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NOT all spheres are spherical. Not even among their material manifestations (and material spheres are not the only kind of spheres to be found in science) are all spheres spherical: they may also be flat – which is to say, they may be planispheres.
In its pure geometric form, a planisphere is just that: a sphere on a plane. Mathematically, the problem of representing a sphere on a plane is by no means trivial. A form of projection is required, in which the three dimensional surface is transformed into something capable of being represented in only two dimensions.

No projection can transform a curved surface into a flat plane without introducing some form of distortion. Projections can be chosen for particular purposes, to maintain certain key characteristics of the original surface while introducing distortion in less critical areas. In the familiar case of cartography, for example, an equal-area projection might be used to maintain the appearance of relative size between countries, while a cylindrical projection would be chosen when relative direction was important.
As few visitors can have failed to notice, the most abundant occurrence of planispheres in the Museum is not with maps of the earth, but with maps of the heavens, and in one form in particular: the astrolabe. A planispheric astrolabe is, essentially, a flat map of the celestial sphere. The mapping can be achieved in various ways, most commonly by a stereographic projection drawn for the location of the observer, but also by one of several alternative forms of universal projection.
The common stereographic projection is made from the south celestial pole onto the plane of the equator. A universal projection, on the other hand, is made from a point on the plane of the equator in the direction of the sun at the equinoxes onto the solstitial plane – the plane through the poles and the sun’s position at the summer and winter solstices.

The origin of the stereographic projection is a little vague, although it must date from before the time of Ptolemy. The universal projection is a more recent invention: it was first introduced by the Muslim scholar Ibn al-Zarqallu of Toledo, in the 11th century. In the first half of the sixteenth century, the Louvain mathematician Gemma Frisius re-invented (or perhaps resurrected) the ‘Saphæa Arzachelis’ as his ‘astrolabum catholicum’ or ‘catholic astrolabe’.
The common stereographic projection and the universal projection each have their own virtues and limitations. In the common stereographic projection, circles on the celestial sphere are preserved as circles when projected, and the angles between them are maintained. The disadvantage of this projection is that it can be drawn for only one latitude at a time: in order to display star positions correctly at different latitudes, different projections must be made. The universal projection gets around this problem. As its name suggests, a single universal projection can be used at any latitude. The observed position of stars in the sky cannot, however, be read directly from a universal projection but must be calculated with the aid of rules and a pointing device.
The Museum owns the largest collection of astrolabes in the world, so it is not difficult to find specific instruments with which to illustrate these principles. The astrolabe chosen here is a particularly fine example from the collections nevertheless. It was made in Louvain in 1565, is 290 mm in diameter, and is finely worked throughout in gilt brass.

Not unusually for the period, this astrolabe actually bears both a common stereographic projection and a universal projection. The stereographic projection is on the front of the astrolabe (the side illustrated) while the universal projection is provided on the back.
All the standard parts of an astrolabe can be seen on the front: a cutout ‘rete’, with pointers to mark the position of the principal stars, which rotates above a fixed latitude plate, consisting of a reference grid drawn in stereographic projection (the characteristic skewed ‘shuttlecock’ pattern). A rule with sights – the ‘alidade’ – is also included, to enable elevations of celestial bodies to be measured and other associated calculations to be performed. As well as the position of the stars, the rete is also marked with the ecliptic circle – the apparent path of the sun against the background of fixed stars over the course of a year.
The ecliptic is divided into and marked with the signs of the zodiac, which often comes as a surprise to many people, but is absolutely standard – astronomers have long referred to the sun by its position in the zodiac. This astrolabe does in fact have specifically astrological features: the planetary influences are given next to stars on the rete, and lines on the latitude plate mark the twelve astrological houses, used for casting horoscopes. But again, these are usual features and simply reflect the association of astronomy and astrology in the period.

The form of the rete on this astrolabe is very characteristic of the Louvain school of instrument makers, with its flame-shaped star-pointers and strapwork in the shape of a tulip. The standard of craftsmanship is also very striking: the precision of the engraved lines, the elaborate cast throne with its two supporting satyrs, and the gilt finish – all qualities which mean the instrument would have been collectable from the day it was made.
The astrolabe comes from Louvain, but the question remains: who exactly made it? It is signed ‘Regnerus Arsenius Nepos Gemmæ Frisÿ fecit Louanÿ anno 1565’ – ‘Regnerus Arsenius the nephew of Gemma Frisius made this in Louvain in the year 1565’. The answer then would seem to be simple: Regnerus Arsenius made it. But this answer is not as straightforward as it seems. Who exactly was Regnerus Arsenius? Indeed, was Regnerus Arsenius at all?

As Koenraad Van Cleempoel has detailed in work for the recent Madrid exhibition (see the back page), the Arsenius workshop was an illustrious centre of instrument making in the sixteenth century, the heir to the legacy of Louvain’s most famous mathematical sons, Gemma Frisius and Gerard Mercator. Until earlier in this century, it was generally believed that the workshop consisted of a number of craftsmen working together under the same roof: Gualterus Arsenius, Regnerus Arsenius, and Ferdinand Arsenius. The view held by scholars today is rather different. While it is accepted that Ferdinand Arsenius existed in his own right, the now current historical orthodoxy is that Regnerus Arsenius did not in fact exist. Regnerus Arsenius, it is argued, is none other than Gualterus Arsenius working under an alternative name.

There can be little doubt that Gualterus was the master of the Arsenius workshop: of the fifty or so Arsenius instruments that survive, nearly half are explicitly signed by Gualterus. However, the total does include more than ten unsigned instruments, and several signed only in the form ‘nepos Gemmæ Frifÿ’. More importantly, four instruments survive which are signed explicitly with the name of Regnerus Arsenius. They are: the Museum’s astrolabe; an astrolabe signed in capitals belonging to the Spalding Gentlemen’s Society; an astrolabe of 1566 in Padua signed ‘Renerus Arscenius’; and an astrolabe of 1569 at the Musée des arts et métiers in Paris signed, ‘Rennerus Arsenius’.

Against this strong material evidence, it is perhaps rather surprising that Regnerus has simply been equated with Gualterus, but several arguments have been put forward in support of the position. Firstly, the style of engraving on instruments signed ‘Gualterus’ and instruments signed ‘Regnerus’ is indistinguishable. Secondly, the dates of construction of Gualterus and Regnerus instruments overlap. Thirdly, letters survive in which Arsenius is referred to in the singular. Fourthly, it is argued that ‘Regnerus’ is Gualterus’s ‘family’ name. Lastly, and perhaps most importantly, in one edition of his Description de tout le Païs-Bas, Lodovico Guicciardini refers to a ‘Gautier Renier’, ‘Maistre excellent de toute sorte d’instruments mathematiques’.

Are these arguments convincing? Certainly the engraving style on Gualterus and Regnerus instruments is indistinguishable, or at least within the range of variation found in Gualterus examples. But then the engraving style on the early astrolabes of Ferdinand Arsenius is also indistinguishable from Gualterus instruments, yet Ferdinand has not been written out of the historical record.

As far as dates of construction are concerned, what is striking is the increased output of instruments in the years for which examples signed by Regnerus survive. Four astrolabes survive from 1565, for example, two being signed ‘Regnerus’. In only one other instance did Gualterus make more than one astrolabe in a single year.
That Gualterus is referred to in the singular should come as no surprise: there was after all only one of him, and he is referred to in the singular despite the fact that, as is accepted, Ferdinand was working with him. That Regnerus was a name in the family which Gualterus might choose to use on occasion is also possible, but what is arguably more likely is that a real Regnerus was using it as a first name on a permanent basis.
The reference by Guicciardini to a ‘Gautier Renier’ is the strongest evidence that exists. Were it not for other evidence it might be conclusive. But other evidence can be found, beyond the instruments signed ‘Regnerus’, that Gualterus and Regnerus were not the same person. The evidence comes from the accounts of Christopher Plantin, the Antwerp printer. Plantin bought instruments from the Arsenius workshop, meticulously recording his purchases in a ledger, including sums paid to Gualterus.

However, Gualterus is not the only Arsenius to be mentioned in the Plantin accounts. On the 20th May, 1565, the following entry occurs: ‘Payé un astrolabe a Reynerus Arsenius fl. 25. st. 4’. It is possible that Plantin is using the two names interchangeably, but one fact suggests otherwise: 1565 is not only a year for which Regnerus instruments survive, it is, of course, the date of the Museum’s own astrolabe.
G.M.H.