

# UNEXPECTED ASPECTS OF ANNIVERSARIES or: Early sundials, widely travelled

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This year my hometown, Feldkirch in Germany, celebrates the 500<sup>th</sup> anniversary of Rheticus. He was the man who published the first report on Copernicus's new heliocentric view of the world. Subsequently, he helped Copernicus complete his manuscript for publication and arranged its printing in Nürnberg. When I planned my attendance at the BSS Conference 2014 at Greenwich, I asked myself if there could be any connections between the 25<sup>th</sup> BSS anniversary and the 500<sup>th</sup> anniversary of Rheticus' birth. And now in fact, I have found a really interesting story!

## Feldkirch 500 Years Ago

Feldkirch, a small district capital of about 30,000 people, is situated in the very west of Austria close to Switzerland and Liechtenstein. Five hundred years ago it was a prospering town of about 1500 inhabitants. In April 1514 Georg

Iserin was appointed town physician and all of his family were accepted as citizens of Feldkirch. Georg, a man with widespread interests, owned a considerable number of books and a collection of alchemical and medical instruments. Over the years, superstitious people suspected this extraordinary man of being a sorcerer in league with sources of darkness.

A few weeks before his appointment as town physician, on 16 Feb 1514, his only son Georg Joachim was born. When the son was 14 his father was accused of betraying his patients and, additionally, of being a swindler and kleptomaniac. He was sentenced to death and subsequently beheaded by the sword. His name Iserin was officially erased by so-called 'damnatio memoriae'. His wife and children changed their name to the mother's surname. As she was well off, her son Georg Joachim could continue to study at the famous Latin school in Zürich. At the age of 18 he enrolled at the university of Wittenberg for mathematics and astronomy. From that time onwards he called himself Georgius Joachimus Rheticus – in memory of the region he was from. Feldkirch after all, had been part of the Roman province Rhaetia.

By the age of 22, Rheticus was appointed by his patron Philipp Melanchthon as lecturer for mathematics and astronomy at the university of Wittenberg. Fig. 1 shows the first page of notes by Nicolaus Gugler of Rheticus' lecture on the 'Tractatus de Sphaera' by Johannes de Sacrobosco (1195 – c. 1256). Sacrobosco wrote this booklet around 1230 at the university in Paris, where he lectured on the old geocentric view of the world by Ptolemy (c. 90 – c. 168). According to this idea, the Earth was considered the centre of the entire universe. Thus, the Earth – at rest itself – was orbited by the moon, the Sun, by all known planets (Mercury, Venus, Mars, Jupiter, Saturn) and by all the stars beyond. Even in Rheticus's time, lectures on this Ptolemaic system were the commonly accepted introduction to astronomy in all West- and Middle-European universities. But scholars knew that calculations of the planets' motions showed rather inaccurate results within this system. For a long time some scholars reported that a canon named Copernicus far away in the East of Prussia had found a new and hopefully better method of calculating the movements of the planets.

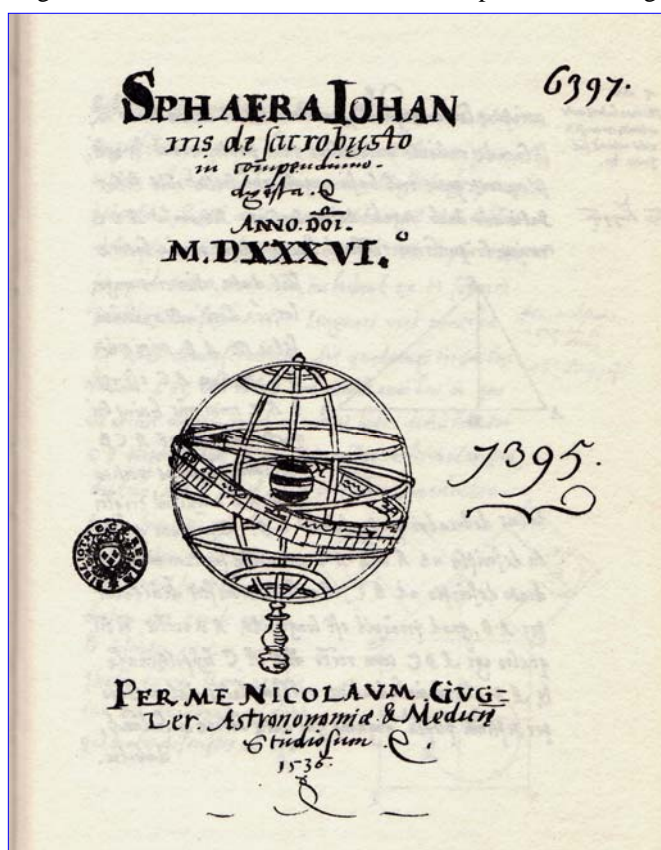


Fig. 1. Notes by Nicolaus Gugler of Rheticus's lecture on Sacrobosco's 'Sphaera'. Gugler copied the armillary sphere with the geocentric Ptolemaic system from Sacrobosco's book. After Burmeister.<sup>10</sup>



Fig. 2. Frombork Cathedral. The roof on the left of the tower is where Copernicus lived during his time in Frombork. Photo by the author.

### A Landmark Journey

Like others, Rheticus had heard of Copernicus’s ideas and he decided to study them at first hand. In the year 1539 he was given leave from the university to undertake the long and exhausting journey to Copernicus in Frauenburg in distant East Prussia (now Frombork in Poland: see Fig. 2). On his arrival in Frombork, the 25-year-old Lutheran scholar Rheticus found a friendly welcome by the 66-year-old Catholic dignitary Copernicus. Soon they were good friends and the elderly man was a helpful tutor to his young guest and only student. He committed his manuscript on the new heliocentric theory to him and they both discussed all of its details and problems. Both worked so hard that Rheticus was able to produce his famous ‘*Narratio prima*’ within a few weeks. In this ‘First account’ he formulated the substance of Copernicus’s revolutionary idea: the Earth was no longer the rotation centre of all objects in the sky but the Sun now took this role. Both of them were convinced that the Earth (together with its moon) moves around the Sun like all the other planets. What appeared to be the daily orbit of the Sun and the stars around the Earth is only the result of the additional Earth rotation around its own axis.

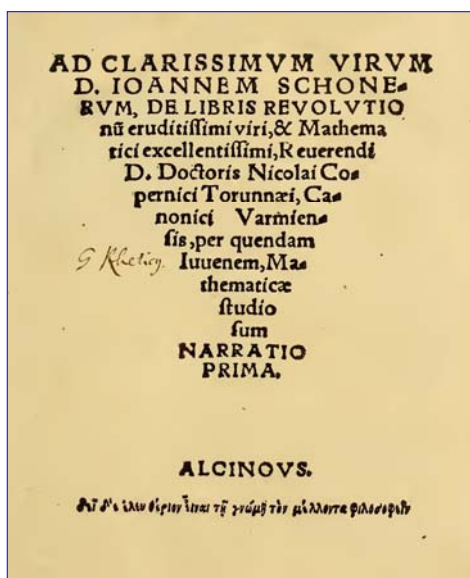


Fig. 3. Title page of ‘*Narratio prima*’ (1540). After Rosenfeld & Zeller<sup>1</sup> or Open Library (<https://openlibrary.org/books/OL25326748M/>).

With Copernicus’s approval, Rheticus published his *Narratio prima* in 1540 (see Fig. 3). It was the first ever printed and published report on the new Copernican heliocentric system. It caused a sensation in the scientific world and became the spark for the so-called ‘Copernican Revolution’. Dibner writes, “The scale of change which Copernicus proposed and which is universally accepted today did more violence to the accepted thinking of man than any other product of thought, including the doctrines of evolution or of relativity.”<sup>1</sup>

After the huge success of Rheticus’s *Narratio prima* and the encouragement Copernicus received from many of his friends, the old man agreed to publish his own manuscript, and so with support from Rheticus, the manuscript was made ready for print. Later, Rheticus organized the printing of Copernicus’s life work ‘*De revolutionibus orbium*’ in Nürnberg. The book was completed in 1543. A copy of it was brought to Copernicus on the day of his death.

### Rheticus’s Interest in Sundials

As far as we know, Rheticus did not show much interest in astronomical instruments or sundials before he made his long journey to Copernicus. He mainly concerned himself with mathematical and theoretical aspects of astronomy. However, just a short time after his arrival in Prussia, he mentioned two astronomical instruments in his *Narratio prima*! He had seen them in the residence of Copernicus’s friend Bishop Tiedemann Giese during his first weeks in Prussia.

The first instrument was an armillary sphere for observing the equinoxes. It enabled astronomers to measure the exact length of the (tropical) year. This was essential for the improvement of the Julian Calendar, in use at that time. For decades or even for centuries adjustments of it had been proposed.

The second instrument was even more fascinating: ‘The bishop ordered a gnomon [sundial] from England. It was proper for a noble bishop and I [Rheticus] saw it with great pleasure because it had been made by a very good artist and an expert in mathematics too.’<sup>2</sup> In a later letter of the bishop, we learn that he had ordered this stone gnomon from a famous mathematician in London constructed specifically

for the latitude of Königsberg.<sup>3</sup> Moreover, he writes that this stone sundial showed coloured lines. So the question arises, who could have been the constructor and mathematician in the early 16<sup>th</sup> century in London?

It seems obvious to suppose that Nicolas Kratzer was the constructor because he was in England at that time. Zinner<sup>4</sup> is quite certain about this because he was the only famous mathematician in London who also constructed stone sundials at that time.



Fig. 4. Nicholas Kratzer (1487–1550). Painting after Hans Holbein the Younger. WikiCommons, from the original in the Louvre, Paris (copy in National Portrait Gallery, London).

### Nicholas Kratzer and Sundials

Fig. 4 shows the very famous portrait of Nicholas Kratzer at work on a sundial. It was painted by Hans Holbein the Younger in the year 1528. At that time, Kratzer and Holbein were both at the court of Henry VIII. Nowadays, the original painting is displayed in the Louvre, Paris, and a very fine copy of it can be seen in the National Portrait Gallery, London.

Nicholas Kratzer (1487–1550) was a Bavarian mathematician, astronomer and horologist. The first time he came to England was in 1517/18. Before this journey he spent some time in the Carthusian monastery of Mauerbach near Vienna to study and copy astronomical and gnomonic treatises. Much of the material can be still found in Kratzer's manuscript '*De horologiis*' in the Bodleian Library.<sup>5</sup>

Kratzer writes in this manuscript, 'In the year 1520, I, Nicolas Kratzer, born a Bavarian of Munich, a servant of King

Henry VIII, at his command lectured at Oxford'.<sup>6</sup> Amongst other topics, his lectures covered *De Sphaera* by Sacrobosco<sup>7</sup> and the construction of the astrolabe. Furthermore, 'While there I set up a column or cylinder before the church of the Blessed Virgin with the help of the mason William Eyst, the king's servant.' In addition, he cites verses by Ludovicus Vivès, his contemporary at Corpus Christi College at Oxford. Vivès' Latin text explains the hour lines with their different colours. Here, two examples in Gunther's translation:

'On the East: The hours [old German or Babylonian hours] are marked by green lines, which the numbers point out, beginning with the birth of the day.'

'On the West: The dark blue lines [the Italian hours] show how many hours of time the sun hath fulfilled since he hid himself beneath the waters.'

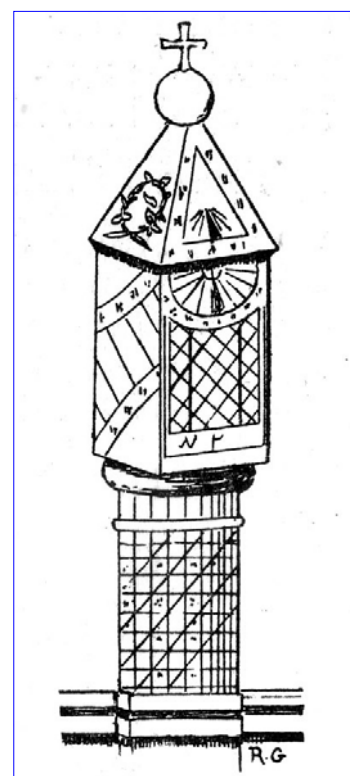


Fig. 5. Kratzer's dial at St. Mary's Church, Oxford. Sketch by Gunther,<sup>6</sup> after Loggan's '*Oxonia illustrata*', 1675.

The only known engraving of this dial is found in Loggan's print *Oxonia illustrata* (1675), which appeared about 50 years later than Vivès' verses. Fig. 5 is an enlarged detail from Loggan's print as shown by Gunther. It can be seen that the hour lines of the West sundial in this engraving do not match Vivès' description, given above.

North<sup>8</sup> hints at further inconsistencies and errors in Kratzer's manuscript. He says "Kratzer never approached the apex of either art or the mathematics of his day. If he established any tradition it related to craft and rationale of instrument-making". He was "more craftsman, perhaps, than scholar, ...with well-developed mercantile instincts."

In a similar vein, Peter Drinkwater writes, "Kratzer triumphed, not through genius or creativity, but through having learned what others had discovered and invented, and by being the first to apply that learning in England."<sup>9</sup>



Fig. 6. Kratzer's polyhedral dial for Cardinal Wolsey.  
 Courtesy of the Museum of the History of Science, Oxford.

### Traces of Kratzer's Sundials

Kratzer left only a few traces of his work. Nowadays, only one complete and functional sundial by Kratzer is preserved. It is the beautiful portable polyhedral sundial for Cardinal Wolsey, which is now in the Oxford Museum of the History of Science and can be seen in Fig. 6.

The dial in the churchyard of St Mary's Church mentioned above was removed in 1744. Loggan's sketch of it in some aspects resembles Turnbull's 'Pelican Sundial' at the quadrangle of Corpus Christi College in Oxford.<sup>11</sup>

Another polyhedral sundial by Kratzer stood in the Corpus Christi College Garden. Again, nothing but a sketch of it by Robert Hegge has survived.

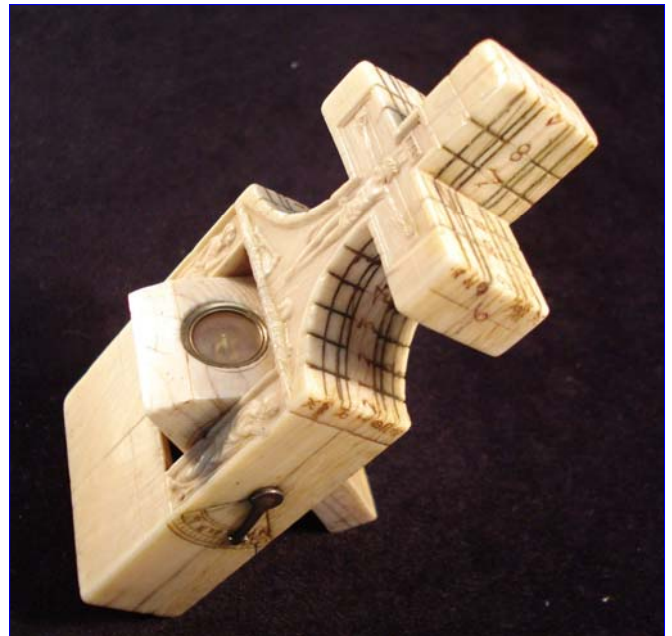


Fig. 7. Ivory cross sundial by G. Hartmann (1541).  
 Courtesy of the Trustees of the British Museum, London.

Even worse, we have no idea of what the stone sundial which was ordered from Nicholas Kratzer by Bishop Tiedemann Giese looked like as this widely-travelled dial is now lost. It has, however, left another link to London. That is to say, the letter that Bishop Giese wrote to Duke Albrecht of Prussia in 1543, which reveals that Giese sent this stone gnomon to Duke Albrecht in return for a marvellous present that Giese had received from him. It was a most precious ivory cross sundial, constructed and manufactured 1541 by the famous sundial-maker Georg Hartmann (1489–1564) in Nürnberg. This dial can still be seen in the British Museum in London (see Fig. 7).

In letters from the Duke to Georg Hartmann, we learn that the Duke repeatedly ordered valuable sundials from Georg Hartmann. He in turn not only sent his sundials but also informed the Duke on the tide of all political events in Nürnberg. This was of special interest for him because

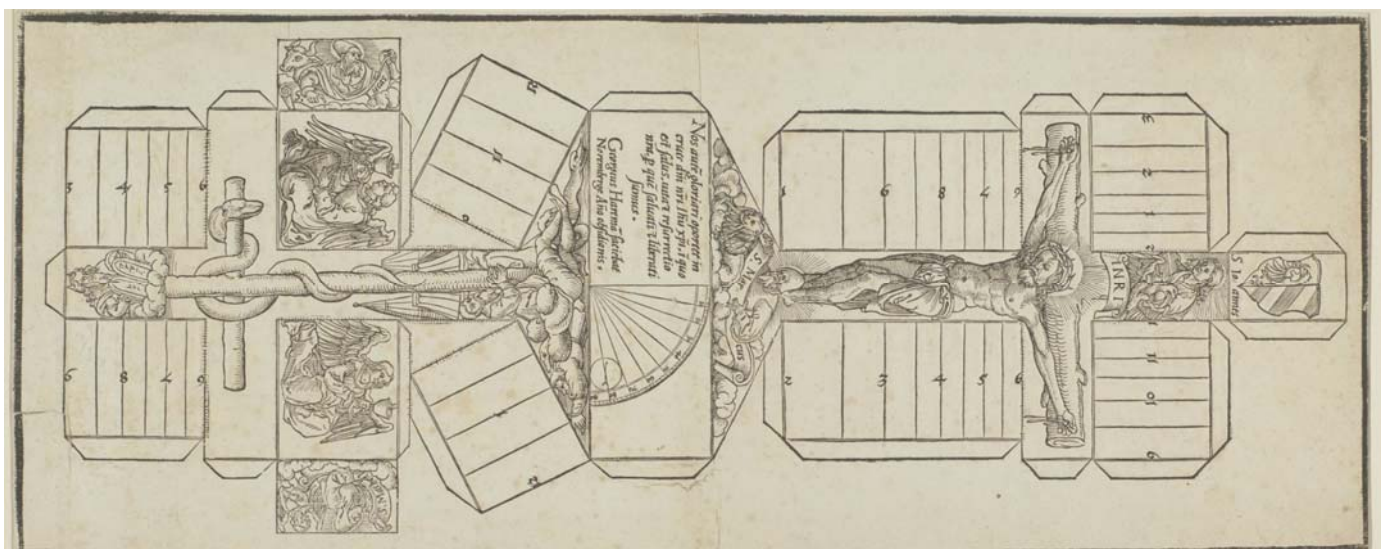


Fig. 8. Hartmann's print of the paper cut-out sundial. Image by the author, courtesy of Germanisches Nationalmuseum, Nürnberg.



Fig. 9: Paper cut-out sundial by Georg Hartmann, Nürnberg. The dial shows 2:30 pm. Image by the author.

Nürnberg was the place of the ‘Imperial Reichstag’ at that time. These were the general assemblies of the Imperial Estates of the Holy Roman Empire and hence the meeting point of many prominent political and clerical dignitaries.

### The Earliest Cruciform Sundial?

In 2004, devotees of paper woodcuts found a very early cut-out sheet for a cruciform sundial in the Germanisches Nationalmuseum (GNM) in Nürnberg (see Fig. 8). It is thought to be the earliest paper cut-out sheet ever created. Georg Hartmann constructed and printed it. Experts interpret the words ‘anno obsidionis’ on it as a clue to its year of construction. They say it must be 1529, which was the year of the first Turkish siege of Vienna.

During Hartmann’s lifetime, Nürnberg itself had never been besieged, however, in the early 16<sup>th</sup> century the siege of Vienna was considered to be a huge danger for all Christian countries in Europe.

If this cut-out sheet is assembled one gets a polyhedral cruciform sundial with eight polar sundial planes (Fig. 9). Moreover, experts find Hartmann’s cut-out sheet a very clever and compact construction which can also be glued together by people without any experience in paper cut-outs.

If we consider the iconography of this dial, we realize it is very similar to the ivory cross dial. Somehow this paper

cut-out dial looks like a preliminary exercise for the ivory sundial cross from 1541. This leads to the assumption the paper cut-out cruciform sundial could be the earliest cruciform polyhedral sundial. The author has failed to find an earlier one. Thus, any interested diallist can make his own original version of the earliest cruciform polyhedral sundial – and for very little money.

### ACKNOWLEDGEMENTS

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2. Original Latin text: *Curavit etiam sibi, vere principe dignum gnomonem ex Anglia adferri, quem cum summa animi voluptate vidi, siquidem ab optime artifice, neque rudi mathematices fabricatus est.*
3. Königsberg (nowadays Kaliningrad in Russia) has nearly the same latitude as Frombork.
4. E. Zinner: *Entstehung und Ausbreitung der Copernicanischen Lehre*. 2nd ed. Munich (1988). p. 418
5. Bodleian Library, Oxford. Corpus Christi College, MS 152.
6. R.T Gunther: *Early Science in Oxford*, vol 2. O.U.P (1923). p. 103, translating from Kratzer’s MS *De Horologiis*.
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### Some People have SatNavs...

Seen in a BMW parked in Eynsham, Oxfordshire, by Dennis Stukenbroeker.

