

On Dividing the Sky
Preliminary version!
Final version in preparation!

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Abstract

An abundant amount of astrological house systems has been developed through the times. By studying the evolution of house systems, it will be shown that there is an underlying guiding principle for the construction of houses as well as for the so-called "primary" directions, that has been approached with different accuracy. The notion of "mundane position" and of "spherical house systems" will help classify and understand the different ways of dividing the Primum Mobile that have been proposed by astrologers.

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1 Introduction

The introduction of the Ascendant, the rising point of the Ecliptic, into individual astrology ¹ marks the starting point of many attempts to integrate the *motus primi mobilis*, the daily motion of the sky around the observer into the building of Astrology.

This became particularly important for two parts of the subject:

- The Ascendant was taken as the starting point of a new division of the Ecliptic, which, after an intermediate period working with eight sections,² very soon arrived at a system of twelve *houses*, which were thought in analogy to the twelve signs of the zodiac. The traditional *zodiacal position* of a planet was complemented by the *house position*, i.e. the number (I,II,... XII) of the house that it occupied. Dividing the sky or at least the Ecliptic into twelve parts, taking into account in some way or another the daily motion of the sky, is called the *domification*.
- In the *theory of directions*, a part of the Horoscope is taken to the mundane position (or house position) of another part by the daily motion of the sphere. For example, if a planet is rising at birth time, then a second planet or aspect point will form a contact to the former when it reaches the horizon. The angle of rotation, the so-called *directional arc*, to make this coincidence happen, is translated into lifetime using a proportionality factor which traditionally was simply the equation of one degree of arc with one year of the native's life.

The notion of *mundane position* may be regarded as a quantification of the position of a celestial body in relation to its daily motion. When such a quantification is given,

- *the domification* will be achieved by computing the Ecliptic points corresponding to certain fixed values of mundane position (i.e. having integer multiples of 30° as mundane position values);
- *the direction problem* is solved by computing the mundane position of the first planet, and then determining the angle by which the sphere has to be rotated until the second planet achieves the mundane position of the first planet.

This paper is a continuation of [25] and [26]. The aim is to give a formal description of the process of domification and to derive some consequences. By using nowadays mathematical notations, the idea of house division and its historical manifestations can be worked out more clearly than it was done in the mentioned predecessors. As sources for the history of house systems, I am using mainly [12] and [13], see also [7], [2] and [10].

I owe special thanks to DIETER KOCH for many valuable discussions.

¹see for example [13], pp. 11, for an outline of this development.

²the *oktatopos*, for a first written reference see [20], II.864-970

2 Primitive first concepts

Since there is some understanding of spherical trigonometry and astronomy required to understand the problem of mundane position, the first concepts of mundane position were of quite an ad hoc nature.

2.1 House position 'by counting'

One of the first house systems – if it is allowed to call it like this – is the method of reckoning signs: The first house simply is the sign of the Ascendant. The second house is the subsequent sign, and so on. The "cusps" of this very primitive method are therefore the beginnings of the zodiacal signs. Neither Ascendant nor MC are house cusps in this system. While the Ascendant at least always is located in the first house, the MC may be in house IX, X or even outside of these. Instead of being house cusps, Ascendant and MC play the role of additional 'sensitive points' – if they are taken into respect at all in the Horoscope.

According to KNAPPICH and GIL BRAND, this method originates in the early graeco-egyptian ('Hermetic') astrology scene which was not interested in such sophisticated details as tables of ascensions; instead, they needed easy and handy algorithms to do their predictions. It had been established by BOUCHÉ-LECLERQ in his *Astrologie greque* with many examples[3] that the counted houses and the counted 'lots' (like the Lot of Fortune, but computed on the level of zodiac sign) were the methods of choice for these astrologers.



Figure 1: *Horoscope from P. Oxy. 235 (about 20 CE).*

The Horoscope figure from the *Oxyrhynchus Papyrus* (redrawn by NEUGEBAUER in

[22], p.18) dates to about 20 C.E. It shows a circular Horoscope diagram, arranged like a modern Horoscope scheme with the ascending sign Taurus to the left, the signs in counterclockwise order, so that the lower half corresponds to the invisible part of the Ecliptic. This figures illustrates the precision of average Horoscopes of that time – up to one sign – which necessarily implies that aspects and houses can only be identified on the level of zodiac sign. With other words: the method of counting houses has its roots in the lack of computational precision.

GIL BRAND quotes the *carmen astrologicum* of DOROTHEUS SIDONIUS (first century C.E.) with a random example,³ a Horoscope with Ascendant in $18^\circ \text{ } \text{♉}$ and \odot in $6^\circ 50' \text{ } \text{♉}$, considered as Hyleg, although above the horizon, which can only be explained by the usage of counted houses, equating the complete zodiac sign $\text{ } \text{♉}$ with the first house.

Later, the method is described in a classical textbook of Vedic astrology due to VARAHA MIHIRA and referred to as *Rasi Chakra*.⁴ Interesting enough, this simple method survived through the Indian and Arabian times of astrology. Even nowadays, Vedic astrologers are working with those 'counted houses' ([12], p.20).

For the Arabian astrologers, note that an early representant of that epoch as MESSAHALAH uses the counted houses simultaneously with another system, like in the following quotation of his *Astrological History* (which is used as an arbitrary example for many similar places):

... and Jupiter and Mars in the eleventh [house], they will be by division in the tenth...⁵

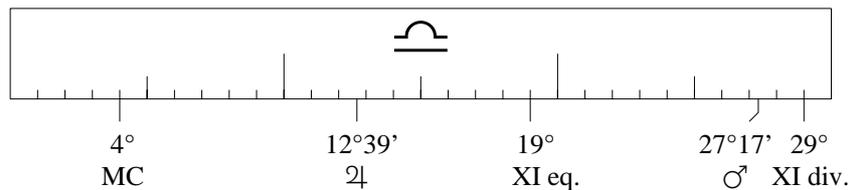


Figure 2: *Ecliptical house divisions (example)*.

The example refers to a Horoscope with Ascendant in $19^\circ \text{ } \text{♈}$, ♃ in $12^\circ \text{ } \text{♈}$ and ♄ in $27^\circ \text{ } \text{♈}$. Since ♈ is the eleventh sign, counted from the sign of the Ascendant $\text{ } \text{♈}$, ♃ and ♄ are therefore in XI "by counting". The method "by division" on the other hand cannot be an equal house system, since then ♃ would be in X and ♄ in XI (the house cusp for XI would be at $19^\circ \text{ } \text{♈}$). Since for the latitude of Bagdad, the above Ascendant results in a Medium Coeli of about $4^\circ \text{ } \text{♈}$ and a cusp XI of

³[4], p. 212. Mind that the original version of the *carmen astrologicum* is lost, however.

⁴[21], quoted in [12], p. 20

⁵[8], p.40

about 29° \simeq , the 'division method' could be the EUTOKIOS method (see section 4.1 below).

2.2 The equal houses

The equal houses start with the Ascendant which is determined as usual as intersection point of the Horizon with the Ecliptic. The cusps of the subsequent houses are obtained by adding integer multiples of 30° to the longitude of the Ascendant.

Compared to the counted houses, the equal houses mark a slight progress, since they take into account the actual longitude of the rising point of the Ecliptic. The Horoscopos is taken more seriously, and the insight is growing that it should be integrated as astronomical point into the house construction.

Although the Ascendant in this system forms the cusp of the first house, the Medium Coeli, is not a house cusp. It remains a sensitive point, usually positioned somewhere in the ninth or tenth house.

3 PTOLEMY

3.1 Houses and Domification

Although the houses are present at many places of the "astrologers' Bible", the *Tetrabiblos* contains no details about the domification. PTOLEMY assumes the readers' knowledge of how to compute the houses, as well as some basics about their classification (e.g. the meaning of angular, intermediate and cadent houses). The astrological aphorisms of the *Tetrabiblos* are working mainly with planets, signs and fixed stars. Only marginally, the meaning of particular houses are taken into consideration. E.g. the connection of the fifth house with children, or of the sixth and twelfth house with servants are mentioned. But there is no systematical explanation of the meanings of all the houses.

From the beginning of section III.10 *Of Length of Life* it has been induced that PTOLEMY used the equal system of houses: In order to define the *aphetical places*, he divides the Ecliptic into 12 houses of 30° , the first house beginning 5° before the Ascendant and ending 25° after it. From this passage⁶, it seems that the tenth house (μεσουράνημα) is nothing else than the part of the Ecliptic in right square aspect ($= -90^\circ$) to the first house.

On the other hand, in this same chapter he works at a later place with the *Medium Coeli* as intersection of the Meridian with the Ecliptic. With no doubt, PTOLEMY knew that this point does not always form a 90° angle on the Ecliptic to the Ascendant. Since he uses the same word μεσουράνημα for the Medium Coeli, there is a contradiction between these two statements.

⁶[28], p.273

Later astrologers⁷ have tried to harmonize these statements by introducing the so-called *mundane aspects*. But it seems more plausible to me that PTOLEMY reproduces two different techniques in parallel, taken from two different traditions. Each tradition may have had its own area of validity: The "hermetic" house division may have been the right method for determining the aphetical places, while the astronomically correct Medium Coeli had been used for the computation of directions.

To let the first house start 5° before the Ascendant, is a speciality of the PTOLEMEIC variant of the equal house system that had some influence on later domification methods; it was probably led from the idea that the Ascendant has an influence by aspect (due to its orb) in both directions. This *Ptolemeic shift* of 5 degrees has been taken over into other house systems of late antiquity (PORPHYRIOS and RHETORIOS, see sections 4.1 and 4.2 in this paper).

3.2 Definition of Mundane Position

In Tetrabiblos, section III.10 *Of Length of Life*, PTOLEMY gives a definition of what we would call the locus of mundane position, and in the sequence he exemplifies his method of computing directions with three examples.

ὅμοιος μὲν γὰρ καὶ ὁ αὐτὸς τόπος ἐστὶν
ὁ τὴν ὁμοίαν καὶ ἐπὶ τὰ αὐτὰ μέρη θέσω ἔχων
ἄμα πρὸς τε τὸν ὀρίζοντα καὶ τὸν μεσημβρινόν.

*For a place is similar and the same if it has the same position in the same direction with reference both to the horizon and the meridian.*⁸

The points on the visible part of the Meridian are therefore all "similar to each others" – they are all in culmination, and "similar" to each others are the points on the eastern semicircle of the Horizon – they are all rising. But what about the points between rising and culmination? How can their "intermediateness" between these two positions be quantified? How can we compare two different points with relation to the angles?

In this chapter, we will work out a formal framework for candidates of "systems of mundane position", claiming to be able to answer this question.

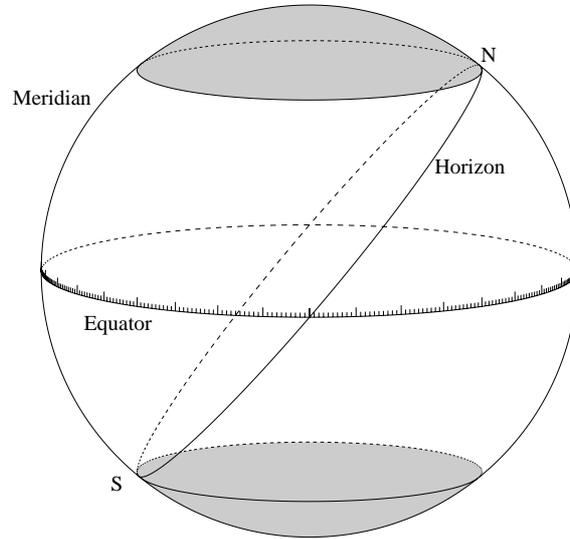
First of all, we want to restrict the problem to those points of the sphere that, additional to culmination, are subject to rising and setting at the given location.⁹ We therefore disregard the circumpolar regions:

Definition I *As region of definition \mathcal{D}_Φ for systems of mundane position, we define the spherical layer resulting from the celestial sphere by excising the two*

⁷e.g. PLACIDUS, see[11], Thesis 12, p. 256

⁸[28], III.10, p.291

⁹This restriction is not arbitrary, but originates in the nature of the problem: It doesn't make sense to express the "intermediateness" between rising and culmination, for a point which doesn't rise at all.

Figure 3: *The domain \mathcal{D}_Φ*

circumpolar caps. If \mathcal{S} denotes the sphere, the points being specified by their coordinates α for right ascension and δ for declination, and Φ the geographical latitude of the location, we thus define

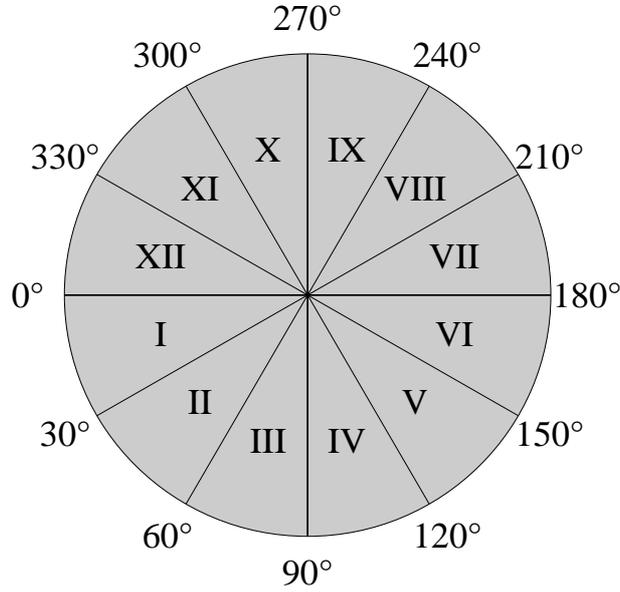
$$\mathcal{D}_\Phi := \{(\alpha, \delta) \in \mathcal{S} : |\delta| < 90^\circ - |\Phi|\}$$

We can think of \mathcal{D}_Φ as the maximal region of the sphere for which it makes sense to speak of a mundane position, because the points of this region are rising, culminating and setting.

Figure 4 demonstrates our convention to measure mundane position which is led by the analogy of houses to zodiac signs (I = Υ , II = ϑ etc.). The Ascendant is therefore in analogy with the Vernal Point, and the houses are counting in the same direction like the signs. The mundane position for Ascendant and Descendant has to be 0° and 180° , respectively. MC and IC get the values 270° and 90° , respectively. From the beginning of the $\delta\omega\delta\epsilon\chi\acute{\alpha}\tau\omicron\pi\omicron\varsigma$ up to the contemporary astrology, the analogy between signs and houses is one of the essential analogies for interpreting houses: The quality of a house can be thought of as a "material" or "mundane" specializations of the traits of the corresponding zodiac sign.

We are now able to give a minimal definition for the notion of "concept of mundane position":

Definition II *Let t be the sidereal time of birth and Φ the geographical latitude of the birth place. A concept of mundane position is a family of maps $\mu_{\Phi;t} : \mathcal{D}_\Phi \rightarrow [0^\circ, 360^\circ[$, such that*

Figure 4: *Mundane Position*

1. The functions $\mu_{\Phi;t}$, considered as maps to the unit circle, are continuous.¹⁰
2. The angular semicircles are mapped to multiples of 90° :

$$\mu_{\Phi;t}^{-1}(0^\circ) = \text{Eastern semicircle of the Horizon}$$

$$\mu_{\Phi;t}^{-1}(90^\circ) = \text{Invisible points of } \mathcal{D}_\Phi \text{ in Meridian transit}$$

$$\mu_{\Phi;t}^{-1}(180^\circ) = \text{Western semicircle of the Horizon}$$

$$\mu_{\Phi;t}^{-1}(270^\circ) = \text{Visible points of } \mathcal{D}_\Phi \text{ in Meridian transit}$$

3. For each parallel circle contained completely in $\mathcal{D}_{\Phi;t}$, i.e. for fixed declination δ (with $|\delta| < 90^\circ - |\Phi|$) the mundane position $\mu(\alpha, \delta)$ is a strictly monotonous function of the meridional distance $MD := \alpha - t$ reduced to the interval $]0, 360]$.
4. The function is equivariant with respect to translations of t and α , meaning more specifically that

$$\mu_{\Phi;t+\tau}(\alpha, \delta) = \mu_{\Phi;t}(\alpha + \tau, \delta)$$

for all τ . This implies that the mundane position in fact depends only on the meridional distance $\alpha - t$ rather than on α and t independently.

In the course of this paper, we will surpress the dependence of t in the notations. This is justified by the translational equivariance (condition II.4). We consider the sidereal time t arbitrary but fixed.

¹⁰This may be formulated more formally by postulating the continuity of the composition $(\cos \mu_{\Phi;t}, \sin \mu_{\Phi;t})$.

Condition II.3 ensures that the mundane position is decreasing strictly with increasing sidereal time.

The definition is minimal, since there still is an infinite quantity of such concepts of mundane position. It only covers its formal requirements. The requirement that such a system should be derived in a conceivable manner from the spherical geometry of the rotating celestial sphere, can itself not be formalized!

If a house system really reflects the daily motion of the celestial sphere, then it should be derivable from an underlying concept of mundane position. This leads us to the following

Definition III *A house system will be called spherical if the corresponding domification can be extended to the sphere, i.e. if it is derived from a concept of mundane position.*

As simple and minimal as they are – the formal requirements of the definition II already lead to some strong consequences:

Consequence 1 *From the definition of a concept of mundane position, it follows: A parallel circle of fixed declination contained in \mathcal{D}_Φ is mapped bijectively to the interval $[0; 360[$.*

This is a standard property of strictly monotonous functions (II.3), combined with the continuity as map to the circle (II.1).

Consequence 2 *A concept of mundane position can neither be based on the ecliptical longitude nor on the right ascension - more precisely:*

1. *The mundane position μ_Φ cannot be a function of the ecliptical longitude alone.*
2. *The mundane position μ_Φ cannot be a function of the right ascension alone.*
3. *The mundane position μ_Φ cannot be a function of the oblique ascension with any fixed polar elevation φ alone.*

Indeed: there are points with different ecliptical longitudes on the part of the Meridian contained in \mathcal{D}_Φ . If mundane position depended on ecliptical longitude alone, $\mu^{-1}(90^\circ)$ would be more than the meridional semicircle, as was required in condition II.2: This semicircle should then have to be joined by the semicircles of points having those longitudes. The same argument, applied to the Equator with the Horizon instead of the Meridian, excludes a dependency of μ_Φ of the right ascension alone. Similarly, the dependency of oblique ascension alone can be excluded.

This consequence has been written out in this detail, since it rules out many historical attempts of domification as non-spherical, insufficient for building a concept of mundane position from it. They don't solve the task of dividing the sky. Of

course, the primitive methods mentioned in section 2 are of this kind, since they are working with the ecliptical longitude alone. But also a slightly more sophisticated method like that of PORPHYRIOS is insufficient for this purpose. Later methods like RHETORIOS, ALCABITIUS (based on right ascensions) have to be excluded as well as the modern method of KOCH based on oblique ascensions of fixed polar elevation.¹¹

The definition II implies that the set \mathcal{D}_Φ of celestial points subject to rising and culmination can be decomposed as a disjoint union of the sets $\mu_\Phi^{-1}(\gamma)$ with $\gamma \in [0^\circ, 360^\circ[$. These sets will get a special name:

Definition IV *The set $\mu_\Phi^{-1}(\gamma)$ is called the position curve for the mundane position γ . It is the set of all points of the sphere having mundane position γ .*

With these sets, we finally arrived at the PTOLEMY quotation from the beginning of this section: The position curve is nothing else than the set of points having a "similar position" in the sphere with respect to Meridian and Horizon.

Since the four special position curves mentioned in the definition II are all semicircles, it is a natural question to ask for mundane position concepts based *completely* on semicircles, meaning that all position curves are semicircles. What can be said about such systems?

Consequence 3 *A position curve that is a semicircle will be called position circle. A position circle must necessarily end in the intersection points of Horizon and Meridian, the North point and South point of the Horizon.*

Indeed – if this wouldn't be the case, the position circle would intersect the Horizon in a point inside of \mathcal{D}_Φ which already would force it to coincide with the Horizon, according to condition II.2.

The position circles have been introduced into the astrological calculations by AL BIRUNI. Later, they were used for the house systems of HALY ABENRAGEL and REGIOMONTANUS.

It is interesting to notice that a concept of mundane position based on position circles can easily be extended from \mathcal{D}_Φ to the complete sphere: Any point, except South and North point of the Horizon (the axes of the position circles) have a unique mundane position, since they lie on a unique position circle. It is not clear whether this can be valued as an advantage of these systems: Since the circumpolar points do not rise nor set, assigning a mundane position to them is a meaningless operation.

3.3 Directions

Let's come back to the chapter III.10 *On the Length of Life* of PTOLEMY. It gives a complicated algorithm to determine the time of death of a native. For our

¹¹However, there is a modification of the ALCABITIUS system ascribed to ABENRAGEL, which is spherical (see section 5.3).

purposes, this chapter is particularly important because it is the only place in the whole book where the method of directions is explained and used. Roughly, the algorithm goes as follows:

In the first place, the astrologer has to determine the *prorogator* (ἀφεικὸς τόπος, called Hyleg in the later Arabic literature), which is usually the Sun by day and the moon by night, if they are not placed in 'bad houses', i.e. the eighth and twelfth house. In that case, there is a list of alternative choices for the prorogator, ending in the ὠροσκόπος, the ascending point of the Ecliptic.

When the prorogator has been distinguished, there are two different methods of determination of lifetime, the *horimaea* (ὠριμαία) and the *projection of rays* or *actinobolia* (ἀκτινοβολία). The latter is the only in which we are interested. It applies if the prorogator is located in quadrant IV: Above the horizon, but eastern of the meridian.

In this case, the motion of the *maleficient planets* ♄ and ♁ and their aspects due to the *motus primi mobilis* is considered. The first of these points reaching the mundane position which the prorogator had at the time of the birth will kill the native. More precisely, the time when this happens is measured in equatorial degrees, and the number of degrees equals to the number of years which the stars allot to the native.¹²

With the notions about mundane position concepts of the preceding section, we may define in accordance with PTOLEMY:

Definition V *Directing a point of the sphere, the Promissor to another point of the sphere, the Significator means to rotate the sphere around its polar axis until the Promissor acquires the mundane position of the Significator. The rotation angle to make this happen is called the directional arc.*

Already REGIOMONTANUS extracted this definition from the text:¹³

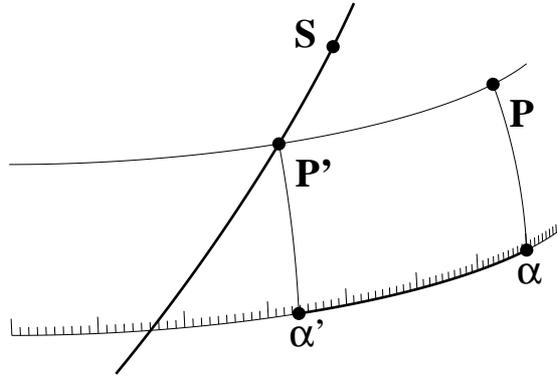
Dirigere non est aliud quam movere spheram
donec locus secundus traducitur ad situm primi.

*Directing is nothing else than rotating the sphere until the second place
is transferred to the position of the first.*

Figure 5 demonstrates the procedure: It shows a point S of the Horoscope located on its mundane position curve (the bold line). Another point P may have a different mundane position – but, by the rotation of the sphere, it will eventually reach the mundane position of S . As the figure shows, the Promissor will in general not meet the place of the Significator itself, since it may have a different declination. The problem therefore *requires* a concept of mundane position: Using such a concept, it

¹²Of course, there are some exceptions of this rule. For example, the beneficent planets Venus or Jupiter could interfere and modify the expected lifetime. But we are not interested in the details, since we want to understand the method of directions.

¹³[30], problem 25

Figure 5: *Directions*

is clear from requirement II.3 that there is exactly one point of intersection of the Significator's position curve with the Promissor's parallel circle. The directional arc Δ will be the difference in right ascension between the Promissor and this intersection point:

$$\Delta = \alpha - \alpha'$$

The question now is: What was the concept of mundane positions that PTOLEMY used? In Tetrabiblos III.10, PTOLEMY describes the concept in words, and additionally provides a computational example for it. Although only one of the examples is of worth for our question, we can be lucky to have it, since it finishes some inappropriate interpretations of the text brought up by REGIOMONTANIANS.¹⁴

PTOLEMY observes that it is easy to determine the directional arc if the prorogator is ascending or culminating: In that case, one just has to determine at what time the destructing aspect point will ascend or culminate and then to compute the difference of these two times, measured in equatorial degrees. However, he sees that it is insufficient to work with ascension or culmination times if the prorogator is located somewhere between rising and culmination. For the intermediate points, he defines the notion of mundane position, as quoted and discussed in section 3.2. The next statement informs us about PTOLEMY's choice:

Τοῦτο δὲ ἔγγιστα συμβέβηκε τοῖς ἐφ' ἐνὸς κειμένοις
 ἡμικυκλίου τῶν γραφομένων διὰ τῶν τομῶν
 τοῦ τε μεσημβρινοῦ καὶ τοῦ ὀρίζοντος,
 ὧν ἕκαστον κατὰ τὴν αὐτὴν θεήσιν
 τὴν ἴσην ἔγγιστα καιρικῶν ὥραν ποιεῖ.

*This is most nearly true of those [points] which lie upon one of those
 semicircles which are described through the intersections of the meridian*

¹⁴The misunderstanding is going back to REGIOMONTANUS himself, but has been propagated in the last century by G. SCHWICKERT, see [31], p. 38 and 123-124.

and the horizon, each of which at the same position makes nearly the same temporal hour.

Thus, in the first place, we are told which concept of mundane position PTOLEMY prefers: Two planets are in the same mundane position if *they make the same temporal hour*. A temporal hour is the twelfth part of the daily arc, i.e. of the time from rise to set. This means, more precisely, that according to PTOLEMY, two points are similar if the times which passed since the points rised, are the same when measured as proportional parts of the arc from rising to culmination. This is a good concept, because the meridian and the horizon are naturally embedded into it: they define lines of equal mundane position (the proportion makes 1 and 0 respectively in these cases). Let's call this concept of mundane the position the *temporal* concept and let us undertake the effort to spell it out in detail:

Definition VI *If*

$$\begin{aligned} MD_d &:= \alpha - t \\ MD_n &:= \alpha - (t + 180^\circ) \end{aligned}$$

denote the meridional distances of day and night, and

$$SA_{d/n} := 90^\circ \pm \arcsin(\tan \delta \tan \Phi)$$

denote the semi-arc of day or night, the temporal mundane position is defined by

$$\mu = \begin{cases} \left(\frac{MD_d}{SA_d} + 3 \right) \cdot 90^\circ, & \text{for points above the horizon} \\ \left(\frac{MD_n}{SA_n} + 1 \right) \cdot 90^\circ, & \text{for points below the horizon} \end{cases}$$

The formal requirements on a concept of mundane position listed in definition II are verified easily.

In the second place, the quotation claims that the position curves belonging to the temporal system can be *approximated* by semicircles. It is important to observe that PTOLEMY mentions the position circles *only* as an approximation for the temporal concept. He doesn't want to base directional calculations on position circles unless as an approximation for the temporal system. This is stressed by the fact, that he uses the word ἔγγιστα (approximately) at two places in this quotation.

This becomes even more obvious by his example following in the text. He directs the ecliptical point with longitude $60^\circ (= 0^\circ \text{ II})$ to the vernal point (0° V) assuming the latter in four different mundane positions: Rising, culminating, setting, and in an intermediate position. If we want to find out whether PTOLEMY worked with the temporal mundane position or with position circles, we need his computations of the directional arc when the prorogator is at an intermediate position – since the position curves of the four angles ASC, DSC, MC and IC coincide for any system

of mundane position.- In his intermediate example, $18^\circ \text{ } \text{♄}$ is in mid-heaven. His computation of the directional arc until $0^\circ \text{ } \text{♈}$ reaches the mundane position of the vernal point results in a value of 64° . Using, as PTOLEMY does in his example, the latitude which yields a maximal daily arc of 14 hours (according to the *Almagest*, this is the climate of Lower Egypt, $30^\circ 22' \text{ N}$ ¹⁵) and the value $23^\circ 51' 20''$ for the ecliptical obliquity,¹⁶ we obtain an arc of 64.1° in the temporal concept and an arc of 66.7° when working with position circles. This proves that PTOLEMY used the temporal mundane positions for his directional calculations.

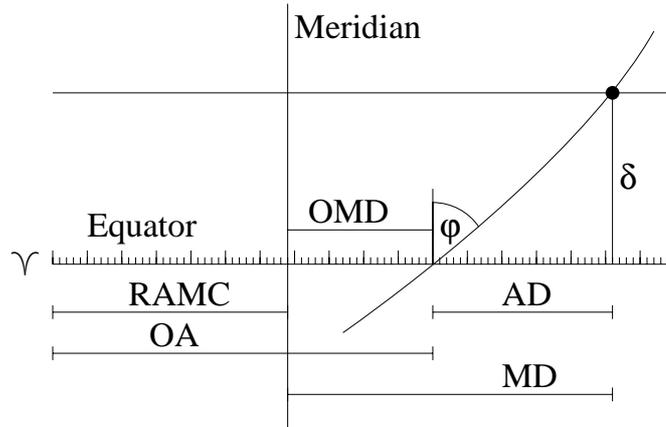


Figure 6: *Parts related to the mundane position curve*

There is a common nomenclature for different geometrical parts which are connected with a concept of mundane position. First of all, by analogy to the horizon, the position curve – and each point on it – has a *polar elevation* φ , which is the complement to its angle with the Equator,¹⁷ and an *oblique ascension* (OA), which is the distance of the curve from the Vernal point, measured on the Equator.¹⁸ In general, each point of the sphere has a *right ascension* (RA). The difference of its right and oblique ascension is called *ascensional difference* (AD). Finally, there is, as we already know, a *meridional distance* (MD) of a star from its culmination, and an *oblique meridional distance* (OMD), defined as distance of the position curve from the meridian, as measured on the Equator. The mundane position can be regarded as a function of MD , δ and Φ .

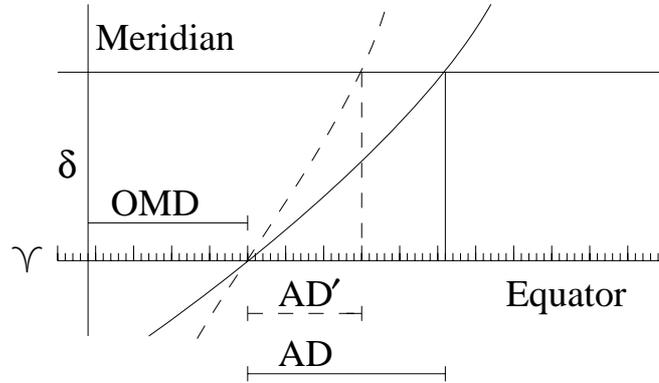
It is interesting to understand the difference between the position circle and the temporal position curve by formulae. For this, it is convenient to keep the OMD

¹⁵[29], p.95

¹⁶[29], p.78

¹⁷For the Horizon, the polar elevation coincides with the geographic latitude and is indeed the elevation (i.e. the altitude) of the celestial pole above the Horizon.

¹⁸This quantity is called ascension by pure analogy to the horizon. Of course, nothing is ascending (rising) on an intermediate mundane position curve.

Figure 7: *Comparing mundane Positions*

arbitrary but fixed and to look at the differences of the AD values that result for different declinations on the two position curves having that fixed OMD (see figure 7).

Let's assume for simplicity that the mundane position in question is somewhere between rising and culmination, i.e. $0^\circ \leq MD \leq 90^\circ$. We denote with AD_p and AD_t the two ascensional differences derived from the position circle concept and from the temporal concept, respectively. Then an easy calculation shows

$$AD_t = \frac{MD}{90^\circ} \cdot \arcsin(\tan \delta \tan \Phi),$$

$$AD_p = \arcsin(\sin(MD) \tan \delta \tan \Phi).$$

We see that AD_t can be transformed into AD_p by applying the following two operations:

- Commute the factor $MD/90^\circ$ with \arcsin , and then
- replace the linear function $MD/90^\circ$ by $\sin(MD)$

Both operations are approximations: For small arguments, a factor can be commuted with \arcsin , and the linear function is an interpolation of the sine (on the interval $[0, 90]$ that we are considering here). This shows that for small values of δ or Φ and for points near the meridian, the two concepts of mundane position are very close.

4 After PTOLEMY

4.1 Division of ecliptical longitudes

In section 2, I already exposed the two oldest house systems based on the longitude of the Ascendant alone. From the beginning, astrology had its focus on the Ecliptic. If we leave aside specialities like the parallel aspects, the planetary latitudes were ignored in astrological considerations – thus, not the body itself but its projection on the Ecliptic is the astrologically relevant object. For a renaissance astrologer like PEGIUS, the Ecliptic plays the role of a mediator, he consistently calls it *Scheinbrecherin* in his textbook *Geburtsstundenbuch* [23].¹⁹

The development went on from the Ascendant to the four *Kentra*, a division into four quadrants of 90° each, and in the first centuries C.E., astrology arrived at the equal house system with a span of 30° for each house, starting with the Ascendant.

As soon as the 'true' or 'mathematical' Medium Coeli and Imum Coeli, the intersections of Meridian and Ecliptic, had been introduced in the Horoscopes, the question arose how to integrate these new points into the system of houses. It was clear to the more reasonable astrologers that only one point could be the MC: either the mathematical MC or the point being in right square aspect to the Ascendant. If it was the first, then how could the quadrants defined by Ascendant, Descendant, MC and IC be trisected in a natural way?

The first methods of this kind were based on ecliptical longitudes. KOCH and KNAPPICH ([13], p.73) mention the Horoscope of the emperor HADRIAN which was most likely erected by ANTIGONOS OF NIKEA in about 160 C.E. This seems to be the first domification known to us that works with the mathematical M.C. This same method has also been used later by the mathematician and astrologer EUTOKIOS OF ASKALON (born 497 C.E.) whose own Horoscope has been preserved in various manuscripts.²⁰

The *Ptolemeic shift*, his postulate that each house should start 5° before its associated cusp (Tetrabiblos III.10, see section 3.1), led to some modifications of the method:

PANCHARIOS (about 200 CE) had an interesting interpretation of the *Ptolemeic shift*: He claimed them to be not a fixed difference in longitude but always the sixth part of the actual house length that comes out with the division method. This means: He subtracts 5° *in mundane position*, not in ecliptical longitude. PORPHYRIOS (about 250 CE) instead, worked with a fixed 5° shift in longitude.

It is interesting to observe that this domification method survived until the late medieval times. The *Astrolabium planum* by PETER OF ABANO (copied in the

¹⁹which could be translated to 'reflector of the rays' – in the sense that all the aspects, the 'planetary rays' are mediated through the Ecliptic. This does not prevent him to base his directional computations on both longitude and latitude, as was done in his reference work, the *tabulae directionum profectionumque* of REGIOMONTANUS.

²⁰[13], p.70

well-known "Heidelberger Schicksalsbuch" [1]) contains for each ascending degree of the Ecliptic an empty Horoscope scheme with the house cusps. The house cusps are computed by division of the Ecliptic, i.e. according to the EUTOKIOS method. In all cases, the lines of mundane position would be the semicircles of fixed ecliptical longitude, which, as was argued in Consequence 2, cannot be the base for a spherical house system.

4.2 The Equator as reference

A manuscript by the byzantine astrologer RHETORIOS (about 600 CE) *How to find on the degree the beginning of the twelve house cusps* has been published by CUMONT in CCAG VIII.1, see also NEUGEBAUER[22], No. L 428. The method described marks the important transition from Ecliptic to Equator as more adequate to the problem of mundane position, since the Equator is the reference plane for the daily motion of the Sphere.

RHETORIOS subtracts the *Ptolemeic shift* of 5° from the given Ascendant of his sample Horoscope. This defines the beginning of his first house. Then he computes the daily semi-arc of this Ecliptic point and divides it into three parts. Starting with the RA for house I, he gets the RA for the beginning of houses XII, XI and X by subtraction of the third parts. RA X, in his system, therefore is not the true MC of this Horoscope but a calculated MC which belongs to his beginning of house I. For houses IX, VIII and VII, he continues with the *nightly* semi-arc of house I (the complement to 180° of the daily semi-arc).

The system itself is clearly of intermediate nature. But it shows that the ecliptical division was felt insufficient. As an ex post definition of the houses, it does not really derive the cusps in a constructive way. It only takes the four *Kentra* as given, it does not look at the spherical construction or astronomical significance of the *Kentra*. The method of RHETORIOS uses the temporal hours of a certain parallel circle instead. From an abstract and astronomically meaningless division of the Ecliptic, it tries to proceed to a division of *ascensional times*.

This same method, but with cusp I as Ascendant (i.e. without applying the Ptolemeic shift of 5° to it), the method has been propagated by ALCABITIUS (about 980 C.E.), and probably it is also identical with the method ascribed to ALBATEGNIUS (880-929), although his domification description is somewhat unclear.

Since the method is defined by meridians – it computes the cusps as Ecliptic points with a given RA – it cannot be extended to the sphere, due to Consequence 2 above.

5 Spherical House Systems

5.1 The projection method

To illustrate some important spherical house systems, we will use the venerable *stereographic projection* which has been used for sky maps at least since the time of EUDOXOS OF KNIDOS. In contrast of the usual choice for astrolabes, however, we will choose a different projection center than the geographic pole. For our purposes, it is more convenient to project from the northern intersection of Horizon and Meridian.²¹ The following picture shows a transversal section of the sphere along the Meridian which therefore forms the circumference of the section. Orthogonal to the drawing plane, we have the Prime Vertical (V1), and the Horizon. The points of the sphere are mapped to the plane Π which is parallel to V1, containing the South Point of the Horizon. The dashed line mapping the point P to P' illustrates the projection method.

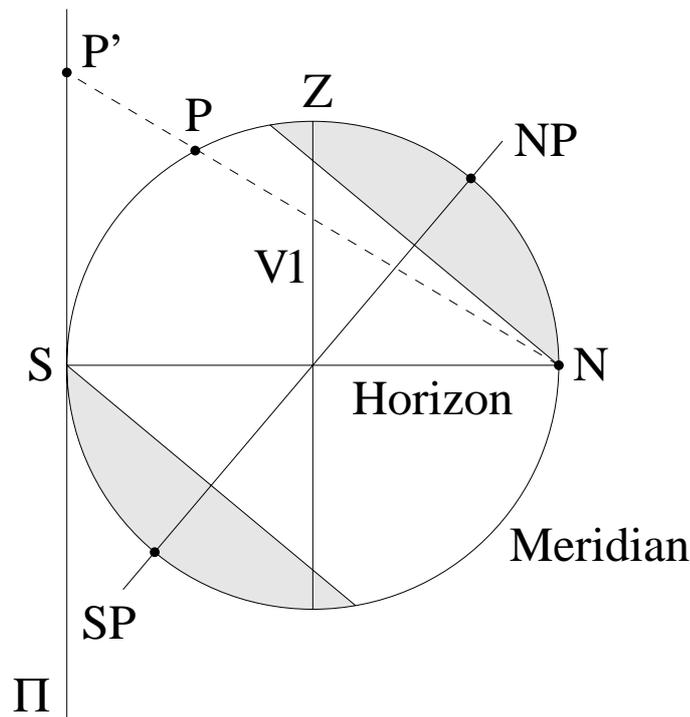


Figure 8: Projecting from N

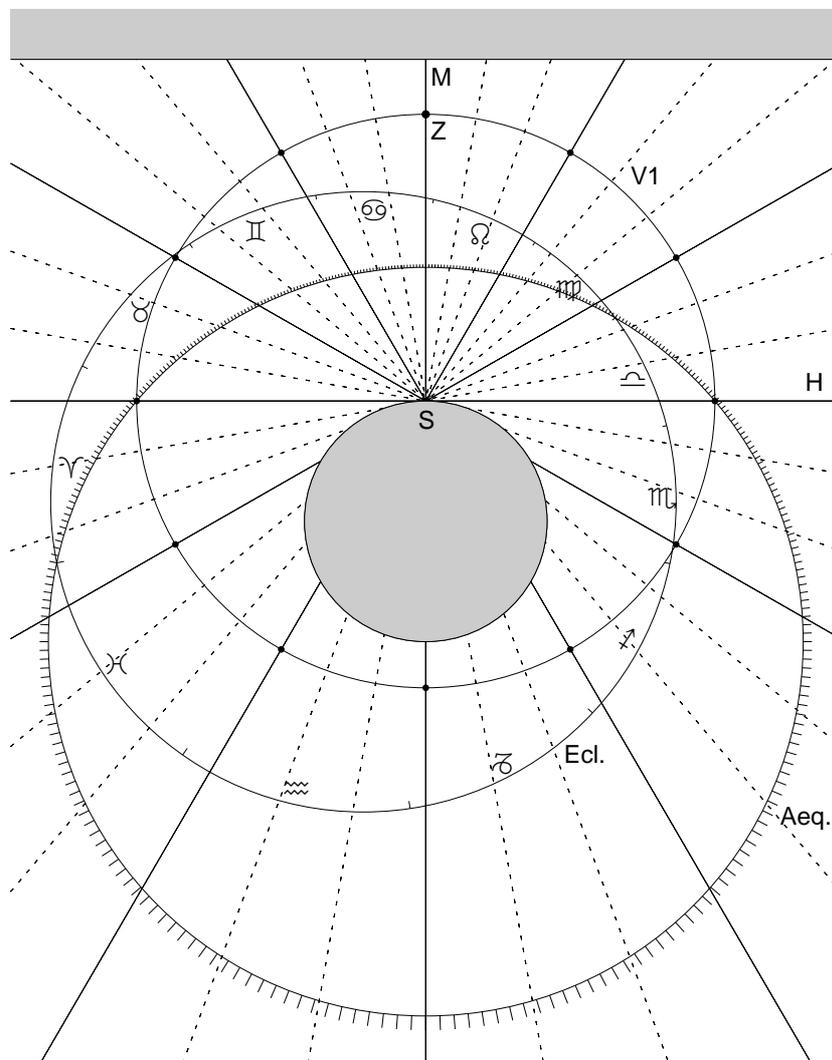
²¹Without loss of generality, we assume in the following that the birth place is located in the northern hemisphere. For southern latitudes, North and South simply switch there roles.

Let's recall the basic features of the stereographic projection: It preserves angles (but cannot preserve distances, like any map of the sphere to the plane), and it maps circles and lines to circles or lines. In our situation, this implies:

- If the plane is suitably normalized, the prime vertical is mapped to the unit circle, and the South Point of the Horizon (S) is mapped to the origin.
- Circles on the sphere are mapped to circles on the plane, if they do not pass through N. If they pass through N, they are mapped to straight lines.
- Position circles are circles passing through North and South point of the Horizon. They therefore correspond to the straight lines passing through the origin.
- The northern circumpolar region is mapped to an upper halfplane bounded by a line parallel to the image of the Horizon.
- The southern circumpolar region is mapped to a circle which is symmetric to the Meridian, tangent to the Horizon at its South Point, and lying completely below it (i.e. in the invisible part of the sky).

The most important of these properties for our considerations is the identification of the position circles with the straight lines passing through the origin. This allows us to compare the methods based on position circles, and to illustrate the differences of their construction methods.

5.2 CAMPANUS

Figure 9: CAMPANUS *mundane position*

Position circles, defined as circles passing through the intersection points of Horizon and Meridian, may have been used already by the classical spherical geometers (AUTOLYKOS OF PITANE, KLEOMEDES). But they were first introduced into the astrological problem of houses by AL BIRUNI (978-1046) in his *Book of Instruction in the Elements of the Art of Astrology* (1029), where he uses them to describe a new method of domification.²² The method is nowadays called the method of CAMPANUS, since it has been described later by CAMPANUS OF NAVARRA (1239-1296).

²²see [12], p.27-28.

In this method, the Prime Vertical – the circle passing through Zenit and East point of the Horizon – is used for measuring the mundane position. The uniquely determined position circle passing through the point with altitude 30° on the Prime Vertical is the boundary for house XII. Similarly, altitude 60° determines the boundary of house XI, and the Zenit determines the meridian which is the position circle for house X. Continuing this manner, one obtains a completely symmetric division of the sphere into twelve equal parts, spherical diangles of angle 30° .

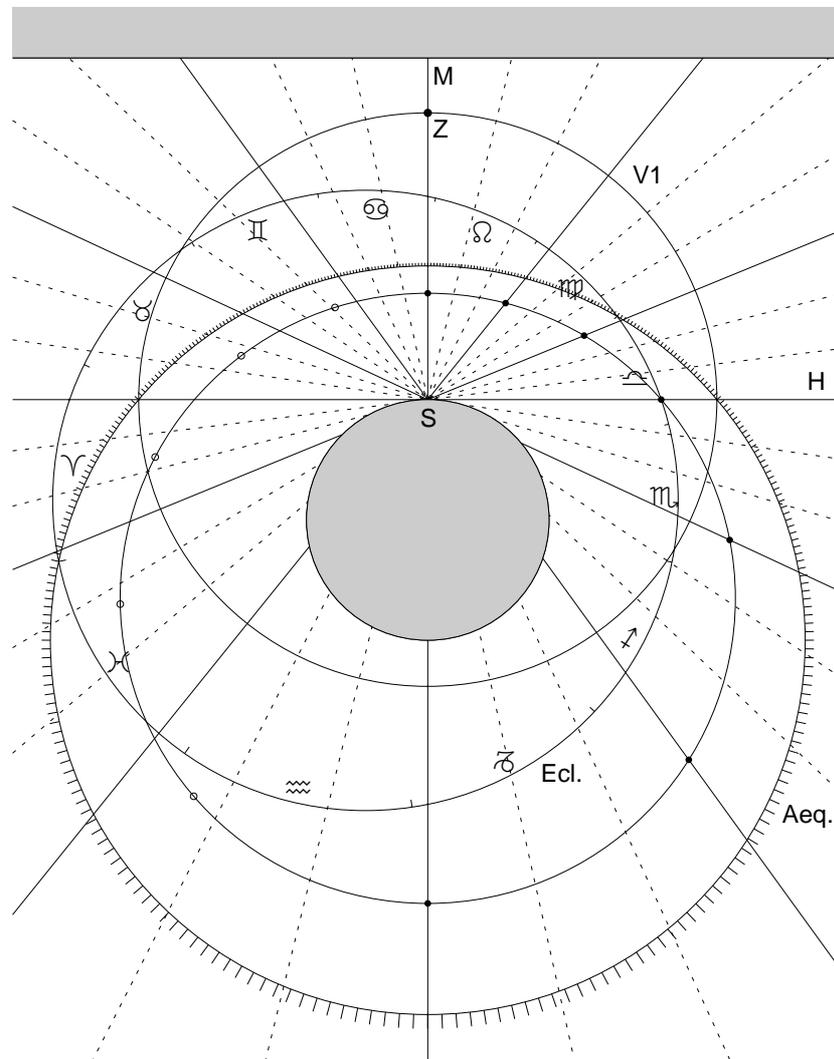
The associated mundane position can be determined for an arbitrary point of the sphere as follows: Find the position circle passing through this point, and intersect it with the Prime Vertical. The distance of that intersection point from the Horizon (i.e. its *altitude*) gives the mundane position.

The CAMPANUS method is the only spherical domification method with this high degree of symmetry.²³ The price is, however, that the reference to the *motus primi mobilis* is lost almost completely. The Prime Vertical, the base circle for this division method, is not related to the daily motion at all. This seems to be the main criticism of REGIOMONTANUS who decided to skate over this method, *”because it is against the minds of the ancients, and futile, because the Prime Vertical is an imaginary circle, not based on anything with effect.”*²⁴

²³The so-called *Azimut houses*, however, which divide the sky around the Zenit using the Azimut, also divide the complete sphere harmonically into twelve segments. They are no true domification method, however, since the cusp I in this system is not the Ascendant but the East point of the Ecliptic.

²⁴[30], 14th problem: *Modus [...] ille quia alienus sit a mentibus antiquorum et quia futilis quam circulo verticali imaginario ac nihil virtutis habenti innititur, silentio pretereundum censemus.*

5.3 HALY ABENRAGEL

Figure 10: ABENRAGEL *mundane position*

In his "Eight Books on Astrology", HALY ABENRAGEL (about 1050) describes an extension of the method of ALCABITIUS: Like ALCABITIUS, he divides the quadrants formed by Meridian and Horizon on the parallel circle of the Ascendant into twelve pieces. But the transfer of the division points to the Ecliptic is afforded by the uniquely defined position circles passing through the division points.

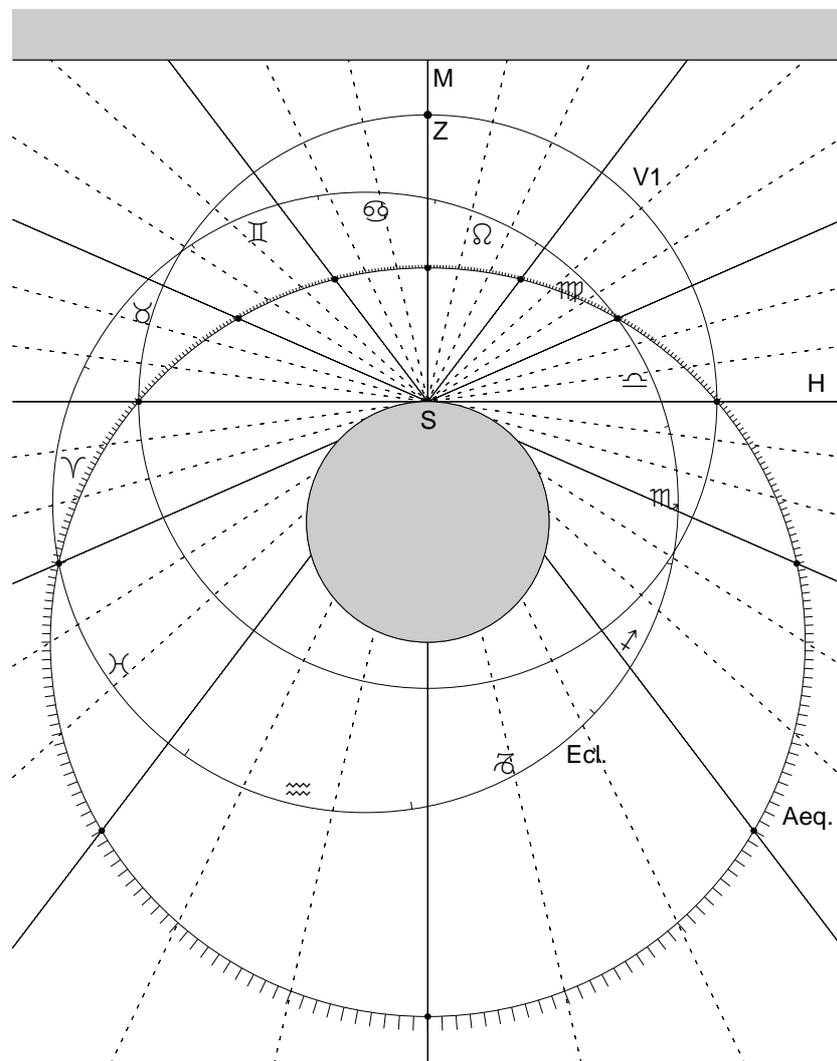
Although even REGIOMONTANUS mentions ABENRAGEL as using position circles (in problem 22 of his *tabulae directionum*), the method of ABENRAGEL has been forgotten in the course of the time, and was re-invented in our times by the Dutch "Workcommunity of astrologers", founded by the TH. J. J. RAM (1884-1961), THERENS and LEO KNEGT ([32],[14]). RAM called it the "Ascendant-Parallel-

Circle system". Thanks to this group, the ABENRAGEL house method is still alive in modern Dutch astrology.

The associated mundane position can be determined for an arbitrary point of the sphere as follows: Find the position circle passing through this point, and intersect it with the parallel circle of the Ascendant. The mundane position can now be determined from the proportion in which the intersection point divides the quadrant between the next intersection points of the parallel circle with Meridian and Horizon.

There is a conceptual inconsistency in this method: If a position circle divides the parallel of the Ascendant in a house proportion, then the second intersection point of that position circle with the parallel will in general not realize the corresponding proportion for the opposite house. If one would take the system seriously, then a consequence would be that intermediate house cusps like II/VIII will not be opposite to each other! Usually, this inconsistency is ignored: One constructs the cusps XI, XII, II and III, and takes the opposition places of these cusps as definition for the remaining cusps. V, VI, VIII and IX. Figure 10 demonstrates the construction: The dashed circle is the parallel circle of the Ascendant. The solid dots on it mark its proportional division. The house boundaries are position circles and therefore straight lines passing through these division points. It can be seen from the figure that the opposite intersection points with the parallel do not meet the division points that should define the house cusp.

5.4 REGIOMONTANUS

Figure 11: REGIOMONTANUS *mundane position*

The Jewish astrologer IBN ESRA (born 1090) may have the priority for the domification that is nowadays called the REGIOMONTANUS method. It was known that IBN ESRA had worked out a domification method, but this work seems to be lost. Surely, REGIOMONTANUS contributed much to the success of this house system by computing and printing tables for it and adding it, among with CAMPANUS tables, to his *tabulae directionum profectionumque*. It should be pointed out that REGIOMONTANUS never claimed the priority for this method. He preferred, somewhat suggestively, to call this domification the *rational method*.

Starting with the East Point of the Horizon (which always intersects the Equator), the Equator is divided into twelve equal sections of 30° . The position circles

passing through these points are the boundaries of the twelve houses.

The associated mundane position can be determined for an arbitrary point of the sphere as follows: Find the position circle passing through this point, and intersect it with the Equator. The distance of that intersection point from the Horizon, measured on the Equator, gives the mundane position.

REGIMONTANUS was consequent enough to base not only the house system but also the calculation of directions on position circles. This shows that he had identified the mundane position as link between house systems and direction methods.

It is interesting to notice that – after the purely geometrical method of CAMPANUS, which is classified by REGIMONTANUS as "imaginary", the REGIMONTANUS method puts the focus on the Equator as the reference plane of the daily motion again.

parallel circle and therefore its own rising times, its own "temporal hours", its own semi-arcs – depending on the declination of the point. These *proper* semi-arcs are used to determine the mundane position.

For directions, this is a well-known technique, as it is identical to the method exposed by PTOLEMY (see section 3.3). The new aspect is that the method is now consequently applied to the domification problem. In the PLACIDUS domification, the cusp of house XII is the uniquely determined point of the Ecliptic that has made precisely 1/3 of the time it needs from rising to culmination.

This is again a *spherical* system of mundane position, although it is not based on position circles. Contrary to the methods based on position circles, it is not possible to assign a PLACIDUS mundane position to the points of the circumpolar region. But, as mentioned, this is not really a problem, since the concept of mundane position makes sense only for points that pass the four angles (rising, setting and the two culminations).

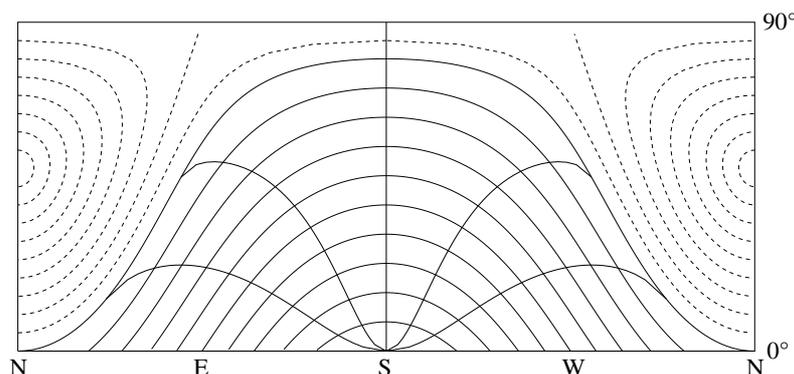


Figure 13: Division of daily arcs ($\Phi = 50^\circ$).

Figure 13 shows the daily arcs of the visible celestial hemisphere in an Azimut/Altitude diagram. The dashed curves refer to the motion of points in the circumpolar region, they are in fact concentric circles around the celestial pole. The solid curves are the daily arcs of the points subject to rising and setting. All these daily arcs are nothing else than the declination parallels inside of the domain \mathcal{D}_Φ , as seen from an observer. The bold curves, crossing the daily arcs transversally, represent the house boundaries according to PTOLEMY/PLACIDUS/MAGINUS, obtained by dividing these daily arcs in the proportions $\frac{1}{6}, \frac{2}{6}, \dots$. Again, the figure shows that an extension of these mundane position curves into circumpolar region does not make sense, since there is no arc that could be divided proportionally.²⁶

²⁶O. A. LUDWIG, however, uses Meridians to join the end points of the mundane position curves with the celestial north pole. This way, he achieves a continuous extension of the curves to the complete hemisphere. But besides of producing non-smooth transitions, the choice of Meridians is arbitrary. His claim that this extension of the mundane position curves goes back to PLACIDUS himself seems improbable to me, since PLACIDUS always worked inside \mathcal{D}_Φ .

PLACIDUS enriched the theory of directions by some own additions: In his attempt to harmonize the two contradictory passages about house cusps in *Tetrabiblos*, III.10 (see above, section 3.1), he introduced the notion of *mundane aspects*: Two planets are in a mundane aspects if the difference of their mundane positions results in the aspect angle. Therefore, the MC always is in mundane \square with ASC, in \times with cusp XII, and so on. Building on these new mundane aspects, PLACIDUS went further and developed a new theory of *mundane directions*. In its elementary form, one does not use the position curve for the position μ of the Significator itself, but for the position $\mu + A$, where A is the aspect angle. Further extensions are the usage of *crepusculine arcs* for directions to the Sun, the notion of *mundane parallels* (directions to equal distances from the Meridian, measured with mundane positions), and, published by his followers, the so-called *rapt parallels*, where both aspect partners are considered moving until they reach equal distances from the Meridian (again in terms of mundane position).

From his examples in [24], it can be seen that in the majority of cases, PLACIDUS worked with temporal mundane position (definition VI), since he determines the directional arc Δ of a Significator S to a promissor P using the proportion

$$\Delta = |MD_s \cdot \frac{SA_p}{SA_s} - MD_p|, \quad (1)$$

where he calls the first term of the right-hand side the "secondary distance" of P . In rare cases, however, he proceeds differently.²⁷ He constructs the great circle passing through the Significator and the Equator point with the same mundane position. This great circle will in general not be a position circle, since it may not contain the South and North point of the Horizon. Nevertheless, he sometimes uses these great circles as an alternative to the proportional formula 1. Aiming a precision of 1° for the final result, the directional arc, he did not bother much about the difference between these two methods.

He admitted the use of these great circles as *approximation* of the mundane position curve, but he vehemently refused the usage of *position circles* for house constructions. In Canon XII of his *Primum Mobile*, he explains how to determine the "polar elevation of a Significator" which determines the great circles which he considers allowed for directional computations. "*I have no idea of circles of position which are directed through the common sections of horizon and meridian, but those that are described by the proportional distances of the stars towards the angles; and we may, by means of a very easy method, know the Pole's elevation upon the Ptolemaic circle of any star whatever...*"²⁸ The method then presented simply is an interpolation of the (given) polar elevations of the surrounding house cusps (*per regulam auream*).

It has often been complained that, due to the inequality of the daily and nightly semi-arc, the PLACIDUS method seems to produce a discontinuity since proportional sections of the Ecliptic change their size at the Horizon. But it has been

²⁷see [24], p.197 for an arbitrary example

²⁸[24], Canon XII, p. 47

overseen that the PLACIDUS method is not based on *sizes* but on *motion*. He criticizes those methods that try to divide the sky into equal spaces as "geometric methods", irrelevant to the domification problem. PLACIDUS himself knew the argument of unequal daily and nightly house sizes. In *Physiomatica*, he answers that he is regarding the *quality*, not the *quantity* of the motion. Although a star may need different times over and under the Horizon to pass through a house, this is only an irrelevant *quantitative* difference – important is the *quality*, being expressed as a proportion of quantities, relating the point to the four angles.²⁹

6 After PLACIDUS

The Placidian works had been forbidden by the censors of the catholic church in 1687, but they found friendly asylum in Great Britain, and his main books were translated by MANOAH SIBLY (1789) and JOHN COOPER (1814). The Placidian Table of Houses, published by RAFAEL I. in his Ephemeris, and in a textbook *Dictionnary of Astrology* by J. WILSON (1819), contributed a lot to the success of this house system in Great Britain. ZADKIEL in his *Grammar of Astrology* (1849, [34]), SIMMONITE with the *Complete Arcana of Astral Philosophy* (1840), A. J. PEARCE with his *Textbook of Astrology* (1911), and ALAN LEO (*The progressed horoscope*, 1906) gave instructions on how to do directions according to PLACIDUS, shifting the focus towards the use of polar elevation instead of temporal position curves. Some authors, like ZADKIEL in [34], completely abandoned the mundane position curves in favor of the polar elevation method. It seems that ZADKIEL was led to this method by practical considerations, since it is clear from the text that he did not fully understand the underlying concept.³⁰

At the time when the astrology renaissance reached Germany, in the first decades of the 20th century, and astrology was propagated by the publications of KARL BRANDLER-PRACHT, A. KNIEPF and A. BETHOR, the situation began to change: Many new astrological systems were created (not only in Germany); some of them were completely new (like the WITTE method), others were going back to almost forgotten older astrological sources, claiming to reinstall the "true astrological tradition". It was realized that many of the methods delivered by tradition, being applied like recipes of a cookery-book, were lacking theoretical foundations. In the sequence, many authors contributed to work out these foundations, among them E. C. KUEHR, O. A. LUDWIG, W. NOESSELT, and Z. WASSILKO.

²⁹*Physiomatica*, p.189, quoted in [11], thesis 29.

³⁰Example: On page 456, he defines the term *circles of position* as "small circles bearing the same relation to the Meridian circle which the parallels of latitude do to the Equator" – which is completely wrong.

6.1 KUEHR

The german astrologer REGIOMONTANUS was rediscovered in this time – this was clearly favoured by the nationalist spirit of the time. REGIOMONTANUS was praised for the elegance, clarity and purely geometric nature of "his" house system. Some astrologers began to study spherical trigonometry and were fascinated of the geometrical concepts. After the shape of the PLACIDUS mundane position curves had been worked out by O. A. LUDWIG,³¹ many astrologers shared the disdainful judgement of ZOE WASSILKO: "*I think I am speaking in the sense of many others, when judging the placidian temporal hour curves as of a very affected nature. Compared to the regiomontanian circles of position, uniting in complete harmony with Meridian and Horizon, they give the impression of artificially constructed curves.*"³²

The fashion of that time was against the temporal position curves, favouring any alternative that was based on great circle instead. It was highly *en vogue* to know about polar elevations, position circles etc. and to make use of these items in a directional system. E. C. KUEHR, although belonging to the placidian camp, could not resist this fashion – and came back to ZADKIEL, propagating that *all* directions should be computed on the base of polar elevations. Other specialities of his method, as the NAIBOD key instead of the true time key used by PLACIDUS, his rejection of mundane directions, and the mixed usage of ecliptical latitudes (only the Significators are computed with their own ecliptical latitude, whereas the Promissors are considered as sensitive points of the Ecliptic itself, having no latitude) are not relevant to our topic.

Like W. A. KOCH, E. C. KUEHR feels supported in his view by some passages in *Tetrabiblos* stating that the planets of the horoscope should be made to Ascendants of auxiliary horoscopes.³³ For him, as for later followers like W. LANG, this means that every house cusp and every planet of the horoscope is associated with an individual "Horizon" which is in contact with it and which is constructed with an appropriate polar elevation and oblique ascension, in correspondence with its mundane position.³⁴ Of course, nothing is really rising at these "Horizons": they are nothing more than great circles in a general position. The word is chosen only to demonstrate the construction idea of intermediate mundane position circles,³⁵ which is carried out in analogy to the real Horizon.

As it turned out, KUEHR's direction method is not new, since it goes back to PLACIDUS himself, who *sometimes*, and to 19th century astrologers like ZADKIEL,

³¹[18], p. 218

³²talk held on the XII. astrology congress in Munich, 1934, [33] p. 301

³³[28], III.4, p.249: "For the rest, in carrying out these particular inquiries, it would be fitting and consistent to set up the paternal or maternal place of the sect as a horoscope and investigating the remaining topics as though it were a nativity of the parents themselves." Similarly at the end of III.5, p. 255, and some other places.

³⁴[16], IV.3, p. 122p, and [17], III.6.b, p. 189p

³⁵which are *not* circles of position in the sense of consequence 3, since they may not meet the north and south point of the Horizon

who *always* used it. It is clear that the set of these "Horizons" does not constitute a system of mundane positions – they are not even disjoint to each other.³⁶ Moreover, such a "Horizon" does not comprise the points of equal mundane position: In general, the only points with the required mundane position are, by construction, the intersection point with the Equator and the planet itself.

Another problem is that the method is not well-defined for points on the equator, since there the two points defining the "Horizon" coincide. One could overcome this problem by defining the "Horizon" to be the *tangent circle* to the mundane position curve starting at this point, resulting in a polar elevation given by

$$\tan \varphi = \frac{MD}{SA} \cdot \tan \Phi. \quad (2)$$

To my knowledge, neither KUEHR nor the British authors of this method mention this necessary extension of the method.³⁷

6.2 KOCH Houses

The KOCH system³⁸ is a product of the same time and of the same spirit: It was the enthusiasm for the spherical geometry, particularly for everything based on great circles and polar elevations which made this new house system appear. KOCH, formerly a Regiomontanian, takes the mentioned quotations of PTOLEMY literally that each planet of the nativity "can be made a Horizon". The Horizon, however, has one and only one polar elevation: The geographical latitude of the birthplace. Therefore, KOCH postulates that the house construction has to be based entirely on great circles with the polar elevation of the birthplace³⁹ For this goal, he translates the Horizon along the Equator until it contains the MC and considers this translated Horizon, not the defining Meridian, as constituent position curve for the MC. By trisections of the semi-arc of the MC, he obtains the oblique ascensions of the intermediate house cusps (which are then determined as intersections of the great circle with this oblique ascension and with the polar elevation the latitude of the birthplace.

Similarly, he postulates for directions that the Significator always has to obtain the polar elevation of the birth place.⁴⁰

The fixed idea of KOCH was that mundane position curves *always* have to be local horizons, i.e. great circles with the polar elevation Φ of the birth place. A

³⁶It follows also from consequence 3, since the "Horizons" are great circles but not position circles in general.

³⁷It may be remarked that formula (2) has been used as the base for another modern variant of the PLACIDUS house system, the so-called *topocentric houses*[27]. The authors POLICH and PAGE use (2) as definition of the polar elevation, together with the OA of the PLACIDUS system, yielding in slightly different house cusps. They use the same circles also for doing directions. This is an even stranger method: The planet that defines the mundane position curve is itself not even contained in this curve!

³⁸which in fact was a byproduct of geometrical investigations of ZANZINGER and SPECHT and was never intended by the authors to be published

³⁹This explains, by the way, the name "*Geburtsort-Häusersystem*".

⁴⁰[12], p.108

critical statement of WASSILKO should finish this section: ” *One cannot glue several different Ascendants together and use them as house boundaries for a time to which they are not related at all.*”⁴¹

7 Discussion

If we overview the evolution of the house systems, leaving out some inessential variations, the following main stages of development can be made out:

- While the first methods worked on the Ecliptic alone, the introduction of the mathematical MC and the increased geometrical skills made it clear that the reference system for the houses, as a partition based on the daily rotation of the sphere, could not be the Ecliptic.
- Beginning with RHETORIOS, astrologers switched to the Equator as reference plane. Since the degrees of the Equator all ascend with the same velocity, the Equator can be regarded as a big celestial clock. For a division of the sky according to its daily rotation it is therefore natural to base it on the Equator.
- The more stress was laid on the connection of house division and directional techniques, the more it became apparent that the house division should be extensible to the celestial sphere. The search for *spherical house systems* began.
- The CAMPANUS/AL BIRUNI method was geometrically most satisfying, as the houses could be derived from a global division of the sphere by position circles into twelve perfectly equal diangles.
- HALY ABENRAGEL and REGIOMONTANUS corrected this tendency to the other direction and put the Equator back in his rights for this problem.
- MAGINUS and PLACIDUS come back to the house division as division of times – more precisely: as division of the daily arcs described by the stars.

The system of mundane position that had been outlined by PTOLEMY in his famous chapter III.10, has been used for primary directions by many astrologers. It is a strange fact that his concept has been used for domification not before the 17th century. How can this delayed evolution be explained? Why did we have to wait almost 15 centuries, until the house system has been worked out by PLACIDUS and MAGINUS which belongs organically to the Ptolemeic concept of mundane positions?

I think, there is a number of reasons for this.

1. *Lack of mathematical understanding.*- First of all, of course, the understanding of the celestial geometry had to increase in order to understand the intimate connection between house systems and directional systems. This level of

⁴¹[33], p.84

understanding had been reached with the time of the *spherical house systems* (ABENRAGEL, CAMPANUS, REGIOMONTANUS). In *Tetrabiblos* itself, houses and directions appear yet as more or less disparate subjects.

2. *Misunderstanding* PTOLEMY.- The misleading hint of PTOLEMY that his mundane position curves are "most nearly position circles" caused many attempts for a purely geometric domification, defining the house cusps by intersections of circles. It had been overseen that PTOLEMY mentions the position circles only as an approximation for the real mundane position curve. Instead, astrologers like REGIOMONTANUS were attracted by constructive solutions that were as clear or "rational" as a construction in elementary geometry.
3. *Ideal that astronomy should work with circles only*.- Apart from the ideal of a "rational", constructive solution to spherical problems, there was another postulate of astronomy requiring that all problems of the celestial sphere can be described or solved using circles and spheres. The circle and the sphere with their perfect symmetry appeared to be the only shapes adequate to the dignity of the celestial spheres. It seems no accident to me that this postulate has been rejected almost simultaneously in astronomy by KEPLER and in astrology by MAGINUS and PLACIDUS. The beginning of the modern times made it possible to break this strong tradition. Some courage was necessary to accept a *position curve* instead of a great circle as house boundary. This step was as weightful as the transition from the epicycle model to the acknowledgment of non-cyclic planetary orbits in astronomy (KEPLER's *Astronomia Nova*).
4. *Baroque emphasis on harmonic proportions*.- In my opinion, the baroque zeitgeist was the midwife and the necessary background for the development of the PLACIDUS houses. One of its main traits is to view the world as "*arranged by measure, number and height*"⁴² This can, for example, be read off from the baroque theory of music which tried to define the musical harmonies from certain geometric or arithmetic proportions. This aspect of music, although common since the PYTHAGOREAN monochord experiments, has been exaggerated to an extreme degree in baroque theory of music. It sometimes goes so far to define music as a branch of mathematics. *musica est scientia mathematica subalternata comprimis arithmeticae...*⁴³ The creator of musical harmonies bases his work on the same harmonies that he finds ubiquitous in the universe, a testimony of God's creation. In this sense, KEPLER was a child of his time when working on the *Harmonice Mundi* – like A. KIRCHER, R. FLUDD and others. KEPLER, favoured by his times, continued a work to which already PTOLEMY had contributed with his book on Harmonies. In his *Harmonice mundi*, KEPLER demonstrates that the proportions defining musical harmonies are indeed omnipresent in the world; in particular, the power of astrological aspects can be derived from these proportions. With this almost exclusive focus on harmonic proportions, it became

⁴²(Wisdom of Salomon, 11:20), which was a frequently quoted (apocryphal) bible passage to justify the claim of omnipresent harmonic proportions.

⁴³LIPPUS, quoted in [6], p.11

possible, if not even necessary, to base mundane position on harmonic proportions too. For the part of directions, this was already afforded by PTOLEMY. The way was now free for astrologers to work out the underlying mundane position concept. Indeed, if according to KEPLER the aspects as effective relations of a nativity can be based on proportions, then this should hold also for houses and directions.

5. *Turn from cosmos to individual.*- In contrast to other house systems, the PLACIDUS system lays a special emphasis on the *subjective perception*. For PLACIDUS, the division of the sky is not merely a geometrical problem. It is the human soul who listens to the celestial harmonies and realizes the proportions and is affected by them. This makes the house cusps and the mundane aspects relevant. This again is an affinity to KEPLER for whom the power of proportions is based on a hidden affectibility of the soul who is stimulated when the sensually perceived proportions coincide with the harmonic ideals: "*Eine geeignete Proportion in den Sinnesdingen auffinden heißt: die Ähnlichkeit der Proportion in den Sinnesdingen mit einem bestimmten, innen im Geist vorhandenen Urbild einer echten und wahren Harmonie aufdecken, erfassen und ans Licht bringen. So findet der Geist Ordnung und Proportion in den Tönen und Strahlen, daß aber diese Proportion harmonisch ist, bewirkt die Seele durch die Vergleichung mit ihrem Urbild. Die Proportion könnte nicht harmonisch genannt werden, sie besäße keinerlei Kraft, die Gemüter zu erregen, wenn dieses Urbild nicht wäre.*"⁴⁴
6. *The dawn of the physical age.*- As MAX CASPAR points out, KEPLER's finding of the elliptic shape of the planetary orbits was inspired by his vision of joining astronomy and physics⁴⁵ Similarly, PLACIDUS calls astrology *physio-mathematics* and tries to found the complete astrological building on *light* and *motion*.⁴⁶
7. *Increasing individualism.*- The PLACIDUS house system carries the signature of an age of individualism, since each point of the sky is considered with its proper mundane coordinate system. This has been characterized in an article by DIETER KOCH (translation by me): "*One cannot say that the PLACIDUS system follows a particular measure of time, as the system of REGIOMONTANUS does – instead, each point of the sky has its own measure of time. Everything is relative, and each point follows its own individual way. PLACIDUS conforms to our zeitgeist, which is characterized by relativism and perspectivism.*"⁴⁷ This observation is not a mere reflection on the house system. Turning it around, the new individualism that started with the renaissance times can be seen as a factor which favoured the development of this house system.

⁴⁴[9], p. 205

⁴⁵[5], p. 156p.

⁴⁶[11], §§1-2

⁴⁷[15], p.16

8. *Increasing routine in solving iterative equations.*- The analogy between KEPLER and PLACIDUS is closer, even on a purely formal level. They both had, in a central place of their theories, to deal with a basic equation that can be solved only iteratively. KEPLER's second law leads to the equation

$$E - e \sin E = M, \quad (3)$$

where M and e are known and the excentric anomaly E is to be determined. If E is known, the heliocentric position of the planet can be computed directly. Equation 3 is a transcendental equation that can be solved approximately (for example, by iterating $E_{n+1} = M + e \sin E_n$).

On the other hand, PLACIDUS and MAGINUS are looking for Ecliptic points that divide their own diurnal or nocturnal semi-arc in a certain fixed proportion a . If ε denotes the obliquity of the Ecliptic, δ the declination and α the right ascension of the Ecliptic point, this produces the equation

$$\alpha = t + a \cdot (90^\circ + \arcsin(\tan \varepsilon \tan \varphi \sin \alpha)),$$

which can be simplified by setting $C := \tan \varepsilon \tan \varphi$ and $\alpha_0 := a \cdot 90^\circ + t$, to an equation that we may call the PLACIDUS-MAGINUS equation:

$$\alpha - a \arcsin(C \cdot \sin \alpha) = \alpha_0. \quad (4)$$

This again is a transcendental equation that can only be solved iteratively. Moreover, for small C and working with radians instead of degrees, we can use the approximation $\arcsin x \approx x$, and (4) reduces to

$$\alpha - a \cdot C \cdot \sin \alpha = \alpha_0,$$

i.e. to the KEPLER equation (3). This means, the KEPLER equation is a first order simplification of the PLACIDUS-MAGINUS equation!

In the course of this paper, we have seen that the historical manifestation of an idea is neither a unique event nor a linear, straight process. There are many sideways, there are necessary stages to reach first, there are phases of stagnation and even fallbacks. But the example shows that in due time the idea will be fully established.

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