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Translations of Kepler's Astrological Writings

Part I. Kepler as Practising Astrologer

Section 4. Weather Prediction

Section 4.1. Introduction: Kepler and the Art of Weather Prognostication

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John Meeks[1]

In 1594, at the age of 22, Johannes Kepler was appointed to succeed Georg Stadius as teacher of mathematics in Graz, Austria. Like his predecessor, he was expected to produce annual calendars with astrological prognostications of the weather and important political events. Despite his critical attitude to traditional astrology, Kepler seems to have embarked on this task with considerable enthusiasm. His very first calendar, prepared for the year 1595, successfully predicted a severe winter, invasions by the Turks and unrest among the peasants, earning him much praise and respect. He continued to publish calendars regularly until his move to Prague at the turn of the century. Here he resumed the work after a brief pause until 1607, after which he produced no further calendars for the next ten years. One reason for this was no doubt his growing vexation at having to bear the blame whenever a prediction failed to materialise. As he stressed repeatedly in the introductions and dedications to his calendars, the weather is affected by celestial and terrestrial factors alike, so that all prognostications are subject to a factor of uncertainty. In addition, he was devoting more and more of his energies to his quest to discover the true nature of the planetary orbits.

[1] Additions to footnotes in square brackets by Dorian Greenbaum [–Ed.].

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The first two laws had been found as early as 1605, but the third, governing the relative distances of the planets from the Sun, had yet to be revealed. In 1610, during this pause in making calendars, Kepler wrote *Tertius Interveniens*, in which he defended astrology as an empirical science, while rejecting those elements of traditional astrology which he considered superstitious.

A further change in Kepler's circumstances took place in 1612 with his appointment as Imperial Mathematician and Professor of Mathematics in Linz. Here he resumed the production of calendars in 1617, somewhat reluctantly, it would seem, and motivated at first by financial considerations. As he explained in 1617 in a letter to Matthias Bernegger in Strassbourg, 'I have been let down by the Imperial Treasury, … and it seems that Mother Astronomy must beg for support from her daughter, the harlot Astrology'.[2] From 1617 to 1624 he published calendars, with an interruption of two years (1621 and 1622) when he was too involved in the witch trial of his mother. But there may also have been a positive reason for resuming the work. Kepler had made considerable progress in his work on the Rudolphine Tables, so that he could now calculate the major planetary aspects with far greater accuracy, giving his calendars a sounder scientific basis than any others available.

The Scientific Basis of Kepler's Weather Prognostications

In *Tertius Interveniens*, Kepler upholds the empirical scientific basis of astrology against the claims of Dr Philipp Feselius, who had categorically denied the standing of astrology as a science. In the course of his arguments, Kepler points out that medicine as an undisputed science depends on empirical observation to determine the healing power of plants, just as scientific astrology relies on experience to arrive at a true understanding of planetary influences. In the course of roughly seventeen years of observation Kepler had failed to find any confirmation for the different qualities assigned by traditional astrology to the twelve signs of the zodiac, or for their association with the four elements. He did, however, uphold the view that each planet embodied in its own way the qualities underlying Aristotle's teachings on the elements: namely warm/cold and dry/moist. Further, he had become convinced that the effectiveness of the planets was greatly enhanced whenever two or more

[2] J. Kepler, *GW* 11.2 (*Calendaria et Prognostica, Astronomia Minor, Somnium*), Nachbericht, p. 451.

of them stood in a significant aspect, such as conjunction, opposition, square, trine or sextile. The following passage may give some idea of the pleasure Kepler took in setting forth his arguments:

> Respecting the principle that conjunctions of Saturn and the Sun in Capricorn and Aquarius are supposed to cause severe cold, Dr Feselius claims that astrologers who rely upon this get seriously bogged down. By way of reply I should like to present Dr Feselius with a whole philosophical lawsuit.
>
> To begin with, I shall set down my own observations of the weather during this conjunction, as far as I have been able to make them.[3]

There follow details of seventeen conjunctions over a period of eighteen years, some occuring in one of the abovementioned signs, others elsewhere. The following example may be of special interest, as it took place shortly before a great conjunction of Jupiter and Saturn (17th December):

> In the year 1603, 29th November in the sign of Sagittarius, the Sun advanced from Jupiter to Saturn, with Venus close behind. The weather had been mild until the 27th, then on the 28th a southeast wind brought frost. In the afternoon it thawed, but the 29th brought freezing temperatures once more, followed by wind and rain in the evening. The 30th was similar. [4]

The fact that Kepler obviously kept careful records of planetary aspects and the simultaneous weather conditions even when he was not making calendars demonstrates that his interest in the phenomena continued unabated. He concludes that these conjunctions do indeed bring cold weather, but that this is the case regardless of their position in the zodiac. He concludes by saying:

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[3] J. Kepler, *Tertius Interveniens*, Thesis 134, in *Was die Welt im Innersten Zusammenhält, Antworten aus Keplers Schriften*, ed. F. Krafft (Wiesbaden, 2005), p. 324. All translations from this volume by the present translator. [For an English translation of *Tertius Interveniens*, see Ken Negus, trans., *Kepler's Astrology: The Baby, the Bath Water, and the Third Man in the Middle* (Amherst, MA, 2008) –Ed.]

[4] J. Kepler, *Tertius Interveniens*, Thesis 134, p. 324.

> From these particulars one can see that the effect of this conjunction is general, and at the very least gives Nature occasion to stir up the air, clearing the sky in winter and bringing frost. If the wind blows over wet ground, snow may result; in summer or in mild winters there may be rain, especially if the conjunction is strengthened by other aspects. … Now Capricorn and Aquarius are supposed to be subject to Saturn and to share in his cold nature. But since this attribution is pure fantasy, we could not but expect that the rule would hit and miss by chance, as in any fabricated lottery.[5]

In addition to assembling empirical evidence to support his claims, one of Kepler's greatest concerns was to discover an adequate philosophical basis for understanding why and how planetary positions should influence earthly events. Indeed, he repeatedly criticised astrologers for lacking philosophy, and for working with traditonal principles which they did not understand.

Kepler's conviction that the movements of the planets were a spatial expression of the harmony of the spheres offered him a key to understanding the nature of the aspects. Whenever two planets form a significant angle as seen from the earth, they may be said to divide the eclipitic into two segments which, if the ecliptic were imagined as the string of a monochord, would produce a harmonious interval. Thus the trine (120°, or a third of a great circle) can also be said to divide 2/3 of the ecliptic from the whole, producing the interval of the fifth. Similarly, the square (90°) produces a fourth, and the sextile (60°) a minor third, and an opposition (180º) an octave. Kepler added the aspects of quintile (72°) and biquintile (144°) to those used in traditional astrology, as they also produced significant musical intervals: The quintile, being one fifth of a great circle, thereby separating 4/5 from the whole, results in a major third, and the biquintile, separating 3/5, produces a major sixth. Kepler's empirical observations seemed to confirm that these angles were significant, just as they are significant in the geometry of regular polygons, and he includes them in his calendars, giving them equal status to the traditional aspects.

The question remained, however, as to how these harmonious qualities were able to stir the elements on the earth and affect the weather. Since

[5] J. Kepler, *Tertius Interveniens,* Thesis 134, pp. 324-325.

the nature of the aspects was revealed to be musical, this seemed to presuppose the existence of a sentient being capable of perceiving and responding to the music of the spheres. Kepler postulated a soul belonging to the earth, permeating the atmosphere and biosphere, and even penetrating into subterranean caves and chasms. This Earth Soul he imagined as having been created out of the same geometrical and musical principles which govern the movements of the planets. For this reason, those aspects which correspond to musical consonances excite it to resonate, setting in motion the elements which are responsible for weather phenomena.

Moreover, Kepler's observations led him to the conclusion that the influence of major planetary aspects was usually of brief duration, and only effective as long as the aspect was fairly exact. He gives an example in his book *Harmonice Mundi*:

> For instance, as soon as the Sun has moved away from its square with Saturn, the tumult in Nature dies away; for exactly thirty days calm prevails (as long as only the rays of the Sun and Saturn are involved), until the Sun enters into trine with Saturn. Then on one day only stormy weather is stirred up, which ceases as soon as the aspect is past. …[6]

This means that a deviation of only one degree from an exact Square (90°) or Trine (120°) is sufficient to cause the influence of that aspect to cease. He explains this by a comparison with musical intervals, which the listener only experiences as harmonious when they are fairly exact:

> For with regard to two tones, the fact that they may stand in a proportion of 3:1 or 3:2 has no effect on their pitch, but they are pleasant to the ear in this relation, and repulsive when the relation is 7:1 or 7:6. And since that faculty which discriminates between 3:1 and 7:1 must be a form of reason, i.e. a Soul which presides over the sense of hearing, so too must we postulate that it is sensitive to the difference between an arc of 60° and those of 59° and 61°.
>
> And this will hold true, regardless of whether the underlying faculty of reason functions discursively, as it does in a human

[6] J. Kepler, *Weltharmonik*, trans. Max Caspar (Munich, 1973), Book IV, ch. 7, p. 258 (my English translation of Caspar's German). [See also the English translation in ADF, p. 362 –Ed.].

> being with an understanding of geometry, or is merely guided by inborn instinct, like that of the plants, whose leaf-arrangements have been governed by the same geometrical laws since the beginning of the world."[7]

(For readers of *Culture and Cosmos* interested in putting this to the test, in 2012 the Sun stood in square to Saturn on 19th January and in trine on 18th February. A year later the dates are 31st December 2012 and 31st January 2013.)

The Openings of the Doors

The term *apertio portarum,* the 'opening of the doors', refers to certain aspects which are particularly effective in causing rain and wind, or in accelerating their arrival. This concept is rooted in traditional astrology, and is invoked occasionally by Kepler to describe somewhat more complex configurations. Among the most important theoretical works on these aspects are the *Apertio portarum* of Al-Kindi and the *Tractatus pluviarum* ascribed to John of Seville (Johannes Hispalensis), the latter written in the second quarter of the 12th century. The 'Opening of the doors' is defined as a moment involving either conjunctions or other aspects of the Sun or Moon with Saturn; or of Jupiter with Mercury or of Venus with Mars. They are further strengthened when the Moon is situated between the planets thus aspected.[8]

There are three configurations in 1618 to which Kepler applies this term. Concerning the first, at the end of February, he writes:

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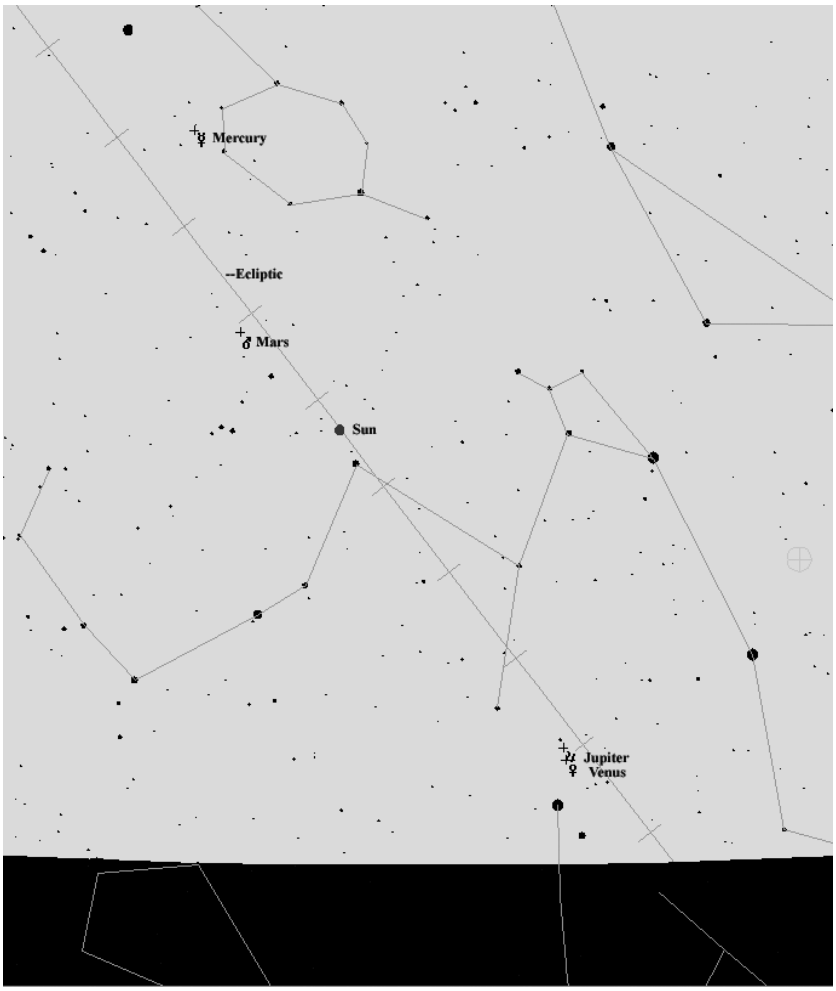
[7] Ibid. (my English translation of Caspar's German). [See also ADF, pp. 361-362 –Ed.].

[8] I am indebted to Dorian Greenbaum for her help in understanding this and several other traditional astrological concepts, and to Charles Burnett of the Warburg Institute, London, for allowing me access to his article in press on the *Apertio portarum* [now published as 'Weather Forecasting, Lunar Mansions and a Disputed Atribution: the *Tractatus pluviarum et aeris mutationis* and *Epitome totius astrologiae* of Iohannes Hispalensis, in *Islamic Thought in the Middle Ages: Studies in Text, Transmission and Translation, in Honour of Hans Daiber*, eds Anna Akasoy and Wim Raven (Leiden and Boston, 2008), pp. 219-265 – Ed.].

Following (the New Moon) the weather will be unsettled until the end of the month due to a quintile of Saturn and the Sun on the 25th, with Venus joining in on the 26th and 27th, forming an 'opening of the doors' (*apertio portarum*) in the form of a conjunction with Jupiter and a square with Saturn.

Figure 1. The western sky at about 15.40 CET on 26 February 1618, showing Venus in close conjunction with Jupiter, just before setting. Mars and Mercury are also shown.[9]



[9] Illustrations for **Figures 1-4** created with Project Pluto astronomical software, Guide 8.0.

Figure 1 shows the arrangement of the planets in the evening sky of 26th February, just before Venus and Jupiter set. These two brightest planets, only half a degree apart, must have offered an impressive sight before sunrise in the east, unless they were hidden behind the rainclouds they were expected to summon. Saturn, near the Pleiades, stood in square to Venus and Jupiter, while Mars was slowly moving into sextile with Saturn. The crescent Moon, moving away from Mercury, Mars, Jupiter, Venus and the Sun, towards Saturn, would have enhanced the strength of the opening of the doors. The second configuration, in early March, is basically a continuation of the first. Kepler writes:

> From the 5th until sometime during the 9th we still have a double opening of the doors (*apertio portarum*), and we may expect some very tempestuous weather to drive out the winter, as it were. At this time not only does Mars advance from a sextile with Saturn to a semisextile with Jupiter, but Mercury moves from a sextile with Saturn to a conjunction with the Sun, with Mars just below; that can be the cause of much wind and rainfall.

Finally, in September: 'On the 14th and 16th Mercury comes into sextile and trine, respectively, with (Saturn and Mars), causing an opening of the doors (*apertio portarum*). If this should give rise to heavy rains, at least there is little danger of cold winds and frost.'

A Closer Look at the Astronomy of the 1618 Prognostications

Kepler's calendar for 1617 was the first to incorporate his own improved calculations for the planetary positions, utilising Tycho Brahe's observations and Kepler's first two laws of planetary motion (the third, not discovered until 1618, concerns the relative distances of the planets from the Sun, and is therefore not relevant to the calculation of their apparent positions.) . Kepler's ephemeris was finally published in 1627 as the Rudolfine Tables. They reduced the mean error in the planetary positions to about one thirtieth of their previous value. In his Dedication Kepler refers to this drastic improvement in the accuracy of his calendar. Unfortunately, no copies of the 1617 calendar have survived, so that the 1618 calendar gives us our first glimpse of the fruits of his labours.

Eclipses

One of the touchstones for determining the accuracy of astronomical calculations are the eclipses of the Sun and the Moon. Referring to the solar eclipse on 26th January, Kepler writes that it 'can be seen in the

uttermost parts of America and Africa, from the Magellanic Straits to the Indian Ocean…and the Sun will be totally eclipsed.'

In reality it was an annular eclipse, meaning that a narrow ring of light remained visible at the moment of centrality, the Moon being too small to cover the Sun completely. However, the centrality zone became very narrow in the South Atlantic (as little as 11 miles wide), so that the eclipse was in fact close to becoming total. The geography of the eclipse is given correctly.

On the second solar eclipse of the year, Kepler writes:

> On the 21st July the Sun will once again be totally eclipsed in the New World. The eclipse can be seen in North America, particularly in Virginia and Nova Francia, as far south as Brasil, and over the Great Ocean with its many islands. The easternomost area of visibility is West Africa, where the Sun may be seen partially eclipsed at its setting. The eclipse is favourable as seen from ships travelling between Africa and America near the island of St. Helena.

Starting in the North Pacific, east of Japan, the path of totality traversed the present United States from northwest to southeast, passing across the Gulf of Mexico and Cuba ('the Great Ocean with its many islands'), and then skimming along the north coast of South America. The last contact with the South American continent was Cape Orange in northern Brasil. The eclipse was not visible from West Africa or from the island of St. Helena. It appears to have occurred slightly earlier than Kepler had predicted, so that the whole visibility zone was shifted westwards.

Finally, referring to the lunar eclipse of 6th August, Kepler expresses the wish that anyone travelling on the way to the New World might observe the New Moon on that morning before sunrise,

> to determine whether some small portion of its southern edge should die away. According to my calculation, it should miss the earth's shadow by just 1½ minutes of arc, passing by it un-wedded. Therefore I should be grateful to be informed how it transpires, for the sake of improving my calculations.

Anyone who had done Kepler this favour would have had reason to be impressed by the precision of these calculations. The eclipse was penumbral, meaning that the Moon only entered the half shadow of the earth. This would have caused only a subtle darkening of the Moon's

southern edge, which might well have gone unnoticed. The Moon missed the umbra by 1.29 minutes of arc, almost exactly what Kepler calculated.

When speaking of Mercury's transit across the solar disc, which Kepler calculated would take place at midnight from 4th to 5th November, he takes the precaution of advising astronomers to 'stand in readiness with a reflecting telescope throughout both days, and to cast the Sun's image through the latter onto a sheet of paper, just in case my calculation should prove inaccurate, and the conjunction take place by day. Others have placed it on 1st November.'

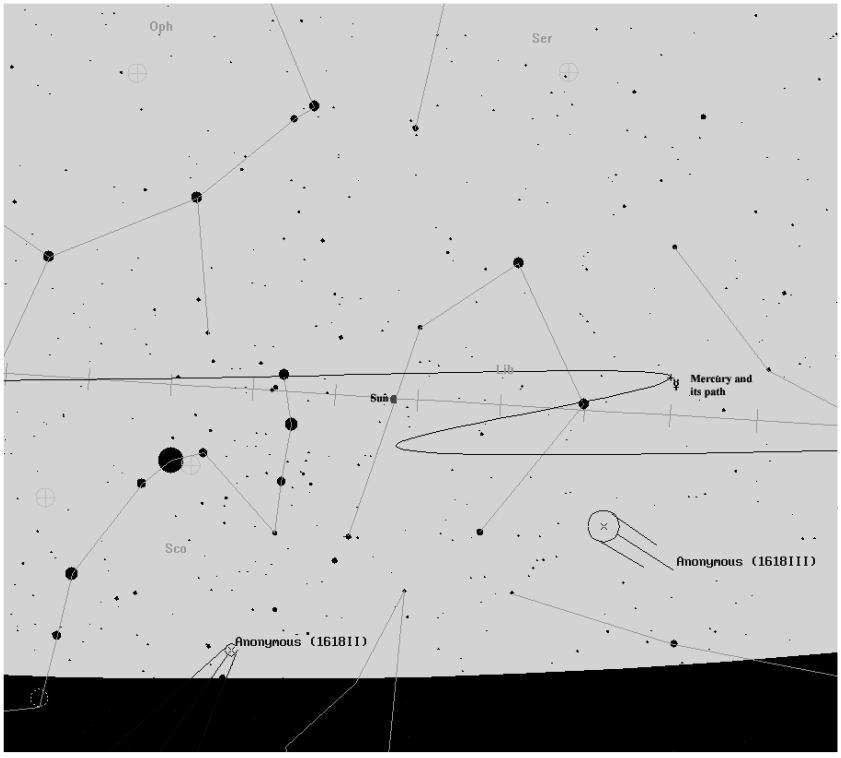
Kepler's precaution proved justified. The transit was indeed visible by day, the first contact of Mercury with the eastern limb of the Sun taking place at ten minutes past noon on 4th November; the transit remained visible until sunset at 4.40 pm. The whole passage of Mercury over the Sun took 5 hours and 4 minutes. The middle was at 2:42 p.m., about nine hours earlier than Kepler had predicted. (Since Mercury is the most difficult of the naked-eye planets to observe, the data available to him did not allow such accurate calculations as for the other planets).

Kepler's further description of the events in the November sky shows clearly that his view of the planets' changing relationships was not dry and abstract, but vivid, pictorial and dramatic:

> From the 7th to the 23rd … Mercury moves from square with Jupiter to biquintile with Saturn, and thence to quintile with Venus, and sextile with Venus. Being surrounded by these planets like a boar encircled by dogs, Mercury uses the same strategy as this animal when thus pressed, and lies down rather than risk running into the jaws of one of his pursuers.

This amusing simile refers to Mercury's standstill before reversing direction and becoming direct. This took place on 13th November (Kepler says the 13th/14th). **Figure 2** shows Mercury's position on its loop near standstill.

Figure 2. The complete loop movement traced out by Mercury during the autumn of 1618, with the stars of Libra in the background. Mercury is shown on its second stationary point on November 13. Just below Mercury's loop Comet 1618III is shown, while Comet 1618II is below Antares and the head of Scorpio. It should be noted that this rather spectacular assemblage is not visible, due to the presence of the Sun.



While a transit of Mercury occurs during inferior conjunction, when the planet passes retrograde between the Earth and the Sun, Mercury can be occulted by the Sun during a superior conjunction, as it slowly overtakes the Sun in the part of its orbit furthest from the Earth. This very nearly happened on 14th May. Kepler writes: 'Mercury sits on the Sun on the 14th near the Pleiades and hurries on from thence towards Venus…'. This expression is exceptionally apt, as Mercury passed only some 38 seconds of arc north of the solar disc. Kepler stresses that four of the five naked-eye planets: Mercury, Venus, Mars and Saturn were gathered

closely around the Sun from the 14th to the 18th. In fact, on the 14th, Mercury, Venus, Saturn and the Sun all stood within were all within about 4 ½° of each other, with Mars about 12° to the west. (See **Figure 3**.) The next day the conjunction of Mercury and Venus occurred. (See **Figure 4**.)

Figure 3. Close grouping of Mercury, Venus, Sun and Saturn on 14 May 1618 at 12.28 CET, just as Mercury nearly grazes the northern limb of the Sun. The two bright star clusters of the Hyades and the Pleiades in the constellation of Taurus frame this impressive concentration of planets.

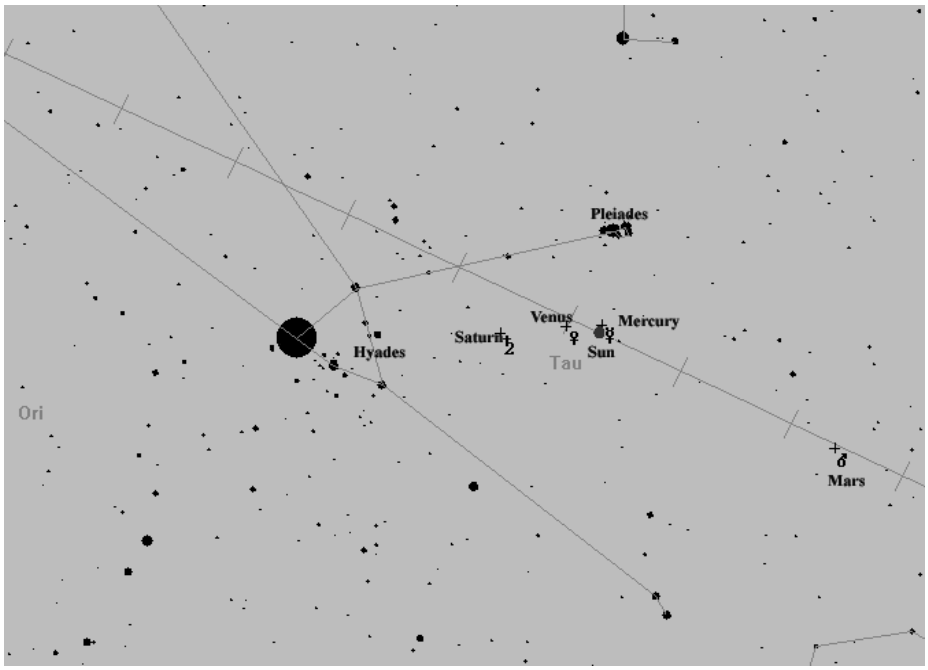
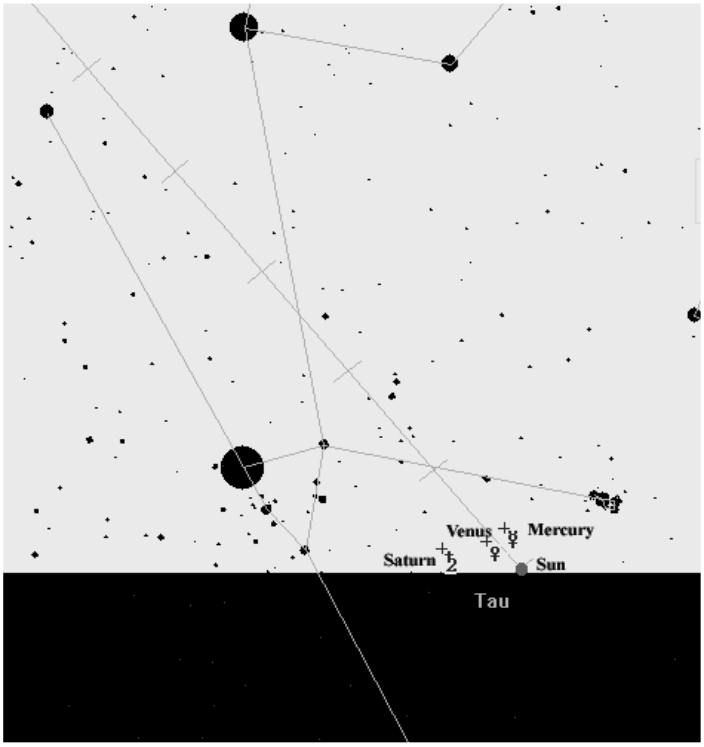


Figure 4. The conjunction of Mercury and Venus on 15 May, just as the three planets and the Sun are about to set (19.40 CET).



On this 15th of May Kepler finally became convinced of his Third Law of Planetary motion, which he had initially rejected when the idea first came to him on 8th March. His jubilation knew no bounds. He spoke of 'divine frenzy',[10] and felt that his discovery possessed a quality of revelation, raising it almost to the level of a religious experience.

On the 23rd May, during a trine of Jupiter and Venus, which Kepler thought might give rise to a 'fearful downpour',[11] the Defenestration of Prague took place, which is generally seen as having triggered the Thirty Years' War.

[10] Max Caspar, *Johannes Kepler* (Stuttgart, 1948), p. 339 (my English translation of Caspar's German).

[11] Kepler's 1618 Calendar, May (see the translation in **Part I.4.2** in this volume, p. 187).

The celestial events of May and November which have here been highlighted formed the background to some of the most dramatic moments in the year 1618: in May the discovery of the Third Law, followed a week later by the Defenestration of Prague, and in November the appearance of the Great Comet of 1618.

Translator's Note. All the Calendars and Prognostications were written in German, so that they might be accessible to the widest possible audience. Kepler's language is vivid and colourful, and often challenging for a speaker of modern German. Every effort has been made to preserve something of the flavour of the original, although it has sometimes been necessary to break up long and tortuous sentences to make them more comprehensible. In order to render the text more readable, I have chosen to write out the names of the planets and aspects, rather than use the sigils, as Kepler did.

The reader will notice that Kepler, who considered the position of the planets in the zodiac to be of secondary importance, seldom indicates the signs in which the aspects take place. In the few cases where he does so, he is referring to the astrological signs, rather than the visible constellations. There is in fact, only one instance where he seems to attach some importance to one of these signs: namely, the entrance of Jupiter into Pisces, which he hopes may be a source of peaceful influences. Astronomically, Jupiter described a loop in the constellation of Aquarius during 1618.