Contents of Bulletin 103, May 2010 R. Hooijenga

Annual meeting, 20 maart 2010 *Secretariat* *8*

Twenty persons attended this meeting. – The Hagen legacy is moved to the Vesters residence. So is, by the way, the last part of the archive of Fer de Vries. Verschuuren suggests the legacy should be cleared, as 90% of it is not unique. This seems a good idea for later, but is not pressing now. – A call for help for the Zonnewijzerkring's web site. Single entries are also welcome. – Sundial walk and Art Show in Deil (see elsewhere). Hollander fills in for De Vries as contact. – Excursion 2010: it is decided we go to the Genk Sundial Park; Verschuuren, Maes [and vd. Beld] organize. Chronicles, financial reports and estimates are approved. Taudin Chabot is re-elected in the committee.

Verschuuren: the floor tack analemma in Gemert castle is in danger of being removed and so destroyed. Dees has informed those concerned about its value.

Maes is raising funds for the restoration of the Echten House sundials.

Jan de Graeve of the Zonnewijzerkring Vlaanderen (Belgium) has news about Mercator Year 2012. There are plans for a convention in Belgium of international sundial societies, a display of original historical instruments, and a book; even more ideas are being developed.

Hollander is involved in the building of a terrace sundial in Almere, following the 2007 plans by De Vries. An analemmatic dial is surrounded by a block (shadow plane) dial.

Doomernik has 30 volumes of the Bulletin to give away.

Sasbrink brought two copies of his two-hemispheres dial. He calls the design self-aligning, but the assembly thinks it is not; a reference is needed to align it.

Fockens mentions the Gouda sundial.

Discussion on biblical sundials (see II Kings 20), and so on to retrograde sundials, about which De Vries has published earlier.

The Linear Astrolabe of Sharaf al-Dīn al-Ṭūsī *Bob Franken* *14*

Putting it slightly irreverently, the Linear Astrolabe is just a stripped-down version of the much wider-known 'general purpose' planar astrolabe. The linear astrolabe by Al-Tusi was a practical instrument, invented for the purpose of solving practical problems.

The author starts with an explanation of the stereographic projection on which the astrolabe's display is based, showing on its mater the sky north of the tropic of Capricorn, altitudes (almucantars), and azimuths. Of course, in the Al-Tusi instrument, azimuths play no role.
Figures 1 through 4 detail the construction of a formal astrolabe mater, including tropics, equator, almucantars, azimuths and crepuscular circles.
Figures 5 and 6 depict the rete, or spider, which bears the fixed celestial bodies, drawn in according to their declinations and right ascensions; the ecliptic; the signs of the zodiac and the months and days of the year. The position of the sun is assumed fixed on each actual day in question.
The rete is supposed to turn once every 23 hours and 56 minutes.

Now, the Linear Astrolabe is really the y-diameter of the planisphere astrolabe, projected onto a wooden rod. Of particular interest are the origin O, the centres C and lower intersections P of the altitudes, and the lower intersections S of the declination circles. The functional length of the rod is the diameter of the Tropic of Capricorn.
To operate the astrolabe, a visor is added and three lines (strings): a plumb line, an angle-measuring line, and a freely adjustable line.

What will it do? We can 1: determine the altitude of a heavenly body, as explained in figure 7; and 2: determine the angle between line OQ and the north-south line on a planisphere (where Q is the intersection of an almucantar (altitude) and a declination circle), for which see figure 8. Figure 9 shows which angle, here marked β, is meant [this would be the hour angle of the luminary – RH].
Even so, this will allow us to determine temporal time, times of sunrise and sunset, local solar time from the sun's altitude, and local solar time from an observation on a star, among others.
Figure 10 shows six scales. I: right ascension in degrees and hours; II: RA of selected stars; III: Signs of the zodiac and dates, from which RA of the sun may be had; IV: Declination of the sun in relation to its RA. These scales go together, but need not be on the instrument proper.
Scale V: locations of O (in the middle), C(h), P(h), and S(δ); VI: values of α for altitude measurements, and for determination of β. Scales V and VI should be next to one another and on the instrument.

To be of useful accuracy, the instrument should be based on an equator circle with a radius of not much under 200 mm, giving a scale length of 1,22 m. In practice, it might have been slightly shorter than this.

And so, by enabling us to measure altitude and hour angle, the Al-Tusi instrument provides us with sidereal and solar time, the latter even at night if we know the date. It is relatively easy to construct, and replaces a large, heavy and expensive planisphere astrolabe. On the downside, it is comparatively difficult to operate.

Unfortunately, none remain – not because they were rare, but because of the exact opposite. They were not deemed very valuable.

The author thanks Alessandro Gunella and Jim Morrison, and provides a reading list.

The annex contains derivations of the equations appearing in the paper.

New astrarium 'De Dondi' in Asten *Museum communiqué* *29*

The 13th century scholar Giovanni de Dondi, although himself an Aristotelian, built a mechanical model of the Ptolemaic geocentric worldview, and left a manuscript on how and why he built it. De Dondi bridged the gap between the old new scientific disciplines.

It took Henk Gipmans several decades to study all available literature, such as De Dondi's manuscript, and to build what he called on 20 April, the "newest old astrarium".

The Gipmans astrarium, which he describes as not an exact De Dondi replica but a lookalike, is on display in the national carillon and natural history museum in Asten.

Planetary hours on other sundials F.J. de Vries 30

According to Drecker, a planetary hour is the space of time between the rising of one sign of the ecliptic and the rising of the next; see Bulletin 100. The figure shows planetary hour lines for a horizontal node sundial; solid lines are for lengthening days, dotted lines for shortening days.

The hour lines marked *Hore Planetarie* in the next figure, of a cylinder dial, are not for planetary hours, but for temporal or antique hours, which were often incorrectly referred to as planetary hours.

Curious what real planetary hours would look like an a cylinder dial, De Vries wrote a computer program to solve this problem on the spot. The result is on the next page, top; the diagrams are for shortening days. The hours from 6AM through 11AM look usable (left); but the hour lines from 1PM through 6PM cross (right).
Planetary hours and cylinder dials do not seem to mix well.

The horizontal azimuth sundial, or spider dial, is more promising. In our districts at least, planetary hour lines will not cross on the dial face, as shown in the accompanying figure . However, between the tropics the lines would get tangled again, because of the retrogradation of the shadow that happens there.

Fer mentions the *Orologi Solari* software by Gian Casalegno, which can – among very many other things – draw spider dials directly.

Think of the infinite regress an excerpt of this section would lead to.