The Museum of the History of Science is lending some of its most famous instruments, in a special exhibition to be held in Florence from 13 March till 30 August 2009, ‘Galileo. Images of the Universe from Antiquity to the Telescope’. The instruments include unique items closely associated with the Museum, such as the ‘spherical astrolabe’ and the ‘geared astrolabe’.

We apologise that they will be gone during the summer months, when we have many visitors, but the anniversary of Galileo’s work is an international event whose focus is properly located in Florence, and items from our international collection should contribute to the celebration. The exhibition is organised by the Fondazione Palazzo Strozzi and the Istituto di Storia della Scienza, is curated by Professor Paolo Galluzzi, and will be held in the Palazzo Strozzi (www.palazzostrozzi.org). This issue of Broadsheet deals with the instruments in Florence that are normally on display here. One side has instruments applied to astronomical calculations; on the other they are used as representations of the heavens.

Inventory no. 48472

Sunglasses and Qibla indicator

Times of prayer and the sacred directions for prayer – towards Mecca – are important elements of Islamic observance and the astronomical and geometrical challenges they present have been a source of ingenious instruments. This one combines a sundial with a ‘Qibla indicator’ (the direction). The horizontal gnomon dial is on the upper section of the plate, the back being hand illustrated and would have had a membrane in the ‘Rabbinic’ form, on a mount framed brass, but the larger gnomon for casting the shadow in a circle at the required time was set in the circular tube. The lower section of the plate, though now incomplete, was used to find the Qibla, in combination with a table of geographical direction names printed on the reverse (see right). This Persian instrument is missing, as is the magnetic compass that would have indicated the time (for direction). The horizontal pin-gnomon dial is one combines a sundial and a ‘Qibla indicator’ (for direction). The horizontal pin-gnomon dial is illustrated (and would have indicated the time (for direction). The horizontal pin-gnomon dial is illustrated (and would have indicated the time (for direction).
**ARMI LARY SPHERE**

Most armillary spheres follow the astronomical system of Ptolemy, with the earth stationary at the centre, while a few adopt the heliocentric arrangement, where the earth moves around the sun with the other planets. This unique Italian armillary sphere is constructed according to the traditional or Ptolemaic system of the astronomer Andreas Argolus who lived in the 16th century. According to this arrangement, the earth revolves around the sun, while the moon, Sun, Mercury, Venus, and Saturn revolve around a central earth. It is the present centurv this system was supported by the heliocentrist scientist Andreas Argolus (1570-1640). Despite dealing with such ancient proposal, the armillary sphere is up-to-date in other respects. Jupiter is represented as having four satellites and Saturn as having three. While Galileo had discovered the satellites of Jupiter, the third satellite of Saturn was discovered in 1672 by Cassini, who discovered the fourth in 1672. This suggests a date for the instrument between 1672 and 1684. The horizon ring carries the name of Dominicus Sanctes Sanctini, who discovered the fourth in 1684. This unique Italian armillary sphere is constructed according to the traditional or Ptolemaic system of the astronomer Andreas Argolus who lived in the 16th century.

Inventory no. 5/012

**ARMI LARY ORRERY**

Richard Glover was a maker of mathematical instruments, such as sundials and armillary spheres, who also sold maps at his shop in London, identified by the sign of ‘Atlas & Hercules’. He advertised ‘44 kinds of Clocks, Spheres and Globes of all Sorts.’ The armillary orrery, dating from around 1720 and standing just over a metre in height, must have been at the top of his range, an impressive and expensive purchase by most of his rich and wealthy customers. It is an attempt to combine one of the oldest forms of astronomical instrument, the armillary sphere, with what was then one of the most recent, the orrery or planetarium. The armillary sphere is the revolving outer part of this instrument, composed of rings representing the circles of the celestial sphere, such as the equator, the tropics (Cancer is rising) and the zodiac. It was best suited to illustrating the traditional Ptolemaic system with the earth stationary at the centre of the cosmos and the heavens rotating around it. The celestial sphere rotates on an axis in this instrument held – somewhat incongruously – at the centre in a planetarium based on the Copernican system, where the sun is central and the earth rotates on its axis daily and moves in an annual orbit. The earth and moon, Mercury and Venus are moved by wheelwork activated by a hand-crank, while Mars, Jupiter and Saturn are pushed round by hand. The drum of the north celestial pole has wheelwork moving the celestial spheres on a dial and hands for displaying the time.

Inventory no. 5/006

**PAIR OF PLANETARIA, PTOLEMAIC AND COPERNICAN**

Dating from around 1780, this is an unusual – perhaps unique – solution to the problem of representing the cosmos by an instrument and accommodating both the traditional Ptolemaic arrangement, with the earth at the centre, and the Copernican, where the earth is in orbit around the sun, accompanied by the moon and rotating on its axis every day. The two systems are treated in a pair of matching instruments, which follow diagrams in J.C. Sturm’s ‘Scientia Cosmica’ of 1670. Each planetarium has an outer ring for the zodiac and concentric rings for the planets, each carrying a planetary symbol. Since the zodiac is horizontal, the earth – whether at the centre in the Ptolemaic system or in orbit in the Copernican – is involved. The outer rings, each carried by four curved supports rising from the centre, can be rotated to represent movements and configurations of the planets; the exception is that in the Copernican instrument the earth is carried by a train of three wheels, so that it rotates as it is moved around in its orbit. In the Ptolemaic instrument the symbol for Mars and Venus, and for Saturn and Jupiter, are enormously reduced, perhaps as a result of some subsequent repair. Although unusual, it is likely that the instruments were made in London by John Rowley.

Inventory nos 5/035, 1/069

on loan from Christ Church, Oxford

**PLANETARIA**

Dials, Spheres and Globes of all Sizes.’

The partnership between Thomas Heath and his former apprentice, Josiah Wing, lasted from 1761 to 1772, with premises at various addresses in the Strand, London, and this is one of their most ambitious and expensive creations – a complete ‘grand orrery’ with all the known planets and satellites fully represented by clockwork. The pendulum-regulated clockwork mechanism is beneath the base plate and it drives the planets out to Saturn with their respective periods, as well as the moon, and the satellites of Jupiter (discovered by Galileo) and the earth. The earth revolves on a calendar scale giving the date. The grand mechanical case is designed both to be appropriately large internal room and to reveal the wheelwork in addition to the planetary system – a clear sign that the mechanism was meant to impress the viewer as well as to illustrate the heavens.

Inventory no. 2/006

on loan from All Souls College, Oxford