Neither Observation nor Astronomical Tables: An Alternative Way of Computing the Planetary Longitudes in the Early Western Middle Ages

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1 *Introduction: early medieval records of planetary longitudes*

Before the age of Arabic-Latin translations of scientific texts in the twelfth century, planetary astronomy (with the exception of lunar and solar cycles needed for the purpose of computus) was in the Western world mainly restricted to information found in ancient encyclopaedias, such as those of Pliny, Calcidius, Macrobius, Martianus Capella and Isidore of Seville.[1] None of these authors had taught how to locate the planets in the zodiacal signs at a given time. This knowledge is normally provided by astronomical tables which indicate the position of the planets at regular intervals over a certain period of time. Such material does not appear to have been known in the West before the Latin translations of the Arabic tables of al-Khwārizmī and the Toledan Tables in the first half of the twelfth century. A possible exception is the *Preceptum Canonis Ptolomei*, a set of astronomical tables, together

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[1] Early medieval planetary astronomy has only recently begun to receive serious scholarly attention. See in particular W. M. Stevens, 'Astronomy in Carolingian Schools', in *Karl der Grosse und sein Nachwirken. 1200 Jahre Kultuur und Wissenschaft in Europa*, eds P. L. Butzer, W. Oberschelp and H. Jongen, I, Turnhout, 1997, pp. 417-87 (esp. pp. 439-56); S. McCluskey, *Astronomies and Cultures in Early Medieval Europe*, Cambridge, 1998, esp. pp. 114-27 and 157-64; and the collected studies of B. Eastwood, *The Revival of Planetary Astronomy in Carolingian and Post-Carolingian Europe*, Aldershot, 2002.

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with rules for their use, which David Pingree has recently studied and edited.[2] The *Preceptum* was translated from Greek in about A.D. 534/535, was known to Cassiodorus (†580) and first occurs in a manuscript copied around the year 1000, probably at the monastery of Fleury (Saint-Benoît-sur-Loire): London, BL, Harley 2506. The relevance of this work with regard to early medieval astronomy is however to be questioned for three reasons. First, the translation is so literal, including transliterations of Greek words unintelligible to a Latin audience, that its use could only have been very limited.[3] Second, only the tables of the luminaries remain in the present state of preservation,[4] which means that the tables of the planets either were lost at an early date or were never available in the Latin version.[5] Third, there is no firm evidence that it was used, or even known, between Cassiodorus and the time of Harley 2506.

We do, however, have some early medieval records of the positions of the planets. In 820, Rabanus Maurus, the schoolmaster of Fulda who later became abbot of the same monastery (822-47) and bishop of Mainz (847-56), composed a treatise of computus based mainly on the works of Bede but also on other sources and personal observations. Among these is the following passage in chapter 48:

> Today, that is in the year of the Lord's Incarnation 820, on the 9th of July, the Sun is in Cancer 23°, the Moon in Taurus 9°,

[2] D. Pingree, 'The Preceptum Canonis Ptolomei', in *Rencontres de cultures dans la philosophie médiévale. Traductions et traducteurs de l'Antiquité tardive au XIVe siècle (Actes du Colloque international de Cassino, 15-17 juin 1989)*, eds J. Hamesse and M. Fattori, Louvain-la-Neuve-Cassino, 1990, I, pp. 355-75. *Preceptum Canonis Ptolomei*, ed. (with translation and commentary) D. Pingree, Louvain-la-Neuve, 1997 (= *Corpus des Astronomes Byzantins*, VIII). This edition includes the canons only, not the tables themselves. See also D. Pingree, 'Avranches 235 dans la tradition manuscrite du *Preceptum Canonis Ptolomei*' (the article is in English), in *Science antique, science medievale. Actes du colloque international (Mont-Saint-Michel, 4-7 septembre 1998)*, eds L. Callebat and O. Desbordes, Hildesheim, 2000, pp. 162-9.

[3] D. Pingree, 'The *Preceptum...*', p. 366, and *Preceptum Canonis...*, p. 17 (as n. 2 above).

[4] D. Pingree, 'The *Preceptum...*' (as n. 2 above), pp. 367- 8.

[5] It is extremely curious that only one chapter of the canons (out of 103) refers to the five planets (cf. *Preceptum*, chap. 62, ed. D. Pingree (as n. 2 above), pp. 85-6).

> Saturn in the sign of Aries, Jupiter in Libra, Mars in Pisces, and the positions of Venus and Mercury are not visible because they are at the moment close to the Sun in daylight.[6]

According to Tuckerman's tables, the positions of Saturn, Jupiter and Mars are correct, and the last statement about Venus and Mercury makes it clear that Rabanus did observe (rather than compute) them.[7] On the other hand, there are some mistakes in the positions of the luminaries: on 9 July 820, the Sun was at Cancer 20°-21°, and the Moon travelled from about Taurus 21° early in the morning to about Gemini 4° in late evening. Three explanations have hitherto been proposed as to how Rabanus determined these positions. On the ground that 'he must have had a set of astronomical tables to arrive at *any* longitude expressed in such precise terms', David Pingree assumed that he used the *Preceptum*, but this leaves unexplained the large error with respect to the Moon.[8] More recently, Wesley Stevens suggested that Rabanus might have located the Sun with the help of an instrument, such as the *horologium nocturnum*, some drawings of which survive in early ninth-century manuscripts from Salzburg and Regensburg.[9] Finally, Bruce Eastwood alluded to

[6] 'Modo autem, id est anno dominicae incarnationis DCCCXX mense Iulio nona die mensis, est Sol in XXIII parte Cancri, Luna in nona parte Tauri, stella Saturni in signo Arietis, Iouis in Librae, Martis in Piscium, Veneris quoque stella et Mercurii, quia iuxta Solem in luce diurna modo sunt, non apparet in quo signo morentur' (Rabanus Maurus, *De computo*, 48, ed. W. M. Stevens, Turnhout, 1979 (= *Corpus Christianorum. Continuatio Medievalis*, 44), p. 259).

[7] B. Tuckerman, *Planetary, Lunar and Solar Positions A.D. 2 to A.D. 1649 at Five-Days and Ten-Days Intervals*, Philadelphia, 1964, p. 428. All true positions given hereafter are taken from this study. On 9 July 820 Saturn was at Aries 19°, Jupiter at Libra 29° and Mars at Pisces 16°. Presumably, then, Rabanus was able to recognize the planets and to locate them in the constellations, i.e. in the 'sidereal' zodiac. It should be noted that, whatever the value of the backward shift due to the precession of the equinoxes we admit, the three planets would remain in the same sign. It is probably for the purpose of observation that Rabanus introduced his chapter by listing the colour/appearance of each of the planets: 'Suus quidem unicuique color est Saturno candidus, Ioui clarus, Marti igneus, Lucifero gaudens, Vespero refulgens, Mercurio radians, Lunae blandus, Soli cum oritur ardens, postea splendens' (*De computo*, 48, ed. W. M. Stevens, p. 258).

[8] D. Pingree, 'The *Preceptum*...' (as n. 2 above), p. 372. See also 'Avranches 235...' (as n. 2 above), p. 163.

[9] W. M. Stevens, 'Astronomy in Carolingian Schools' (as n. 1 above), pp.

the possibility that he simply used computus texts, including his own.[10]

This latter solution appears to be the right one. The computation of the position of the Sun and the Moon formed an integral part of early medieval computus, and Rabanus himself, like others before and after him, had provided the relevant procedures in his treatise. For the Sun he states (1) that it enters a sign on the 15th kalends of the month, starting with Aries in March, and (2) that it transits a single sign in 30 days and $10\frac{1}{2}$ hours, or a single degree in one day.[11] A mere application of these rules leads to the result that the Sun (1) enters the first degree of Cancer every year on 17 June, and (2) reaches the 23rd degree of Cancer 22 days later, i.e. on 9 July.[12] The procedure for computing the position of the Moon, more complex because of its velocity (the Moon traverses about 13° along the zodiac every day and, therefore, a little more than 1° in two hours), relies on the (correct) assumption that the age of the Moon determines its position with respect to the Sun. Following Bede's model, Rabanus devoted two chapters to the

440-41. See also idem, 'Compotistica et astronomica in the Fulda School', in *Saints, Scholars and Heroes. Studies in Medieval Culture in Honour of Charles W. Jones*, eds W. M. Stevens and M. H. King, Collegeville, 1979, II, pp. 27-63, here pp. 47-8 (reprinted in W. M. Stevens, *Cycles of Time and Scientific Learning in Medieval Europe*, Aldershot, 1995, article IX).

[10] B. Eastwood, 'Astronomia, computo e astrologia', in *Storia della scienza*, vol. IV: *Medioevo, Rinascimento*, sezione II: *La scienza bizantina e latina*, ed. J. D. North, Rome, 2001, pp. 149-68 (p. 157).

[11] See especially *De computo*, 39: 'Nam Ariete Martio mense... Februario Pisces... Singulis autem signis triginta partes, ternae uero decades putantur, eo quod Sol triginta diebus et decem semis horis illa percurrat, a medio mensis, id est XV kalendarum die, semper incipiens' (ed. W. M. Stevens, pp. 250 and 251); chap. 40: '*Demonstratio signorum per Solis cursum*... Siquidem Sol moratur transiens in unoquoque signo XXX dies, decem horas ac semissen. Ad deinde in aliud signum ingreditur, quod similiter in XXX diebus et decem horis ac semisse pertransiens, tertium intrat' (pp. 251-2, see also chap. 28, p. 232, l. 13-18); chap. 42: 'Sol igitur cotidie partem unam zodiaci sui complet' (p. 254). These information are also found in Bede (*De natura rerum*, 17, and *De temporum ratione*, 16 and 18).

[12] On this computation of the position of the Sun in other contexts, see A. Borst, *Die karolingische Kalenderreform*, Hannover, 1998, pp. 435-6 and 478-9. The same result could also have been easily obtained from the data provided in Carolingian calendars, most of which indicate for each month the date of the entry of the Sun in the corresponding zodiacal sign; see for instance the 'Lorsch Prototype' of 789 edited *ibid.*, pp. 254-98, esp. p. 274: 'Sol in Cancrum' on 17 June.

question,[13] providing the following formula: the day of the Moon is to be multiplied by 4 and divided by 10; the resulting quotient corresponds to the number of signs separating the Sun and the Moon and the resulting remainder to the number of additional *puncti* (one *punctus* being equal to 3 degrees).[14] The computation using the correct day of the Moon, i.e. the 24th day on 9 July 820,[15] would be as follows:

$24 \times 4 = 96$
$96 : 10 = 9$ (remainder: 6)
$= 9$ signs and 6 *puncti* (or 18 degrees) counted from Cancer 23° (position of the Sun)
$=$ Taurus 11°

The small difference between Taurus 11° and Taurus 9° can be explained either as a mistake or as the result of some adjustments made to fit the time of the computation. We cannot be certain whether this reconstruction is valid or not, but there is no reason to believe, especially in the context of a handbook composed for his students, that Rabanus did not follow his own teaching.

In her exhaustive survey of astronomical phenomena mentioned in annals and chronicles written between 600 and 1200 in the area of

[13] *De computo*, 41 (*De Lunae cursu per signa*, ed. W. M. Stevens, pp. 252-4) and 42 (*Argumentum ad investigandum Lunae cursum*, pp. 254-5). The source is Bede, *De temporum ratione*, 17-18.

[14] Rabanus gives, among several examples, those for the 5th and 8th days of the Moon: 'Luna quotidie quattuor punctis siue crescens a Sole longius abit, seu decrescens Soli uicinior, quam pridie fuerat, redditur. Singula autem signa decem punctos habent, id est duas horas, sicut et superius admonuimus, quinque enim puncti in Luna horam faciunt. Et ideo si uis scire in quo signo Luna est, sume Lunam quam uolueris, utputa quintam; multiplica per quattuor, fiunt XX; partire per decem, bis denis uies; duobus ergo signis quinta Luna semper a Sole distat. Item sume octauam Lunam; multiplica per quattuor, fiunt XXXII; partire per decem, ter deni tries et remanent duo. Tribus ergo signis et duobus punctis octaua Luna semper a Sole dirimiter. Duos autem punctos sex partes intellege, id est quantum Sol in zodiaco sex diebus conficit itineris; punctus siquidem habet tres partes, quia signum quodque decem punctos, XXX habet partes' (*De computo*, 41, ed. W. M Stevens, p. 253). For a detailed commentary on this procedure, see F. Wallis, *Bede: The Reckoning of Time*, Liverpool, 1999, pp. 58-63 and 290-91.

[15] The preceding full Moon, i.e. the 14th or 15th day of the Moon, occurred on 29 June 820 in the evening (see H. H. Goldstine, *New and Full Moons, 1001 B.C. to A.D. 1651*, Philadelphia, 1973, p. 152).

present-day Belgium, Isabelle Draelants pointed out that eclipses were never reported with a high degree of technical precision, with the notable exception of four successive eclipses which occurred during the years 806 and 807.[16] The most detailed report of these is found in the *Annales regni Francorum*, which also mentions two conjunctions involving Jupiter and Mercury:[17]

Date	Event	Sun	Moon	Sun (true)
2 September 806	lunar eclipse	Virgo 16°	Pisces 16°	Virgo 14°
31 January 807	conjunction			
	Moon-Jupiter	–	–	–
11 February 807	solar eclipse	Aquarius 25°	Aquarius 25°	Aquarius 27°
26 February 807	lunar eclipse	Pisces 11°	Virgo 11°	Pisces 12°
17 March 807	conjunction			
	Sun-Mercury	–	–	–
22 August 807	lunar eclipse	Virgo 5°	Pisces 5°	Virgo 2°

For the eclipses, a comparison with Tuckerman's tables shows that the positions of the Sun are correct with, however, a difference of 1 to 3 degrees in each case. Again, this difference is fully

[16] I. Draelants, *Eclipses, comètes, autres phénomènes célestes et tremblements de terre au Moyen Age. Enquête sur six siècles d'historiographie médiévale dans les limites de la Belgique actuelle (600- 1200)*, Louvain-la-Neuve, 1995, pp. 75-6 and 115 (and n. 219).

[17] 'DCCCVII. Anno superiore IIII. Non. Septembr. [= 2 September 806] fuit eclypsis Lunae; tunc stabat Sol in XVIma parte Virginis, Luna autem stetit in XVIma parte Piscium; hoc autem anno pridie Kal. Febr. [= 31 January 807] fuit Luna XVIIma, quando stella Iovis quasi per eam transire visa est, et III. Id. Febr. [= 11 February 807] fuit eclypsis Solis media die, stante utroque sidere in XXV parte Aquarii. Iterum IIII. Kal. Mart. [= 26 February 807] fuit eclypsis Lunae, et apparuerunt acies eadem nocte mirae magnitudinis, et Sol stetit in undecima parte Piscium, et Luna in undecima parte Virginis. Nam et stella Mercurii XVI. Kal. Aprilis [= 17 March 807] visa est in Sole quasi parva macula, nigra tamen, paululum superius medio centro eiusdem sideris, quae a nobis octo dies conspicitur. Sed quando primum intravit vel exivit, nubibus impedientibus minime adnotare potuimus. Iterum mense Augusto, XI. Kal. Septembr. [= 22 August 807], eclypsis Lunae facta est hora noctis tertia, Sole posito in quinta parte Virginis et Luna in quinta parte Piscium. Sicque ab anni superioris Septembrio usque ad anni praesentis Septembrium ter Luna obscurata est et Sol semel' (*Annales regni Francorum inde ab a. 741 usque ad a. 829, qui dicuntur annales Laurissenses majores et Einhardi*, ed. F. Kurze, Hannover, 1895 (= *Monumenta Germaniae Historica, Scriptores Rerum Germanicarum in Usum Scholarum*), pp. 122-3). On this passage, see also the commentary by R. and M. Mostert, 'Using Astronomy...' (as n. 21 below), pp. 250-53.

explained if we assume that these positions were computed according to the same method as Rabanus's, that is, starting with the 15th kalends (or the 14th kalends in the month of February) as the date of the entry of the Sun into the corresponding sign and adding one degree per day:[18]

Position of the Sun on the (14th-)15th kalends	Computation for the relevant date
18 August = Virgo 1°	2 September (+ 15 days) = Virgo 16°
18 January = Aquarius 1°	11 February (+ 24 days) = Aquarius 25°
16 February= Pisces 1°	26 February (+ 10 days) = Pisces 11°
18 August= Virgo 1°	22 August (+ 4 days) = Virgo 5°

As for the positions of the Moon, they were clearly inferred from those of the Sun, by taking the degrees of the Sun and locating the Moon in the correct sign (the same sign in the case of a solar eclipse and the opposite sign in the case of a lunar eclipse), as anyone aware of the general mechanics of eclipses would have done.[19]

The two other celestial phenomena mentioned in the *Annales* are said to have been observed ('visa est' is used in both cases). There was indeed a conjunction of the Moon and Jupiter on 31 January 807. This conjunction was exact around the middle of the night and would therefore have been visible at almost any time between sunset on 30 January and sunrise on 31 January.[20] On the other hand, the Sun and Mercury were not in conjunction on 17 March 807 (the Sun was at Aries 1° and Mercury at Aries 19°); so the reported 'small black spot' ('parva macula, nigra tamen') on the Sun must have been another phenomenon.

Other early medieval reports of the planetary positions have also been preserved. There is the well-known example of the Leiden

[18] A. Borst, *Die karolingische Kalenderreform* (as n. 12 above), pp. 435-6. The use of the 14th of the kalends for the month of February is attested in Carolingian calendars, e.g. the 'Lorsch Prototype' (see n. 12 above), ed. *ibid.*, p. 259: 'Sol in Pisces' on 16 February.

[19] See e.g. Bede, De temporum ratione, 27. Rabanus's formula would have led to the same results, using as a basis the 15th day of the Moon for a lunar eclipse and the 30th day of the Moon for a solar eclipse.

[20] On 31 January 807, Jupiter was at Libra 3° and the Moon at Libra 11°. Tuckerman's positions are given at 16h00 Universal Time (= 4 p.m. Greenwich Civil Time); the Moon was then at Libra 3° around the preceding midnight.

Planetarium (ninth century), where the positions of the seven planets, depicted inside a circular zodiac, correspond to those of 18 March 816.[21] A series of astronomical manuscripts from the ninth century onwards contains records of the positions of Saturn, Jupiter, Mars and Venus in the signs for the years 770, 781 and 797.[22] In both cases, unfortunately, neither the context nor the

[21] As shown by R. and M. Mostert, 'Using Astronomy as an Aid to dating Manuscripts. The Example of the Leiden Aratea', *Quaerendo*, 20, 1990, pp. 248-61 (on pp. 253-5, with a reproduction of the *Planetarium* on p. 249) against an earlier dating (28 March 579) proposed by B. Eastwood, 'Origin and Contents of the Leiden Planetary Configuration (ms Voss. Q.79, fol. 93v), an Artistic Astronomical Schema of the Early Middle Ages', *Viator*, 14, 1983, pp. 1-40 (with the reproduction as Fig. 1, at the end). D. Pingree, 'The *Preceptum*' (as n. 2 above), p. 373, had independently suggested 816 as a possible date for the positions depicted in the *Planetarium*.

[22] (1) 'Anno DCCLXXXI, stella Iouis et stella Martis et stella Veneris in sidere Cancri, sed Venus fugiens statim reuersa est ad Phoebum.' (2) 'Anno DCCLXX, indictione VIII, prima die Ianuarii mensis stella Saturni necnon et stella Iouis in sidere Cancri uersabantur. Et cuicumque codicellus iste perueniat in manus, si tamen curiosus est errantium cognoscere siderum cursus, intellegat post annorum curricula, quod ad idem redeant sidus.' (3) 'Anno dominicae incarnationis DCCXCVII, indictione V, stellarum in mense Mar<tii> <stella Saturni> in Geminis et stella Iouis in Scorpione, stella Martis in Cancro, et stella Veneris in Tauro uersatur.' Extracts (1) and (2) appear in this order in Berlin, Staatsbibl., Phill. 1869 (*ca.* 840, Prüm), fol. 7v (as an insertion in a calendar, in the month of August); see edition in D. Lohrmann, 'Alcuins Korrespondenz mit Karl dem Grossen uber Kalendar und Astronomie', in *Science in Western and Eastern Civilization in Carolingian Times*, eds P. L. Butzer and D. Lohrmann, Basel-Boston-Berlin, 1993, pp. 79-114, on p. 113, and in A. Borst, *Die karolingische Kalenderreform* (as n. 12 above), p. 284, with commentary on pp. 478-9. Extracts (2) and (3) occur together in Paris, BNF, lat. 5543, fol. 130v; Paris, BNF, lat. 5239, fol. 123r; Strasbourg, Bibl. Nationale et Universitaire, 326, fol. 125r (on these three manuscripts, see below); and London, BL, Harley 3091 (s. ix, Nevers), fol. 21v. Lohrmann also notes extract (2) in a manuscript that I have not seen: Valenciennes, Bibl. Municipale, 343 (s. ix, St-Amand), fol. 29r. Extracts (1) and (2) are taken from Borst's edition. Extract (3) is my edition based on the above-mentioned manuscripts. Paris, BNF, lat. 5543; BNF, lat. 5239 and Strasbourg 326 (which derive from the same model, as will be shown below) give 'DCCXCIIII' as a date in extract (3), but this is evidently a misreading of 'DCCXCVII' (given in Harley 3091), as the year 797 (not 794) corresponds to the 5th indiction. In extract (3), the name of the planet staying in Gemini is omitted in all the manuscripts but it must be Saturn. (1) In 781, Mars and Venus are found together in Cancer from 5 August to 3 September, but Jupiter travelled then from Leo 7° to 13°. (2) On 1 January 770, Saturn and Jupiter were not in Cancer but they were together in the following sign, at Leo 9° and 19° respectively. (3) During March 797, Saturn

available data allow us to settle with certainty whether these positions were observed or somehow computed. Whatever the case, the examples of Rabanus Maurus and the *Annales regni Francorum* show that it was possible both to obtain precise positions of the luminaries by means of elementary rules of computus and to observe the position of the planets (at least Saturn, Jupiter and Mars) in the correct signs.

2 *In quo signo versetur Mars?*

But the determination of the planetary longitudes was not limited to these possibilities. There is another method which is found in a short text, without attribution or title, opening with the words 'In quo signo versetur Mars...'. This text was noted in 1936 by André Van de Vyver, who identified it as a source of the *Liber Alchandrei* (on which see below) and gave a list of manuscripts in which it occurs; but it seems not to have received any attention since.[23] The *In quo signo versetur Mars* (hereafter *IQSVM*) consists of five chapters describing a handy method for computing the position of each planet (Mars, Jupiter, Saturn, Venus and Mercury) in the zodiac for any time, past, present or future. This method has nothing to do with the usual procedures; instead, it is based on an empirical combination of the following three elements: (1) the position of the planets at the creation

travelled from Cancer 0° to 1°, Jupiter was stationnary at Sagittarius 0°, Mars was retrograde from about Cancer 21° to 17°, and Venus travelled from about Taurus 0° to 29°. As such, these positions are rather inaccurate. If, however, we take into account the precessional shift (see n. 7 above), all the positions reported in 797 would be correct (Saturn would be found in Gemini and Jupiter in Scorpio), and this could also apply, to some extent, to the positions given in 781 and 770. On 15 August 781, for instance, Jupiter was at Leo 9°, and Mars and Venus were in conjunction at Cancer 10°; the three planets could therefore have been seen around that date in the constellation of Cancer. It should be noted that Venus was clearly visible both in August 781 and in March 797, since it was at its maximal elongation from the Sun.

[23] A. Van de Vyver, 'Les plus anciennes traductions latines médiévales (Xe-XIe siècles) de traités d'astronomie et d'astrologie', *Osiris*, 1, 1936, pp. 658-91 (pp. 670-3). A brief description of the text is given in D. Juste, 'Les doctrines astrologiques du *Liber Alchandrei*', in *Occident et Proche-Orient: contacts scientifiques au temps des Croisades (Actes du colloque de Louvain-la-Neuve, 24 et 25 mars 1997)*, eds I. Draelants, A. Tihon and B. van den Abeele, Turnhout, 2000, pp. 277-311 (pp. 289-90, see also pp. 284-5).

of the world, (2) the zodiacal periods of the planets and (3) the time elapsed since the creation of the world. The procedure to determine the position of Saturn, for instance, is as follows (see edition in Appendix I):

1. One has to divide the number of years elapsed from the creation of the world by 30 (30 years = zodiacal period of Saturn).

2. The remainder is to be converted into months (i.e. multiplied by 12).

3. This result is to be distributed along the zodiac from Capricorn (= the sign of Saturn at the creation of the world) at the rate of 30 months per sign (since Saturn travels along the zodiac over a period of 30 years, it traverses a single sign in 30 months). The sign in which the last unit, i.e. a group of 30 months or fewer, falls is the sign of Saturn.

The procedure is the same for the other planets, taking into account, of course, the necessary adjustments due to their original sign and zodiacal periods. These two pieces of data require some brief comments. The distribution of the original signs (Mars in Scorpio, Jupiter in Sagittarius, Saturn in Capricorn, Venus in Libra and Mercury in Virgo) is identical to the diurnal domiciles of the planets as found both in astrological texts and in the ancient *thema mundi* or *genitura mundi* transmitted to the Latin world by Macrobius and Firmicus Maternus.[24] On the other hand, the zodiacal periods are problematic; for, with the exception of Saturn, they do not correspond to anything 'real' and appear to be arithmetically based on multiples of six following the arrangement of the planetary week: Mars 6 years, Mercury 12 years, Jupiter 18 years, Venus 24 years, Saturn 30 years. These values come into conflict with the 'true' mean periods of the planets, widely known in the early Middle Ages through the works of Pliny, Macrobius, Martianus Capella and Bede, as well as with the values given by Isidore of Seville, as indicated in the table below:[25]

[24] Macrobius, *Commentarii in Somnium Scipionis*, I.21.24; Firmicus Maternus, *Mathesis*, III.1.1. On the *thema mundi*, see A. Bouché-Leclercq, *L'astrologie grecque*, Paris, 1899, pp. 185-96.

[25] Pliny, *Historia naturalis*, II.32-9 (and Bede, *De natura rerum*, 13); Macrobius, *Commentarii in Somnium Scipionis*, 19.3-4; Martianus Capella, *De*

	Pliny–Bede	Macrobius	Martianus Capella	Isidore of Seville
Saturn	30 years	30 years	30 years	30 years
Jupiter	12 years	12 years	12 years	12 years
Mars	*ca.* 2 years	2 years	almost 2 years	15 years
Venus	348 days	*ca.* 1 year	*ca.* 1 year	9 years
Mercury	339 days	*ca.* 1 year	almost 1 year	20 years

It should be noted that the only basic data not provided in the text is the number of years elapsed from the creation of the world. But this is not a problem, for the chronology from the Creation to the Incarnation (to which the year of the computation is to be added) was a well-known element in early medieval computus, although the value differed depending on the translation of the Bible in use. The two main figures were 5199 years according to the Greek Septuagint and 3952 years according to the Hebrew tradition.[26]

The *IQSVM* occurs among astronomical material in nine manuscripts from the ninth to the twelfth century.[27] These are, in chronological order:

M Melk, Stiftsbibl., 412 (*olim* 370, *olim* G.32), pp. 29-30. This manuscript was copied around 840 at Auxerre and belonged to Heiric of Auxerre, who annotated it until *ca.* 875.[28]

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nuptiis Philologiae et Mercurii, VIII.879-86; Isidore of Seville, *De natura rerum*, 23.4 and *Etymologiae*, III.66.2 (Isidore also gives 19 years for the Sun and 8 years for the Moon).

[26] See e.g. Bede, *De temporibus*, 22: 'conpletis ab Adam annis III.DCCCCLII, iuxta alios V.CXCVIIII' (ed. C. W. Jones, Turnhout, 1980 (= *Corpus Christianorum. Series Latina*, 123C), p. 607); Rabanus Maurus, *De computo*, 55: 'Secundum hebraicam ueritatem anni III milia DCCCCLVI (*sic*), secundum uero septuaginta interpretes anni V milia CXCVIIII' (ed. W. M. Stevens, pp. 281-2). On these chronological questions, see R. Landes, 'Lest the Millenium be Fulfilled: Apocalyptic Expectations and the Pattern of Western Chronography 100-800 CE', in The *Use and Abuse of Eschatology in the Middle Ages*, eds W. Verbeke, D. Verhelst and A. Welkenhuyzen, Leuven, 1988, pp. 137- 211.

[27] Van de Vyver (see n. 23 above) did not know Strasbourg 326 and Vatican City, BAV, Reg. lat. 123. I have also found a late copy in Vatican City, BAV, Urb. lat. 102 (s. xv), fols 192vb-193ra.

[28] T. Sickel, 'Un manuscrit de Melk venu de S. Germain d'Auxerre', *Bibliothèque de l'Ecole des Chartes*, 23, 1862, pp. 28-38; A. Van de Vyver, 'Les plus anciennes traductions...' (as n. 23 above), p. 671; B. de Gaiffier, 'Le calendrier

P Paris, BNF, lat. 5543, fols 131v-132r. This well-known manu script of computus and astronomy copied at Fleury is generally dated to the mid-ninth century (the date '847' appears on fol. 120v), but it could have been written in several stages until the first half of the tenth century.[29]

V Vatican City, BAV, Reg. lat. 309, fol. 3r. The manuscript, copied at the monastery of Saint-Denis, mainly belongs to the second half of the ninth century, but our text, together with two chapters on eclipses, has been added by a late ninth- or early tenth-century hand on fol. 3r, originally blank. The manuscript contains the most complete copy of the 'Seven-Book Computus' of 809.[30]

P_1 Paris, BNF, lat. 5239, fol. 124r. Another well-known manuscript of computus and astronomy, copied at Saint-Martial of Limoges in the middle or in the second half of the tenth century.[31]

V_1 Vatican City, BAV, Reg. lat. 596, fol. 51v. This is a composite manuscript, of which fols 10-23 were copied at Fleury at the beginning of the eleventh century. Fols 46-51, written in the tenth century in France—but not at Fleury according to Marco Mostert—, contain a treatise of computus and astronomy in 40

d'Héric d'Auxerre du manuscrit de Melk 412', *Analecta Bollandiana*, 77, 1959, pp. 392-425. C. Glassner, *Inventar der Handschriften des Benediktinerstiftes Melk*, I: *Von den Anfängen bis ca. 1400*, Vienna, 2000, pp. 191-3.

[29] See most recently B. Munk Olsen, *L'étude des auteurs classiques latins aux XI^e et XII^e siècles*, II, Paris, 1985, p. 264; and M. Mostert, *The Library of Fleury. A Provisional List of Manuscripts*, Hilversum, 1989, pp. 207-208. Both agree on the mid-ninth century as a date, but an unpublished and very detailed notice at the Institut de Recherche et d'Histoire des Textes (IRHT, Paris) indicates the tenth century for fols 129-45. See also A. Van de Vyver, 'Les plus anciennes traductions...' (as n. 23 above), p. 672, n. 66.

[30] F. Saxl, *Verzeichnis astrologischer und mythologischer illustrierte Handschriften des lateinischen Mittelalters*, I: *In römischen Bibliotheken*, Heidelberg, 1915, pp. 59-66; A. Wilmart, *Codices Reginenses Latini*, II, Roma, 1945, pp. 160-74; B. Munk Olsen, *L'étude des auteurs classiques...* (as n. 29 above), II, p. 270; D. Nebbiai-Dalla Guarda, *La bibliothèque de l'abbaye de Saint-Denis en France du IXe au XVIIIe siècle*, Paris, 1985, p. 231. For the chapters on eclipses, see n. 41 below.

[31] R. Derolez, *Runica manuscripta. The English Tradition*, Bruges, 1954, pp. 329-32; B. Munk Olsen, *L'étude des auteurs classiques...* (as n. 29 above), I, pp. 408-409; R. Landes, *Relics, Apocalypse, and the Deceits of History. Ademar de Chabannes, 989-1034*, Cambridge, Mass.-London, 1995, pp. 346-9.

chapters of which our text forms chapters 36-40.[32]

S Strasbourg, Bibl. Nationale et Universitaire, 326 (s. x-xi, Angoulême), fols 125v-126r.[33]

V_2 Vatican City, BAV, Reg. lat. 123, fols 170r-174r. This manuscript was copied in 1056 in Catalonia, most probably at the monastery of Ripoll. It contains a compilation in four books entitled *De Sole*, *De Luna*, *De natura rerum* and *De astronomia*, of which this manuscript seems to be the only copy.[34] Our text is divided among a group of chapters devoted to the planets on fols 170r (Mars), 171r (Mercury), 171v (Jupiter), 173r (Venus) and 174r (Saturnus).

P_2 Paris, BNF, lat. 12117 (*ca.* 1063, Saint-Germain-des- Prés), fol. 130r.[35]

V_3 Vatican City, BAV, Vat. lat. 643 (s. xii, Melk), fol. 71r.[36]

As we can see, the *IQSVM* existed in Auxerre in the first half of the ninth century and circulated principally in France (including

[32] A. Guerreau-Jalabert, *Abbon de Fleury: Questions grammaticales*, Paris, 1982, pp. 199-200; M. Mostert, *The Library of Fleury...* (as n. 29 above), pp. 272-3; *Codices Boethiani. A Conspectus of Manuscripts of the Works of Boethius*, III: *Italy and the Vatican City*, eds M. Passalacqua and L. Smith, London-Turin, 2001, pp. 486-8. There is also an unpublished and very detailed notice on this manuscript at the IRHT.

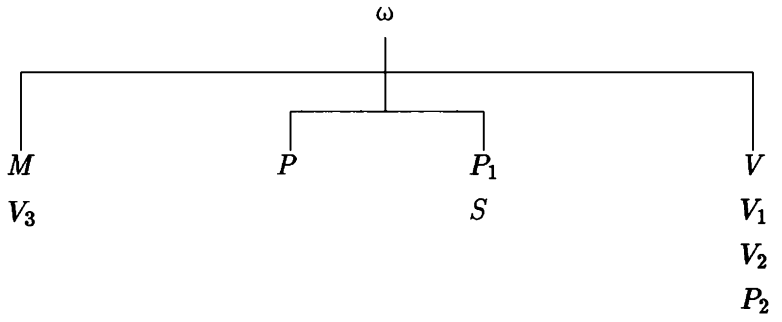
[33] R. Derolez, *Runica manuscripta...* (as n. 31 above), pp. 332-4; C. Leonardi, 'I codici di Marziano Capella', *Aevum*, 34, 1960, pp. 1-99 and 411-524 (p. 453); B. Munk Olsen, *L'étude des auteurs classiques...* (as n. 29 above), I, p. 409, and II, p. 269.

[34] F. Saxl, *Verzeichnis astrologischer...* (as n. 30 above), pp. 45-59; A. Wilmart, *Codices Reginenses Latini*, I, Roma, 1937, pp. 289-92; E. Pellegrin, *Les manuscrits classiques latins de la Bibliothèque Vaticane*, II.1, Paris, 1978, pp. 35-8; B. Munk Olsen, *L'étude des auteurs classiques...* (as n. 29 above), I, pp. 533-4; G. Puigvert, 'El manuscrito Vat. Reg. 123 y su posible adscripcion al scriptorium de Santa Maria de Ripoll', in *Roma, magistra mundi. Itineraria culturae Medievalis*, ed. J. Hamesse, III, Louvain-la-Neuve, 1998, pp. 285-316; A. García Avilés, *El tiempo y los astros. Arte, ciencia y religión en la alta edad media*, Murcia, 2001, pp. 107-115 and 129-43.

[35] C. Leonardi, 'I codici...' (as n. 33 above), p. 441; M. Vieillard-Troiekouroff, 'Art carolingien et art roman parisiens. Les illustrations astrologiques jointes aux Chroniques de Saint-Denis et de Saint-Germain-des-Prés (IXe-XIe siècles)', *Cahiers Archéologiques*, 16, 1966, pp. 77-105; B. Munk Olsen, *L'étude des auteurs classiques...* (as n. 29 above), II, p. 268.

[36] M. Vatasso, *Codices Vaticani Latini*, I, Roma, 1902, pp. 493-4; F. Saxl, *Verzeichnis astrologischer...* (as n. 30 above), pp. 70-71.

Catalonia) until the second half of the eleventh century. Variant readings in the text allow us to state more precisely the relationship between the manuscripts. M is clearly the model of V_3.[37] P_1 could be the model of S,[38] and both manuscripts have in common with P the omission of 'signo' in chapter 1, although it seems unlikely that P_1S derive from P.[39] $VV_1V_2P_2$ form a distinct family, characterized by several divergent readings and the addition of a title to each chapter.[40] Thus, a plausible *stemma* would be the following:



[37] Both agree on most readings, including mistakes such as 'parte faciet' for 'patefaciet' (chap. 4 in fine). The close relationship between the two manuscripts had already been established by A. Van de Vyver, 'Les plus anciennes traductions...' (as n. 23 above), p. 671, and C. W. Jones, *Bedae Pseudepigrapha: Scientific Writings Falsely Attributed to Bede*, Ithaca-London, 1939, p. 30.

[38] As suggested by several common spellings and mistakes, as well as by the final addition 'Virgo latitudinem signiferi scandes' (chap. 5).

[39] Two variants in P have not affected P_1S ('signatis' instead of 'assignatis' in chap. 1, 'annis' omitted in chap. 2). The relationship between the three manuscripts, which have also preserved the planetary positions of 770 and 797 (see n. 22 above), has long been recognized, see in particular C. W. Jones, *Bedae Pseudepigrapha...* (as n. 37 above), p. 128 (and references cited there), and his introductions to the edition of Bede's works, 3 vols., Turnhout, 1975-80 (= *Corpus Christianorum. Series Latina*, 123A-B-C), pp. 179, 182, 250, 253, 634 and 656; R. Derolez, *Runica manuscripta...* (as n. 31 above), pp. 329, 333 and 349; V. H. King, *An Investigation of Some Astronomical Excerpts from Pliny's Natural History Found in Manuscripts of the Earlier Middle Ages*, M. Phil. Thesis, Oxford, 1969, pp. 106, 108 and 110-1.

[40] These variants are: 'totidem' (instead of 'tot') in chap. 2 and 5, 'non congruentium' (instead of 'congruentium') in chap. 4 and 'assignandi' (instead of 'assignando') in chap. 5. The titles (omitted in V_2) are *In quo duodecim signorum Mars habeatur, In quo feratur Iuppiter, In quo Saturnus consistat, In quo moretur Venus* and *In quo meet Mercurius*. On the relationship between V and P_2, see also M. Vieillard- Troiekouroff, 'Art carolingien...' (as n. 35 above), *passim*.

Mistakes of copying in *M* make it clear that this manuscript cannot be the archetype of the text, and there is evidence that it derives from a model copied between 808 and 832, two dates corresponding to the *termini* of a short text on eclipses which immediately precedes the *IQSVM* in this manuscript as well as in VV_1V_3.[41] We have otherwise no clue as to the early history of the text, but two facts might suggest that it was not current before the first half of the ninth century. First, no known earlier records of planetary positions, all of which are dated from 770 to 820 as we have seen, were computed by means of this method. Second, the text is absent from the 'Seven-Book Computus' of 809, which includes virtually all the material on astronomy—including planetary astronomy— available at that time.[42]

The question arises as to whether such a curious method, based on zodiacal periods which conflict with those given in authoritative works, was actually practiced by early medieval scholars. The fact that it was copied in astronomical manuscripts is perhaps enough to prove that it was used; but better evidence is provided by two other examples.

3 *August 978: Abbo of Fleury computes the position of Mars*

At about the time when the *Preceptum Canonis Ptolomei* was being copied in Fleury, the abbot of the monastery was Abbo

[41] See T. Sickel, 'Un manuscrit de Melk...' (as n. 28 above), p. 32. The text in question is based on a 24-year cycle starting in 808: 'Solis eclipsis quemadmodum innotescat (title in VV_1 only). Deliquium Solis contigisse fertur anno ab incarnatione domini DCCCVIII (DCCCVII V), quicquid ergo inde aut abscessit annorum per XXIIII diuidatur et semper, ut nonnullis placet, XXIIII anno eclipsis inuenietur. Quo argumento sit uestigandum (title in VV_1 only). Eclipsis (EKΛYCIC *V*) etiam Lunae nosci posse existimatur si cognito solari deliquio inde CLXXVII dies computentur. Namque si sub ea summa XIIII Luna occurrerit, lunarem defestum (*sic*) pariter euenturum. Sin autem rursum CLXXVII alios supputandos donec eis aetas XIIII Lunae concordet, quod quotiens contingerit totiens eclipsin non defuturam (defecturam *M*)' (my edition, based on the four manuscripts; only significant variants are noted).

[42] On this still unpublished work, see A. Borst, 'Alkuin und die Enzyklopädie von 809', in *Science in Western and Eastern Civilization...* (as n. 22 above), pp. 53-75, and the detailed table of contents (from Vatican City, BAV, Reg. lat. 309) given in F. Saxl, *Verzeichnis astrologischer...* (as n. 30 above), pp. 60-65.

(988-1004), one of the most learned men of his time, who is generally considered the equal of Gerbert of Aurillac in his knowledge of the sciences of the *quadrivium*, including astronomy.[43] According to his biographer, Aimoin of Fleury (†after 1008), he is the author of some *disputationes* on the course of the Sun, the Moon and the planets.[44] These *disputationes* must be identified with the *De ratione spere* or *Sententia Abbonis de ratione spere* (inc.: 'Studiosis astrologiae primo sciendum est...'), a treatise in two parts which Abbo wrote in 978, when he was the schoolmaster in Fleury.[45] This treatise turns out to be the first Latin text of the Middle Ages entirely devoted to planetary astronomy. In the first part, Abbo gives a general description of the heavenly sphere and discusses a number of features pertaining to the planets drawn from Pliny and other sources (motions, *absides*, colours, elongation, distinction between planets and fixed stars, latitude, harmonic intervals, distance from the Earth to the Moon and the Sun), while the second part provides the basic data to compute their position. As far as the luminaries are concerned, Abbo's discussion offers no departure from the standard computus: the age of the Moon allows one to determine its position with respect to the Sun; and the position of the Sun is to be inferred from its

[43] On Abbo's scientific works and teaching, see A. Van de Vyver, 'Les œuvres inédites d'Abbon de Fleury', *Revue Bénédictine*, 47, 1935, pp. 125-69; G. R. Evans and A. M. Peden, 'Natural Science and the Liberal Arts in Abbo of Fleury's Commentary on the Calculus of Victorius of Aquitaine', *Viator*, 16, 1985, pp. 109-27; E.-M. Engelen, *Zeit, Zahl und Bild: Studien zur Verbindung von Philosophie und Wissenschaft bei Abbo von Fleury*, Berlin and New York, 1993; B. Eastwood, 'Calcidius's Commentary on Plato's *Timaeus* in Latin Astronomy of the Ninth to Eleventh centuries', in *Between Demonstration and Imagination. Essays in the History of Science and Philosophy Presented to John D. North*, eds L. Nauta and A. Vanderjagt, Leiden, 1999, pp. 171-209 (pp. 178-86).

[44] 'de Solis quoque ac Lunae seu planetarum cursu a se editas disputationes posterorum mandavit notitiae' (Aimoin of Fleury, *Vita s. Abbonis*, ed. J.-P. Migne, *Patrologia Latina*, 139, col. 390D).

[45] Ed. R. B. Thomson, 'Two Astronomical Tractates of Abbo of Fleury', in *The Light of Nature. Essays in the History and Philosophy of Science Presented to A.C. Crombie*, eds J. D. North and J. J. Roche, Dordrecht-Boston-Lancaster, 1985, pp. 113-33. On this treatise, see also A. Van de Vyver, 'Les œuvres inédites...' (as n. 43 above), pp. 140-50; B. Eastwood, 'Astronomy in Christian Latin Europe *c.* 500 - *c.* 1150', *Journal for the History of Astronomy*, 28, 1997, pp. 235-58 (pp. 251-3); S. McCluskey, *Astronomies and Cultures...* (as n. 1 above), pp. 152-3.

regular motion throughout the signs, starting with the entry into Aries on the 15th kalends of April (the exact hour of entry into the signs is even given according to the leap year cycle).[46] The last section is devoted to the five planets:[47]

A Scorpione Mars VI:	sexies m[ille] XXVIIII, sunt VI [milia] CLXXIIII.
A Sagittario Iuppiter XVIII:	decies octies CCCXLII sunt VI [milia] CLVI.
A Capricorno Saturnus XXX:	tricies CCV sunt VI [milia] CL.
A Libra Venus XXIIII:	vicies quater CCLVII sunt VI [milia] CLXVIII.
A Virgine Mercurius XII:	duodecies DXIIII sunt VI [milia] CLXVIII.

Signa in quibus singuli planetarum morentur scies si annos ab initio mundi secundum LXX per numeros hic eisdem planetis subiectos diviseris, hoc tantum retinens quod annorum quos idem numerus dividere non poterit sint colligendi menses et, ipso numero cuilibet planete subiecto, metiendi sumpto initio a signo ei prenotato de quo scire volueris.

Ut si de Marte vis, quia VI [milia] CLXXVII anni sunt, sexies mille sunt VI [milia] et sexies XXIX sunt CLXXIIII. Supersunt hoc tertio anno in mense Augusto menses XXX, quia hos annos in mense Martio cepimus et finivimus et sexies V [= quini] sunt XXX. In quinto igitur a Scorpione signo, hoc est in Piscibus, Martem modo esse credimus. Similiter de reliquis.

Mars 6 from Scorpio:	$6 \times 1029 = 6174$
Jupiter 18 from Sagittarius:	$18 \times 342 = 6156$
Saturn 30 from Capricorn:	$30 \times 205 = 6150$
Venus 24 from Libra:	$24 \times 257 = 6168$
Mercury 12 from Virgo:	$12 \times 514 = 6168$

You will know the signs in which each of the planets stays if you divide the <number of> years from the beginning of the world according to the Septuagint by the numbers here ascribed to the corresponding planets, keeping in mind only that the number of years which cannot be divided is the <number of> months to be taken into account and (this number having been ascribed to the <correct> planet) to be distributed <along the zodiac> starting

[46] *De ratione spere*, l. 98-122 for the Moon, and 123-69 for the Sun (ed. R. B. Thomson, 'Two Astronomical Tractates...' (as n. 45 above), pp. 127-31).

[47] *De ratione spere*, l. 170-85 (ed. pp. 132-3). I have slightly modified Thomson's punctuation.

> from the sign ascribed above to that <planet> whose sign you want to know.
>
> For example, if you want <to make the computation> for Mars, since there are 6177 years, 6 × 1000 = 6000 and 6 × 29 = 174. In this third year, in the month of August, there remain 30 months, for we have begun and finished these years in the month of March and 6 × 5 = 30. Then we believe that Mars is at the moment in the fifth sign from Scorpio, that is Pisces. The same <applies> to the other <planets>.

Abbo's source is immediately obvious. The basic data and all the details of the procedure are identical to those of the *IQSVM.* Abbo first sets up a table containing the original signs and zodiacal periods of the planets, as well as the planetary cycles valid for the time of the computation, i.e. from *annus mundi* 6174 (beginning of the cycle of Mars) to 6180 (end of the cycles of Mars, Saturn and Mercury).[48] In the second paragraph, he summarizes the procedure and makes it explicit that the chronology to be used is that of the Septuagint style (= 5199 years). Finally, he computes the position of Mars for the month of August 6177 (6177 - 5199 = A.D. 978):[49]

1. 6177 : 6 = 1029, remainder: 3 (Mars completed 1029 cycles of 6 years in 6174 years, 6177 - 6174 = 3).

2. Given that the year begins in March (Abbo uses the Annunciation style, i.e. 25 March) and that the current month

[48] As Thomson pointed out ('Two Astronomical Tractates...' (as n. 45 above), p. 132, commentary on lines 170-4), Abbo made a mistake in calculating the current cycle of Jupiter. It should read '18 × 343 = 6174' instead of '18 × 342 = 6156'. As set up by Abbo, the table is valid for *annus mundi* 6174 only. It should be noted that a similar table, containing the original signs and zodiacal periods of the planets, was included in Abbo's *Computus*, at least in two manuscripts: Berlin, Staatsbibl., Phill. 1833 (s. x-xi), fol. 38r, and Vatican, BAV, Reg. lat. 1573 (s. xi), fol. 52r, as well as in a very corrupt form in the printed version of the *Patrologia Latina*, 90, col. 228. I thank Bruce Eastwood for calling my intention to this; see his 'Calcidius's Commentary...' (as n. 43 above), p. 183 n. 24 (with a different interpretation of the purpose of this table) and p. 203 (for a reproduction of the relevant page of the Berlin manuscript).

[49] This allowed Van de Vyver to date the text ('Les œuvres inédites...' (as n. 43 above), p. 146); see also Thomson's comments on line 180 ('Two Astronomical Tractates...' (as n. 45 above), p. 132). The final sentence ('Martem modo esse credimus') makes it clear that August 978 is the current ('modo') date.

is August, the number of months is 24 (= 2 years) + 6 (6 months from March to August) = 30.

3. Since Mars takes 6 months to cross a single sign, in 30 months it traverses 5 signs, from Scorpio (original sign). Scorpio + 5 signs = Pisces.

This calculation is, in fact, not correct. Abbo misinterpreted the value of the remainder (3) which means three completed years in the cycle of Mars, rather than the third year, as he states ('hoc tertio anno'). From March 6174 to August 6177, there are 42 months, not 30, and the result should be Taurus instead of Pisces.

In his commentary on this section of the *De ratione spere*, Stephen McCluskey pointed out that such a calculation, which 'would often find the two inferior planets opposite to the Sun', was in contradiction to Abbo's previous statement about the maximal elongation of Mercury and Venus.[50] If Abbo noticed this contradiction, he said nothing as to how to accommodate the two theories. What is clear is that he took this system seriously and not just as something thrown in to entertain the reader. Doubtless the Fleury schoolmaster accepted the validity of the method, for he appears to have arranged certain data in order to give a better foundation for it. In the first part of his treatise, he carefully avoided mentioning the zodiacal periods of the planets current in his time—a piece of data that, as we have seen, he could hardly have failed to notice. But more significant is the fact that he altered the well-known concept of *absides*, by which Pliny, Martianus Capella and Bede had designated the signs where the planets reach their apogee (i.e., the remotest point from the Earth), in order to refer to the signs in which the planets stood at the Creation.[51] This shift might result partly from a reading of Mac-

[50] S. McCluskey, *Astronomies and Cultures...* (as n. 1 above), p. 153. Following Pliny, Abbo states that the elongation of Mercury is 32° (22° in Pliny, *Historia naturalis*, II.39) and that of Venus 2 signs at most (46° in Pliny, II.38): 'Mercurius..., qui numquam a Sole plus XXXII partibus poterit elongare' (*De ratione spere*, l. 32-3, ed. R. B. Thomson, p. 121); 'Mercurius numquam plus uno nisi duabus partibus; Venus vero plus uno signo sed numquam plus duobus recedit a Sole' (*ibid.*, l. 63-5, pp. 122-3). McCluskey (p. 152) believes that Abbo is the inventor of this method.

[51] 'Absides autem dicimus, loca ubi in principio conditi sunt planete, ut Mars in Scorpione, Iuppiter in Sagittario, Saturnus in Capricorno, Venus in

robius, as has been suggested,[52] but the omission of the luminaries as well as the unusual order of the planets (Mars, Jupiter, Saturn, Venus, Mercury) in Abbo's statement make it clear that his direct source was the *IQSVM*.

4 *The Alchandreana and the introduction of a variant version of computation*

The second context in which the *IQSVM* occurs is another late tenth-century text which I have already alluded to, the *Liber Alchandrei*. The text belongs to the oldest collection of astrological treatises of Arabic origin available in the West: the *Alchandreana*. This collection came to the Latin world from Spain and was fully elaborated in Catalonia, at least partly at the monastery of Ripoll, during the second half of the tenth century. Some of the texts appear to be direct translations or adaptations from Arabic, while others consist of new, more elaborate versions of the same material by different author.[53] The *Liber Alchandrei* belongs to this second stage and is distinctive for having been influenced by Latin science.[54] Its author knew of some computus sources, quoted passages from Martianus Capella and Pliny, and reproduced in full the *IQSVM* (= *Liber Alchandrei*, chap. 10), with

Libra, Mercurius in Virgine' (*De ratione spere*, l. 53-5, ed. R. B. Thomson, p. 122). Compare with Pliny, *Historia naturalis*, II.63-5; Martianus Capella, *De nuptiis Philologiae et Mercurii*, VIII.884-6; Bede, *De natura rerum*, 14. On the significance and importance of the concept of absides in the early Middle Ages, see B. Eastwood, 'Plinian Astronomical Diagrams in the Early Middle Ages', in *Mathematics and its Applications to Science and Natural Philosophy in the Middle Ages*, eds E. Grant and J. Murdoch, New York, 1987, pp. 141-72 (pp. 145-6 and 153-7).

[52] R. B. Thomson, 'Two Astronomical Tractates...' (as n. 45 above), p. 122, commentary on lines 53ff.; E.-M. Engelen, *Zeit, Zahl und Bild...* (as n. 43 above), p. 76; B. Eastwood, 'Astronomy in Christian Latin Europe...' (as n. 45 above), p. 251; S. McCluskey, *Astronomies and Cultures...* (as n. 1 above), p. 152.

[53] The corpus is studied and edited in D. Juste, *Les* Alchandreana *primitifs. Recherches sur les plus anciens traités astrologiques latins d'origine arabe (Xe siècle)* (forthcoming in the *Collection des Travaux de l'Académie Internationale d'Histoire des Sciences*, Turnhout). All passages from the *Alchandreana* cited hereafter are taken from this study. See also A. Van de Vyver, 'Les plus anciennes traductions...'(as n. 23 above), pp. 666-84, and D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), *passim*.

[54] D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), pp. 288-90.

an introductory sentence accommodating the material to the astrological context: 'Per has autem VII planetas quia, ut diximus et adhuc probabimus, humana fata disponuntur, regulam certam demus, qua in quo signo quaeque sit pernoscatur'. The text has otherwise been copied with only minor changes and, not surprisingly, it shares all the divergent readings of the group $VV_1V_2P_2$, which includes the copy made in Ripoll in 1056 (V_2).[55]

The insertion of the *IQSVM* into an astrological text does not require a long explanation. Due to the lack of astronomical tables, the method of the 'years of the world' represented for Western scholars of the tenth century the only way of computing the planetary longitudes, an element which appears indispensable in various places in the *Alchandreana*, notably in the prognostics based on the position of the planets in the signs and in the twelve mundane houses. But what is curious is that the corpus includes a variant version of the method of the 'years of the world'. This variant occurs in chapter 25 of the *Liber Alchandrei* and in two other texts: the *Proportiones competentes in astrorum industria* (chap. 42.14-23) and the *Quicumque nosse desiderat legem astrorum...* (chap. 14). The *Liber Alchandrei* and the *Proportiones* give almost verbatim the same version (though the latter is more complete) and all three texts basically agree with regard to the contents (see editions in Appendix II). For convenience, I shall distinguish between the method of the *IQSVM* and this variant by calling them 'System A' and 'System B' respectively.

[55] Variants between the *Liber Alchandrei* and the *IQSVM* as edited in Appendix I are: 1. Scorpio] Scorpione. 2. *Title:* In quo signo Iuppiter; Eisdem] Ex eisdem; partem *omitted*; tot] totidem; ut quorundam fert opinio *omitted*; non occurrerint] tribuendi defecerint; morari] morari dicunt. 3. *Title:* In quo signo Saturnus; transgressi] transgressi numerum; mensibus] menses; cognoscatur] cognoscantur; caetera deinde] deinde caetera; denique] deinde. 4. *Title:* In quo signo Venus; parte separare] separare parte; hinc] huic; congruentium] non congruentium. 5. *Title:* In quo signo Mercurii; Quin] Qui; ac *omitted*; tot] totidem; defuerint assignado XII] XII assignandi defuerint; inueniri] putant inueniri. Chapter 10 of the *Liber Alchandrei* is preserved in the following manuscripts: Paris, BNF, lat. 17868, s. x, fol. 3r-v; Munich, Bayerische Staatsbibl., Clm 560, s. xi, fols 63r-64r; London, BL, Addit. 17808, s. xi, fols 86v-87r; Orléans, Bibl. Municipale, 282, s. xi/xii, pp. 11-14 and 3^{bis}; Los Angeles (*olim* Malibu), J. Paul Getty Museum, Ludwig XII.5, s. xii, fols 78v-79r; London, BL, Cotton Appendix VI, s. xiii, fols 38va-39ra; Bernkastel-Kues, Cusanusstiftsbibl., 214, s. xiv, fol. 21r-v; Vatican City, BAV, Vat. lat. 4084, s. xiv, fol. 8v; Vatican City, BAV, Pal. lat. 1416, s. xv, fol. 119r-v.

'System B' essentially differs from 'System A' by giving alternative basic data. Here the original signs of the planets do not offer an altogether coherent astronomical or astrological picture: Saturn is in Libra, Jupiter in Aries, and the texts are in complete disagreement regarding the positions of Mars (Scorpio is given in the *Liber Alchandrei*, Capricorn in the *Proportiones*, Leo in the *Quicumque*) and Venus (Capricorn in the *Liber Alchandrei*, Libra in the *Proportiones*, Pisces in the *Quicumque*). On the other hand, the zodiacal periods correspond to the 'true' mean periods of the planets (Saturn 30 years, Jupiter 12 years, Mars $1\frac{1}{2}$ year, Venus 300 days). These values are not convenient to use in the process of calculation, and it is probably for this reason that the remainder of the first division, instead of being converted into months, is expressed in years or days corresponding to the period of transit of the planets in one sign (Saturn $2\frac{1}{2}$ years, Jupiter 1 year, Mars 45 days, Venus 25 days). Moreover, in the case of Venus, the computation becomes more complicated: one has (1) to divide the number of years from the creation of the world by 8; (2) to divide the remainder, converted into days, by 300; (3) to add 40 to the remainder; and (4) to count the result in the order of the signs starting from Libra at the rate of 25 days per sign. If the figures 300 and 25 days are easily recognizable, it is not clear what the initial division by 8 and the addition of 40 days refer to.[56] Finally, the procedure for Mercury is omitted in both the *Liber Alchandrei* and the *Quicumque*, but the author

[56] The account of the procedure for Venus is that of the *Proportiones* (42.21), which preserves the most complete version. There are some variations in the two other texts. The *Liber Alchandrei* (25.6) omits steps 1 and 3. The author of the *Quicumque* (14.5) speaks of an initial addition of 60 (years) and omits step 3; he made a mistake here, for he had previously (in chapter 8) described the cycle of Venus as follows: 'Venus igitur moratur in unoquoque signo XXV diebus, et ideo constat percurrere eam signiferum CCC diebus, et expletis semper annis octonis ad unde cursus sui sumit exordium, reuertitur signum Librae [n.b. not Pisces], ita tamen ut in unaquaque annorum ogdoadis LX adiciat dies supra praedictum numerum' (8.7). '60' ('LX') is obviously a misreading of '40' ('XL'), or vice versa. On the cycle of 8 years for Venus, see n. 72 below. It should also be noted that the *Quicumque* gives a similar rule for Mars, which is said to return to the same sign every seven years (chap. 14.3), again in accordance with the description of the cycle of Mars provided in chapter 8: 'Mars denique moratur in unoquoque signo XLV diebus, permeat signiferum in DXL diebus, semper septenis annis peractis ad unde cursus sui sumit exordium, reuertitur signum Leonis' (8.4).

of the *Proportiones* states (chap. 42.23) that the planet should always be found close to the Sun, either in the preceding or in the following sign.[57]

Another feature of 'System B' is that it includes the computation of the longitude of the lunar nodes (i.e. the two intersections of the ecliptic with the lunar orbit, called the 'Head' and 'Tail of the Dragon'). The computation is given, together with a series of astronomical and astrological theories pertaining to the Dragon, in the same texts: *Liber Alchandrei*, 24; *Proportiones*, 42.1-5; and *Quicumque*, 9. Again, the procedure is identical and all three texts agree on the following parameters: the original sign of the Head of the Dragon is Leo, its zodiacal period is 18 years (and $1\frac{1}{2}$ year per sign), its motion is retrograde, and the Tail is always in the opposite sign (see Appendix II).

The author of the *Proportiones* was not satisfied with quoting only the text of 'System B'. Earlier in the treatise, he had devoted one chapter to the computation of the Head of the Dragon, Saturn, Jupiter, Mars and Venus for *annus mundi* 4795, explaining step by step—and successfully throughout—the mathematical procedure (chap. 32).[58] But this chapter provided him with an opportunity to raise doubts about the validity of the method.

[57] An attempt to compute the position of Mercury according to 'System B' appears in Vatican City, BAV, Vat. lat. 4084, a manuscript which has also preserved the *Liber Alchandrei* and the *Quicumque* (see n. 55, 92 and 94): 'Mercurius. Hisdem annis ab initio mundi sumptis, diuide per XXVIII et da unicuique singno (*sic*) XXVIII; cui XXVIII tribuendi defuerit, in eo morari Mercurium pronunciabis, sed a Virgine sumpto initio' (fol. 1r). This paragraph is part of a chapter giving a somewhat different version of 'System B', where the original signs correspond to the astrological exaltations of the planets (Saturn in Libra, Jupiter in Cancer, Mercury in Virgo, Mars in Capricorn, Venus in Pisces, the sign of the Head of the Dragon is omitted). The text is quite corrupt but '28 days' corresponds to the period of transit of Mercury in one sign, as indicated in the Alchandrean texts (*Liber Alchandrei*, 13; *Proportiones*, 1; *Quicumque*, 8). The same attempt to compute the position of Mercury is implied in a closely related manuscript: Vatican City, BAV, Reg. lat. 1324 (see n. 65 below).

[58] Here is the example for Saturn: 'Saturni autem cursum uel in quo signo uersetur ad praesens si forte ignoras, iterum ab initio mundi annos per XXX partire. Et primum de mille, centum sume, et ter sumptos XXX, supersunt X; de mille, tantum supersunt centum; de C, supersunt X; set, ad hunc modum, de IIII milibus, remanent XL; demptis XXX, supersunt X; de septingentis autem, remanent LXX; de septuaginta, X; de XCV, ter sumptis XXX, supersunt V. Residui quidem omnium numerorum simul iuncti, fiunt XXV. Hoc

For Mars, he says that the theory 'seems superstitious'; and for Venus, he points out the contradiction with its bounded elongation (which he estimates too generously at three or four signs) and invites the reader to observe the planet by night, as he himself claims to do.[59] In both cases, nonetheless, he describes the procedure in full.

This appears to be the only instance in which the validity of the method was called into question. A more serious problem was that the reader of the *Liber Alchandrei* is left with two incompatible systems of computation. The author himself said nothing as to which one was to be used, although he seems to have favoured 'System A' which occurs in chapter 10, while 'System B' is relegated in an incomplete form to the second part of the work. This preference was accepted by a scribe of northern France (possibly Fleury) who inserted an *exemplum* of the computation of Mars for the year 1040 or 1048 according to 'System A'.[60] But, apart from

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uero per signa distinguens a Libra sumpto initio, cuique duos et dimidium tribue, et ubi defuerit numerus, ibi se receptat Saturnus' (*Proportiones*, 32.7-10). I do not know what the *annus mundi* 4795 corresponds to; moreover there is a problem here, for in the first sentence of the chapter, the author speaks of the year 4715: 'Annos ab initio mundi si uis computando colligere, quatuor milia septingentos quindecim poteris proferre, et tantum per omnia supra memorata sidera planetas scias cucurrisse' (*ibid.*, 32.1).

[59] 'De Marte uero, quoniam uidetur ratio superstitiosa esse, duxi congruum, ne omnino praetermitterem, describere compendiose' (*Proportiones*, 32.15); 'Veneris autem incertior caeteris habetur statio, incertior et difficilior exigitur sui cursus ratio. Verbi gratia. Cum Solem IIII praeoccupat signis, uidetur solito more exequi cursum caeterarum suae anticipationis et sic multos fallit imperitos reciprocando uestigia sui cursus, quia non est fas sibi Solem aut praeterire aut subsequi plus IIII signis. Et ut haec certius scias, disce experimento ipsius rei, ut ego iam didici, et inuenies in tempesta noctis diligenter oculos pascendo me nil mentiri' (*ibid.*, 32.20-2). The warning about the elongation of Venus is repeated in chap. 42.22 (see text in Appendix II).

[60] The *exemplum* is inserted into chapter 10, immediately after the rule for Mars: 'Verbi gratia. Accipe annos ab initio mundi qui modo sunt IIII.DCCCCLXX (?). Iunge his annos domini, qui modo sunt M.XL<VIII?>, et fiunt VI.XVIII anni. Hos, ut praefatum est, per senarium diuide ita: sexies M sex milia reddunt, remanent XVIII anni; bis sex faciunt XII, supersunt VI anni. Et quia annos amplius per senarium diuidere non uales, menses exuberantium annorum qui modo sunt XII applica supradictis signis ita. Da VI menses Scorpioni, VI Sagittario, item VI Capricorno, VI Aquario, VI etiam Piscibus, VI quoque Arieti, nil minus VI Tauro, VI item Geminis, Cancro VI, Leoni VI, Virgini etiam VI et Librae VI. Ecce deest quid Scorpioni iterato tribuas. Unde scias necesse esse in eo commorari Martem per supradictam

that, later versions based on the Alchandreana bear witness to hesitations and disputes about the two systems. A good example is provided by the treatise *De planetarum et signorum ratione*, which was published among the works of Bede, first by Johannes Hervagius (Basel, 1563) and most recently by Jacques-Paul Migne in Volume 90 of his *Patrologia Latina* (cols 941-4). No manuscript is known of this work, but the surrounding texts in Hervagius's and Migne's editions suggest an early date, since they are all prior to the end of the tenth century.[61] Here we find together 'System B' (from *Proportiones*, 42) and 'System A' (from *Liber Alchandrei*, 10, with a different order of planets, starting with Saturn) under the titles *Inquisitiones aliquot planetarum* and *Item de alio modo* respectively. The text is immediately followed (cols 943-6) by a series of rearranged chapters from the *Alchandreana* dealing, *inter alia*, with two different versions of the *thema mundi*, as well as with the domiciles, exaltations and falls of the planets (taken from *Liber Alchandrei*, 6, 9 and 27), in other words, the basic data of the computation.[62] In the copy of the *Liber Alchandrei* preserved in London, BL, Cotton Appendix VI (s. xiii), fols 38va-39rb, chapter 10 (entitled *Modus unus inueniendi planetas*) has been displaced just before chapter 25 (entitled *Alia acceptio*). In a twelfth-century manuscript of computus and astronomy from Hereford (Cambridge, Trinity College, O.7.41), a contemporary or somewhat later scribe added on fol. 59r-v, originally blank, several notes from the *Liber Alchandrei*, among which there is a

rationem.' This passage is preserved in four manuscripts deriving from a lost copy (London, BL, Addit. 17808 and Cotton Appendix VI; Orléans 282; Vat. Pal. lat. 1416; see n. 55 above for the details). The date (1040 or 1048) cannot be definitely sorted out: the manuscripts agree on the date *annus domini* '1040' (except Cotton App. VI, which gives '1048') while the indicated chronology Creation-Incarnation varies between '4970' (Vat. Pal. lat. 1416), '4978' (Orléans 282) and '3970' (the two London manuscripts). Whatever the case, the calculation was made for *annus mundi* 6018 (although Vat. Pal. lat. 1416 gives '6010') and is correct throughout. This *exemplum* does not seem to be related to Abbo's computation of the position of Mars.

[61] All these texts are discussed in C. W. Jones, *Bedae Pseudepigrapha...* (as n. 37 above), pp. 85-90.

[62] The concordances of Pseudo-Bede's text with the *Alchandreana* were noted by A. Van de Vyver, 'Les plus anciennes traductions ...' (as n. 23 above), p. 669, n. 97, and are supplemented in D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), p. 287, n. 33. On the two versions of the *thema mundi* and related Alchandrean chapters, see *ibid.*, pp. 288-9.

summarized version of the twofold *thema mundi* and of the computation mixing 'System B' (for Jupiter) and 'System A' (for the other planets).[63] In Vatican City, BAV, Reg. lat. 1324, written in the fifteenth century but reflecting a very early textual stage of the *Alchandreana*,[64] chapter 14 of the *Quicumque* is followed by eight tables (fol. 45r-v) for the division of numbers corresponding to the periods of the planets, mixing those of 'System A' and 'System B'.[65] Two astrological compilations, preserved in thirteenth- to fourteenth-century manuscripts and based on the *Alchandreana* as well as on more sophisticated material deriving from twelfth-century translations from Arabic, include a chapter devoted to the computation of longitudes and providing for each planet the rules of both systems.[66] Finally, the most spectacular

[63] '<A>nnos ab initio si computes ad presentem in quo es et, reiectis quotiens poteris XXX, quod superest annorum redigas in menses, et incipiens a Capricorno unicuique signorum XXX menses attribuas, ubi distributio defecerit, ibi Saturnum esse estimato. Eosdem si per XII reicias, et quod supererit per menses ab Ariete inchoans cuique signorum distribuas XII, ubi deerit numerus, ibi stellam Iouis attende. Eosdem si per senarium reicias et a Scorpione cuique signorum ex reliquo VI menses assignes, ubi deerit numerus, ibi est Mars. Eosdem per XXIIII annos eicere, itemque reliquum per XXIIII menses singulis dare signis iubemur, uidere Venerem ubi hic deest. Eosdem per XII separa, et de reliquo menses iterum per XII diuidens, a Virgine incipe, et ubi deerit, Mercurium attende' (fol. 59v).

[64] D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), p. 282, n. 16.

[65] The tables are: (1) Venus = 25, (2) Mercury = 28, (3) Mars = 45, (4) Venus = 24, (5) Mars = 6, (6) Jupiter and Mercury = 12 (i.e. 'System B' for Jupiter and 'System A' for Mercury), (7) Dragon = 18, (8) Saturn = 30. For the second table (Mercury = 28), see n. 57 above.

[66] These compilations, totally different from each other, occur in Florence, Bibl. Medicea Laurenziana, Plut. 30.29 (s. xiii), fols 26ra-32ra (inc.: 'Omnis homo 12 participat signis...'), and Paris, BNF, lat. 7416B (s. xiii/xiv), fols 101ra-104va (fol. 100, which contained the beginning of the work, has been cut out). I give here below extracts about Saturn and Jupiter as they appear in the manuscripts: 'Item docendum est consequenter in quo signo queque planetarum reperiatur. Quod sic inuenies: Saturnum querens annos secundum Hebraicam ueritatem per 30a diuide, reliquos uero per 2 annos et medium diuidens signis distribue, sumptoque initio a Capricorno uel Libra singulis 30a dabis menses; cui autem desierint, in eo Saturnus erit. Iouem autem sic inuenies: perfectos mundi annos per 12 uel per 18 diuide et unicuique signo da 12 a Cancro incipe; et cui defuerit I, in illo erit. Aliter: prefatos mundi annos per 19 diuide, de reliquis 19 mensibus singulis signis tribue a Sagitario incipe, et Iouem inuenies...' (Florence, Bibl. Medicea Laurenziana, Plut. 30.29, fol. 29va-vb). 'In quo signo queque planeta fuerit certam regulam damus... Saturnus in quo signo moretur, annis ab initio mundi per 30 diuisis quo-

combination occurs in the *Opusculum de ratione spere ex summorum disciplinis philosophorum cum labore et diligentia excerptum*, a cosmological, geographical, astronomical and astrological compilation which probably dates from the eleventh century. In Book III, on planetary astronomy and astrology, we find chapter 14 of the *Quicumque* followed by the last two paragraphs of Abbo's *De ratione spere* ('Signa in quibus singuli planetarum... Martem esse modo credimus').[67]

5 *Origin of the method of the 'years of the world': related Greek, Syriac and Latin texts*

The final issue that I would like to address concerns the relationship between the two systems. Because 'System B' does not appear in Latin before the *Alchandreana*, I had suggested elsewhere that it was a revision of 'System A', reflecting an attempt to take into account more accurate astronomical data, i.e. the 'true' mean periods of the planets.[68] This is not, however, the case. The calculation of the planetary longitudes based on the periods of the planets from a given chronological starting point is not a medieval invention. The principle is already found in the Greek *Anthologiae* of Vettius Valens (second century A.D.),

ciens potuerint metiantur, cumque trangressi numerum qui constent menses cognoscatur, atque ex hiis primo Capricornus deinde cetera signa sortiantur 30, ubi consistunt Saturnum nonnulli similiter colligendum existimant; deinde ubi 30 defuerint, ibi Saturnum uersari. Aliter: annos predictos per 30 diuide sumpto a Libra initio et quicquid infra 30 remanserit per duos annos et dimidium partire, da unicuique signo totidem; cui autem defuerint, in illo Saturnus moratur. Hic planeta 30 annis cursum suum explet, morans in uno signo 30 menses. Iupiter in quo signo uersetur supradictos annos per 12 diuide et quod infra remanserit initio ab Ariete sumpto unicuique signo annum tribue; ubi annus defuerit, ibi Iupiter morari. Aliter: annis ab exordio mundi per 18 separatis, menses exuberantium annorum si denuo per eandem partem diuisi 18, primum Sagitario deinde ceteris totidem tribuantur, ubinam Iupiter domicilium habeat, indicabunt; siquidem cui signo 18 tribuendi defuerint, Iouem in eo morari dicunt. Iupiter 12 annis suum conficit iter, morando in unoquoque signo 12 menses...' (Paris, BNF, lat. 7416B, fol. 101ra-vb).

[67] Oxford, Bodleian Library, Digby 83 (s. xii), fol. 37r-v. On the compilation, see L. Thorndike, *A History of Magic and Experimental Science*, I, Baltimore, 1923, pp. 705-709, and A. Van de Vyver, 'Les plus anciennes traductions...' (as n. 23 above), pp. 689-91.

[68] D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), p. 289 and n. 40.

where the rules— also given for the Sun—are accompanied by examples which can be dated from A.D. 109 to 120.[69] Subsequently, the same method occurs in Byzantine manuscripts, in particular in a text where the positions have been computed for the year 906.[70] In this Greek tradition, the computation is based not on the years of the world but rather on the positions of the planets at the beginning of the era of Augustus (= 29 August 31 B.C.), with the exception of the position of the Sun which, in the Byzantine text, was calculated for *annus mundi* 6414.[71] The general procedure is otherwise the same and appears much closer to 'System B', especially in the use of the 'true' mean periods of the planets, in the more complex computation for Venus—which includes the initial division by 8[72] and the distribution of the final result along the zodiac at the rate of 25 days per sign—, as well as in the computation of Mercury, which aims only to determine its position with respect to that of the Sun, i.e. in the preceding or the following sign.[73]

It is clear, then, that 'System B' ultimately derives from the Greek tradition. This affiliation provides an explanation for the

[69] Vettius Valens, *Anthologiae*, I.18 (ed. D. Pingree, Leipzig, 1986, pp. 32-6) ; ed. with French translation and commentary J.-F. Bara, *Vettius Valens d'Antioche: Anthologies, Livre I*, Leiden etc., 1989, pp. 168-77. On this chapter, see O. Neugebauer, *A History of Ancient Mathematical Astronomy*, Berlin-New York, 1975, II, pp. 793-801. Following the first edition of the *Anthologiae* by W. Kroll (Leipzig, 1908), Neugebauer, Bara and Tihon (see n. 70 below) refer to this chapter as 'I.20'.

[70] This text has been edited, translated and studied in detail by A. Tihon, 'Le calcul de la longitude de Vénus d'après un texte anonyme du *Vat. gr.* 184', *Bulletin de l'Institut Historique Belge de Rome*, 39, 1968, pp. 603-24; and *ead.*, 'Le calcul de la longitude des planètes d'après un texte anonyme du *Vat. gr.* 184', *ibid.*, 52, 1982, pp. 51-82 (both are reprinted in *ead.*, *Etudes d'astronomie byzantine*, Aldershot, 1994, articles I and II).

[71] A. Tihon, 'Le calcul de la longitude des planètes...' (as n. 70 above), p. 11.

[72] This division is explained by the fact that Venus covers 5 synodic revolutions in 8 years. It should be noted that the procedure includes one substraction of 120 days which must be somehow related to the addition of 40 days found in 'System B'. All these refinements result from an attempt to account for the irregularities of the motion of Venus. See A. Tihon, 'Le calcul de la longitude de Vénus...' (as n. 70 above), pp. 62-9; O. Neugebauer, *A History* ... [as n. 69 above], pp. 796-800.

[73] O. Neugebauer, *A History...* (as n. 69 above), p. 800; A. Tihon, 'Le calcul de la longitude des planètes...' (as n. 70 above), pp. 22-3.

'odd' original signs: presumably, they corresponded to the 'true' positions of the planets at a given date.[74] The immediate source of 'System B' is not known with certainty, but it is likely that it came to the West through the same channel as the rest of the *Alchandreana*, i.e. through Arabic sources. Two independent elements might confirm this: the inclusion of the lunar nodes, and the fact that the relevant chapters of the *Proportiones* and the *Liber Alchandrei* are mingled with a set of meteorological prognostics based on the position of Saturn in the four triplicities (fire, earth, air, water).[75] The lunar nodes and the elemental triplicities—which both received considerable development in the *Alchandreana*—were rarely used in Greek astrology, whereas they are typical features of medieval Eastern, including Arabic, astrology.[76]

The presence of the method in the medieval East, beyond Greek sources, is moreover attested by an astrological collection in Syriac compiled in the twelfth century at the latest.[77] Here the computation is based on the 'years of Alexander' (= the Seleucid era of 311/312 B.C.)[78] and explicitly mixes elements from different sources.[79] It includes the lunar nodes and lists the planets in the order of the spheres (with an inversion of Mercury and Venus), i.e. two elements closer to 'System B'. On the other hand, the original signs correspond to the astrological domiciles of the planets,

[74] It is unlikely that the date might be inferred from the positions given in the *Alchandreana*, both because the three texts diverge on this point and because, as Neugebauer pointed out (*A History...* (as n. 69 above), p. 796), the positions given in Vettius Valens were already inaccurate.

[75] See *Liber Alchandrei*, 25.2, and *Proportiones*, 42.15, in Appendix II.

[76] See D. Juste, 'Les doctrines astrologiques...' (as n. 23 above), pp. 292-3 (on the elemental triplicities) and 300-301 (on the lunar nodes).

[77] The collection has been edited from a twelfth-century manuscript and translated by E. A. W. Budge, *The Syriac Book of Medicines. Syrian Anatomy, Pathology and Therapeutics in the Early Middle Ages*, 2 vols, London, 1913 (reprint St-Helier and Amsterdam, 1976), I, pp. 441-553 (edition) and II, pp. 520-655 (translation). Chapters 60 and 61 are devoted to the planetary longitudes (II, pp. 571-573).

[78] The Seleucidian era is usually called the 'Era of Alexander' in late Greek, Syriac and Arabic texts; see s. H. Taqizadeh, 'Various Eras and Calendars Used in the Countries of Islam', *Bulletin of the School of Oriental Studies (University of London)*, 10, 1939, pp. 107-32 (pp. 124-30).

[79] As is clear, e.g. from the sentence 'divide them by three, though some say divide them by twenty' (see the text n. 80 below).

as in 'System A', although, in this case, it is the nocturnal— not the diurnal—domiciles which are involved (Saturn in Aquarius, Jupiter in Pisces, Mars in Aries, Mercury in Gemini and Venus in Taurus—the Head of the Dragon is in Libra). Unfortunately, the text is in such a bad condition that it is not possible to infer the zodiacal periods with confidence.[80]

But the most detailed account of the method appears in another Latin text which I have not so far mentioned: the *Liber Nemrod*. This curious astronomical treatise, composed in the form of a dialogue between Nemrod and his disciple Ioanton, first occurs in a few manuscripts of the twelfth century, including Paris, BNF, lat. 14754, fols 202v-229v, on which what follows will be based. Five long chapters (fols 214v-217v) are devoted to the computation of the longitude of Mars, Mercury, Jupiter, Venus and Saturn, each of which contains four parts: a brief exposition of the procedure; a table showing the progression of the relevant planet throughout the zodiac according to its transit period in one sign and starting with its original sign; a lengthy discussion between Nemrod and Ioanton about various—not always relevant—subjects; and a second table giving the cycles of the planet for the whole history of the world, i.e. from Creation to *annus mundi* 7000. The original signs are not arranged in an entirely consistent way, but they seem to correspond to the diurnal domiciles of the planets: Mars in Scorpio, Mercury in Gemini (= nocturnal domicile!), Jupiter in Sagittarius, Venus in Sagittarius (instead of Libra), Saturn in Capricorn. The periods of the planets are given in two forms, the zodiacal periods and the periods of transit in one sign, as follows: Mars 72 years (6 years in one sign), Mercury 144 years (12 years), Jupiter 216 years (18 years), Venus 288 years (24 years), Saturn 360 years (30 years). The same periods appear in two

[80] Here is the example of Saturn in Budge's translation (as n. 77 above, II, p. 572): 'Kronos, that is Zûkhâl. Take the years of Alexander the Greek at the time when thou makest thy enquiry, however many they may be, and divide them by three, though some say divide them by twenty, and the number which remaineth divide into thirties. And of the number which remaineth and which doth not amount to thirty, allot to each House two and a half. And [begin] to count with the Water-Carrier, and, where thy number stoppeth, there is Kronos.' The first division by 3 or 20 is hard to explain; the second division by 30 is not significant here, since the same divisor is given for each planet. Nevertheless, the last step involving $2\frac{1}{2}$ (years) per sign is formulated in the same way as in 'System B'.

other chapters of the treatise (fols 218v and 223v-224r).

As is immediately obvious, the basic data and the enumeration of the planets in the order of the planetary week are closely related to those of 'System A'. The additional features as well as the variations in contents and the contrasts in formulation,[81] however, make it unlikely that the *Liber Nemrod* derives from the *IQSVM*. Unfortunately, little is known about the origin and date of the *Liber Nemrod*. The text has been said either to descend from Syriac sources or to be an original Latin composition, while it has been variously dated from the late eighth to the late eleventh century.[82] A thorough study of its astronomical content is still needed, but there is one feature in the text which may be of interest to us: the recurrent use of the kalends of October as the beginning of the year (e.g. fols 204r, 225r-226v, 227v-228r and 229v). This dating system, unknown in the West, was that of the Julian Calendar of Antioch, used alongside the Seleucid era.[83]

[81] Compare the example for Mars with the *IQSVM*: 'Mars planeta quomodo currit in signis et quantis annis ibidem stat. Si cupis scire in quo signo currit Mars, numera annos ab origine mundi usque dum uenias ad annum quem cupis et diuide eos totos per LXXII; et dum perueneris ubi non complentur LXXII, diuide ipsos per sex; et quantis uicibus habueris, ipsa sunt signa in quibus currit Mars; et ubi non complentur VI, ipsum signum est initia, et numera VI de Scorpione, et cetera' (*Liber Nemrod*; Paris, BNF, lat. 14754, fol. 214v).

[82] The *Liber Nemrod* was first studied by C. H. Haskins (*Studies in the History of Mediaeval Science*, Cambridge, Mass., 1927, pp. 336-45) who adduced evidence in favour of a Syrian origin and dated the text between 791 and 826. He was followed by A. Van de Vyver, 'Les plus anciennes traductions...' (as n. 23 above), pp. 684-7 (who, however, preferred to date the text to around the First Crusade), and by R. Lemay, 'Le Nemrod de l'"Enfer" de Dante et le "Liber Nemroth"', *Studi Danteschi*, 1963, pp. 57-128. More recently, S. J. Livesey and R. H. Rouse, in a meticulous analysis based on all the known manuscripts ('Nimrod the Astronomer', *Traditio*, 37, 1981, pp. 203-265), rejected previous conclusions and argued that the text was based solely on Western sources. This study was in turn criticized by R. Lemay, 'De la scholastique à l'histoire par le truchement de la philologie: itinéraire d'un médiéviste entre Europe et Islam', in *La diffusione delle scienze islamiche nel Medio Evo europeo*, Roma, 1987, pp. 399-533 (pp. 488-526). No conclusive evidence about the origin of the *Liber Nemrod* is as yet available.

[83] See V. Grumel, *La chronologie*, Paris, 1958, pp. 174 and 210 (= *Traités d'Etudes Byzantines*, I); E. J. Bickerman, *Chronology of the Ancient World*, London, 1980 (revised ed.), pp. 71-2. It should be emphasized that this feature was unknown to Haskins, Van de Vyver and Lemay (see n. 82 above). The use of the kalends of October was noticed by Livesey and Rouse, but

The passages in question are not connected to the computation of the longitudes, but what is striking is that 1 October is also given as the beginning of the year in a text which occurs together with the *IQSVM* in six of the nine manuscripts listed above, including the oldest one (*M*).[84] This cannot be an accident, and provides us with strong evidence that 'System A' originated from a place where this dating system was in use, that is, broadly speaking, Syria, the region furthermore which appears to be the homeland not only of the Syriac collection, but also of Vettius Valens, who was a Syrian from Antioch. It is difficult to state more precisely the date, place and interrelationship of all these texts, but it is sufficient for the aims of this paper to note that both 'System A' and 'System B', and therefore the method of the 'years of the world' itself, originated from ancient or early medieval East and came to the Latin West through two distinct routes.

6 *Conclusion*

The method of the 'years of the world' appears to have been the standard way of computing the planetary longitudes in the early Western Middle Ages. It circulated as early as the first half of the ninth century and gained new popularity from the late tenth century onwards through Abbo of Fleury and the *Alchandreana*. By the end of the eleventh century, it was available in at least seven distinct Latin texts: the *IQSVM*, Abbo's *De ratione spere*, three treatises of the *Alchandreana*, the anonymous *Opusculum de ratione spere* and the *Liber Nemrod*. The existence of this method, as well as its unexpected success, has a bearing on two issues which may be of some importance for the history of science.

In recent years, scholars have been puzzled to find astrological texts and practices in times and places where the fundamental tool for astrologers, namely astronomical tables, was missing. In Muslim Spain, for instance, court astrologers were active as early

they seem to have played down its significance. They indicate that it appears (only?) on fol. 225v ('Nimrod the Astronomer' (as n. 82 above), p. 207, n. 13) and, building upon the 'Western ties to East' in the Early Middle Ages, they argue that 'it is possible that this Eastern practice was known in the West and was deliberately employed in a text like the Liber Nemrod which purports to relay ancient Eastern astronomy' (*ibid.*, pp. 208-209).

[84] See n. 89 below.

as the late eighth century, while the first set of astronomical tables was imported there from Baghdad only in the mid-ninth century. Again, during the second quarter of the twelfth century, numerous astrological treatises were translated from Arabic into Latin before astronomical tables began to circulate in Western Europe. These examples have been pointed out by Julio Samsó, Charles Burnett and David Pingree,[85] but the same might also apply to other times and places. The method of the 'years of the world' provides a possible and plausible answer to these questions. Julio Samsó, referring to the *De planetarum et signorum ratione* published in the *Patrologia Latina*, suggested that Andalusian astrologers of the eighth and ninth centuries might have used this method.[86] The fact that 'System B' came to the West through Spain adds credibility to this hypothesis.

Returning to the time and place covered in this paper, we may wonder what the intended purpose of the method of the 'years of the world' was. If the aim is plain in the case of the *Alchandreana*, both the *IQSVM* and Abbo of Fleury remain silent on this score. It is hardly necessary to recall that knowledge of the planetary longitudes is irrelevant for the ecclesiastical computus. Mere curiosity might be an explanation but, if so, it is not easy to explain why Abbo went so far as to manipulate well-established astronomical concepts in order to strengthen the foundations of the *IQSVM*. A more appropriate context might be astrology. Although no one has conducted a systematic investigation of the subject, it is a common assumption that horoscopic astrology was unknown in the early Western Middle Ages. Various reasons have been put forward to support this assumption: for instance,

[85] J. Samsó, *Las ciencias de los Antiguos en al-Andalus*, Madrid, 1992, pp. 32-3: 'Esto nos ayuda a resolver un problema evidente: si, como veremos, la introducción de las primeras tablas astronómicas en al-Andalus tuvo lugar durante el emirato de 'Abd al-Rahman II (821-52), ¿ cómo podían calcular los astrólogos del año 800 las longitudes planetarias que eran imprescindibles para levantar un horóscopo ?'; C. Burnett and D. Pingree, *The* Liber Aristotilis *of Hugo of Santalla*, London, 1997, p. 1: 'It is well known that among the earliest scientific texts translated from Arabic into Latin in the first half of the twelfth century were treatises on astrology; indeed, so eager were Westerners for such intriguing material that they read their Abū Ma'shar and their Māshā'allāh almost before they had any certain means of determining where the planets might actually be.'

[86] J. Samsó, *Las ciencias de los Antiguos...*, p. 35.

the condemnations of the Church, the scarcity of documentation or the general decay of learning from the sixth to the twelfth century. But the most recent view, which seems to prevail today, is that the text books potentially available, such as the *Astronomica* of Manilius and the *Mathesis* of Firmicus Maternus among others, were useless because of the lack of any means for determining the planetary longitudes and therefore for constructing a horoscope.[87] The method of the 'years of the world' runs counter to this view and consequently opens the way for a reconsideration of the subject. In this perspective, it is perhaps no coincidence that the oldest extant manuscript of the *Mathesis* of Firmicus Maternus was copied around the end of the tenth or the beginning of the eleventh century at Fleury,[88] which means that Abbo could have had access to it or to its model. Now it is fair to say that the knowledge of the planetary longitudes does not fully solve the problem, for the construction of a horoscope requires a second and equally important element: the knowledge of the rising sign, or the astrological ascendant, from which the twelve mundane houses are drawn. But if we look at the above-mentioned text using 1 October and occuring in six manuscripts of the *IQSVM*, we find that it provides indeed a handy method for computing

[87] E.g.: 'Some historians maintain that astrology was then eradicated by the Western Church continually renewing the condemnations by St Basil, St Augustine, and St Gregory. But if, after what might better be called a lengthy hibernation, astrology was reborn suddenly and with such profusion in the twelfth century, it was not because the attitude of the ecclesiastical authorities had changed. What had changed was that, thanks to the Arabs, Latins had learned to use astronomical tables and to calculate the longitude of the planets for any time whatever, past, present, or future—the precondition of an astrology which truly believed in itself' (G. Beaujouan, 'The Transformation of the Quadrivium', in *Renaissance and Renewal in the Twelfth Century*, eds R. L. Benson and G. Constable, Oxford, 1982, p. 480). See also idem, 'En quoi les recherches récentes sur l'astrologie et l'alchimie peuvent-elles améliorer notre compréhension de la philosophie médiévale ?', in *Sprache und Erkenntniss im Mittelalter. Akten des VI. Internationalen Kongressen fur Mittelalterliche Philosophie...* (Bonn, 29 August-3 Sept. 1977), ed. A. Zimmermann, Berlin and New York, 1981, p. 318; S. J. Tester, *A History of Western Astrology*, Woodbridge, 1987, p. 113; S. McCluskey, *Astronomies and Cultures...* (as n. 1 above), p. 148.

[88] Paris, BNF, lat. 7311, fols 4r-49r. See J. Vezin, 'Leofnoth: un scribe anglais à Saint-Benoît-sur-Loire', *Codices Manuscripti*, 3, 1977, pp. 109-120 (pp. 113 and 118).

the rising sign for any time, past, present or future.[89] Considered together, these two texts (the *IQSVM* and the '1 October' text) offer a short—yet complete—treatise devoted to the construction of a horoscope.

[89] The text opens 'Hortum signorum XII qualibet diei uel noctis hora quisque liquido deprehensurus est, si a kal. Octobris horas dierum...' It occurs in *M*, p. 29; *P*, fols 134v-135r; P_1, fol. 141r-v; V_1, fol. 51v; *S*, fols 117v-118r; V_3, fol. 70v. In MV_1V_3, it immediately precedes the text on eclipses (n. 41 above), while in PP_1S it is separated from the *IQSVM* by chapters dealing with planetary astronomy. The text is also preserved in a number of other manuscripts and appears in *Patrologia Latina*, 90, cols 213D-215A. I am preparing a new edition of it.

Appendix I: In quo signo versetur Mars (IQSVM)
= 'System A' [90]

1. <Mars> In[91] quo signo uersetur Mars: annis ab initio mundi per senarium diuisis et annorum hunc numerum excedentium mensibus item per senarium separatis atque unicuique signo VI assignatis a Scorpio dumtaxat sumpto initio traditur manifestari; namque in eo signo Martem inueniendum cui VI tribuendi defuerint.

2. <Iuppiter>[92] ab exordio mundi annis per XVIII partem separatis, menses exuberantium annorum si denuo per eandem partem diuisi XVIII, primum Sagittario deinde signis caeteris tot tribuantur (ubinam Iuppiter domicilium habeat ut quorundam fert opinio) indicabunt; siquidem cui signo XVIII non occurrerint, Iouem in eo morari.

3. <Saturnus> Eorundem[93] annorum summam si XXX quotiens potuerint metiantur, cumque transgressi quot constent mensibus cognoscatur, atque ex his primo Capricornus caetera deinde signa sortiantur XXX, ubi consistat Saturnus nonnulli similiter colligendum existimant; denique ubi XXX defuerint, ibi Saturnum uersari.

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[90] The text is based on all nine manuscripts (see above for the sigla). I have imposed consistency in the use of *ae* (rather than *e* or *e* with a cedilla) and *ti-* (rather than *ci-*) before vowels. In these two cases, variant readings have been ignored. All other variants are noted in the apparatus. For the variants of *Liber Alchandrei*, 10, see n. 55 above.

[91] *Tit.*: De signo. Mars P_1S; In quo duodecim signorum Mars habeatur VV_1P_2 || diuisis] diuisus P_1S || excedentium] extendentium P_1S || item *om.* V_2 || (unicuique) signo *om.* PP_1S || VI] sex V_2 || assignatis] signatis P || Scorpio] Scorpione P_2 || initio *sus.* M || manifestari] est V_2 || VI] sex V_1V_2

[92] *Tit.*: In quo feratur Iuppiter VV_1P_2 || Eisdem... annis] Annis ab exordio mundi V_2 || Eisdem] Ex isdem VP_2 || mundi *om.* P_2 || annis *om.* P || (per) XVIII] Xam VIIIam V; XVIIIIam V_2; XVam IIIam V_3 || (diuisi) XVIII] XVIIII V_1 || Sagittario] Sagittarium P_1S; Sag. P || tot] totidem $VV_1V_2P_2$ || Iuppiter] Iupiter V_3 || quorundam] quorum undam M || indicabunt] indicabit P_1S || occurrerint] occurerint P

[93] *Tit.*: In quo Saturnus consistat VV_1P_2 || Annos ab exordio mundi sumam V_2 || quot] quod MV_3 || Capricornus] Capricornius VP_2 || consistat] consistit (?) P_2; constat S || Nonnulli] Nonnullis V || existimant] existiman S

4. <Venus> Eosdem[94] annos praeterea XXIIII parte separare iubemur et hinc summae congruentium annorum menses consideratos applicare signis, exordio sumpto a Libra, ita ut unumquodque XXIIII semper accipiat; etenim sic expensus numerus Veneris patefaciet stationem.

5. <Mercurius> Quin[95] etiam praefati saepe anni duodenario separati, annorumque superfluentium cogniti menses ac XII Virgini et ordine reliquis tot attributi, ubi se receptet Mercurius indicabunt; namque cuicumque signo defuerint assignando XII, in eo uersari Mercurium curiosi rerum talium opinantur. Sin autem prima partitio duodenario concludatur, in Virgine memoratum semper inueniri planetam.

Appendix II: Alchandrean versions = 'System B' [96]

Liber Alchandrei, 24.1-5 and 25[97]

24. 1 <Caput Draconis> Ut scias autem in quo signo quaeque planetarum, Caput Caudaue Draconis omni tempore uersetur, haec regula a tuo animo non labatur. 2 Annos ab initio mundi

[94] *Tit.*: In quo moretur Venus VV_1P_2 || Eosdem annos praeterea] Annos ab exordio mundi V_2 || XXIIII parte] XXam IIIIam partem V_2; XXa IIIIa parte V_1 || hinc] hic P_1S; huic VV_1V_2 || congruentium] non congruentium $VV_1V_2P_2$ || XXIIII] uiginti et IIIIor V_2 || sic] sit P_2 || patefaciet] parte faciet MV_3

[95] *Tit.*: In quo meet (et P_2) Mercurius VV_1P_2 || Quin etiam praefati saepe anni] Annis ab initio mundi V_2 || separati] separato M || ac] hac MV_3 || ordine] ordini P_1S || tot] totidem $VV_1V_2P_2$ || attributi] adtributi P_1S || indicabunt] indicabit P_1S || signo defuerint cuicumque V_2 || signo *om.* P_1S || assignando XII] asignando XII P_1S; assignandi XII VV_1P_2; *om. (and add. later hand)* V_2 || uersari] uersarii (?) P_1; uersarum (*or:* uersari in) V_1 || prima *om.* P_1S || partitio] partito P_1S || concludatur] concludantur P_1S || Virgine memoratum] Virginem memoratam P_2; Virginem memoratum V || inueniri planetam] inueri planeta V; Virgo *add.* MPV_3; Virgo latitudinem signiferi scandes *add.* P_1S

[96] All the texts are taken from my forthcoming edition (see n. 53 above).

[97] Manuscripts: Paris, BNF, lat. 17868, s. x, fol. 9r-v; Munich, Bayerische Staatsbibliothek, Clm 560, s. xi, fol. 72r-v (chap. 25 only); London, BL, Addit. 17808, s. xi, fols 94v-95v; Paris, BNF, lat. 14065, s. xi- xii, fol. 52r (chap. 25 only); Kremsmünster, Stiftsbibl., CC30, *ca.* 1200, fols 62r-64v; London, BL, Cott. App. VI, s. xiii, fol. 38rb-va and 39ra-39rb ; Vatican City, BAV, Vat. lat. 4084, s. xiv, fol. 11r (chap. 24 only); Florence, Bibl. Riccardiana, 917, s. xiv, fols 32r-33r; London, BL, Sloane 702, s. xv, fol. 26v (chap. 24 only). There is also a slightly different recension in London, Wellcome Institute, 21, s. xii, fol. 1ra.

per XVIII diuide quandiu possis; initio a Leone sumpto, quod autem infra XVIII remanserit, per annum et dimidium tantum concedens singulis distribuis; cui autem annus et dimidius non contigerit, in illo Caput Draconis tunc commorari indubitanter pronuntiabis. 3 Memento tamen post Leonem non Virginem set Cancrum, post Geminos et sic per uniuersum ordinem esse computandum, quia Draco, solus inter caeteras stellas quae per se feruntur, sequi cursum firmamenti perhibetur. 4 Perficit autem cursum suum XVIII annis, unumquodque signum anno et dimidio. 5 Caput uero in quo signo moretur reperto, Ventrem eius, qui ut Caput prospera protendit, semper scias esse in quarto, Caudam eius uenenosam in septimo. <...>.

25. 1 <Saturnus> Saturnus in quo signo moretur si nosse desideras, item annis ab initio mundi diuisis per XXX, a Libra sumpto initio quicquid infra XXX remanserit per duos annos et dimidium diuide; cui uero duo et dimidius tribuendi defuerint, in illo signo uersari indubitanter pronuntiabis. 2 Et hoc notandum est summopere quanta omnibus rebus Saturnus dominetur potestate: illo namque inter XII signa spatiante, quando astra ignea intrauerit, siccitate omnia constringit; si in terrea, grandine uniuersa percutit; si in aerea, uenti asperitate disperdit; cum autem in aquatica, aquarum inundatione cuncta laborant. 3 <Iuppiter> Iouem uero reperies si, eisdem annis per XII diuisis, hoc quod remanet initio sumpto ab Ariete unicuique signo annum unum tribues, quia ubi unus tribuendus deerit, ibi se receptat Iouis. 4 Notandum hic quod si quando contingit has duas, Saturnum scilicet et Iouem, Solem aut IIII signis praecurrere aut IIII retrogradare, quia calorem solitum Solis spatiorum longinquitate nequeunt mutuare, his qui tunc nascuntur, et Iouem antea semper mitem aliquantulum aduersari, et Saturnum semper aduersum magis tum minitari. 5 <Mars> Isdem item annis per annum et dimidium diuisis, quod remanserit initio a Scorpione sumpto per signa tribue; ubi uero XLV dies deerint tribuendi, ibi Martem habebis. 6 <Venus> Venerem uero, si eosdem annos in dies deductos per CCC diuisos, unicuique signo initio a Capricorno sumpto XXV tribuis de eo quod remanet.

Proportiones competentes in astrorum industria, 42[98]

In quo signo moretur quaeque planetarum. 1 <Caput Draconis> Si uis scire in quo signo omni tempore uersetur quaeque planetarum, siue in Capite siue in Cauda Draconis (sic), haec regula a tuo non labatur animo. 2 Annos ab initio mundi quandiu possis per XVIII diuide; sumpto initio a Leone, si quis uero numerus in eadem computatione superfuerit, non ualens peruenire usque ad supradictae diuisionis limitem, id est XVIII, da unicuique signo annum et dimidium; cui autem hoc non contigerit, in illo signo Caput Draconis morari indubitanter scias. 3 Memento tamen post Leonem, Virginem, set non Cancrum, post Virginem, Libram, non Geminos, et ita per uniuersum ordinem esse computandum, quia Draco, solus inter caeteras stellas quae per se feruntur, sequi firmamenti cursum perhibetur. 4 Perficit autem cursum suum XVIII annis, nec est dubium quoniam in unoquoque signo moretur annum et dimidium, id est XVIII mensibus. 5 Capite autem Draconis in quo moretur signo reperto, Ventrem eius, qui ut Caput prospera protendit, semper esse in quarto, Caudam uero in septimo quae semper uenenosa atque nociua dicitur. <...>.

14 <Saturnus> Saturnus in quo signo moretur si nosse desideras, item annos ab initio mundi per XXX diuide, sumpto a Libra initio, et quicquid infra XXX remanserit per duos annos et dimidium partire, dato unicuique signo totidem; cui autem signo defuerint anni duo et dimidius, in illo uere Saturnus moratur. 15 Et hoc est notandum quanta potestate praecellit omnes res: illo namque inter XII signa spatiante, quando ignea astra intrat, omnia comburit siccitate; quando autem terrea, saepe uastat grandine multa; cum uero aerea, uento et multa tempestate dispertit; cum in aquaticis manet, aquarum inundatione cuncta laborant. 16 Saturnus autem, usque expallet insidias Martis, et Mars cum omnibus expallet Saturnum. 17 <Iuppiter> Iuppiter indubitanter in quo signo moretur si uis scire, supradictos annos per XII diuide, et quod infra remanserit initio suo ab Ariete sumpto unicuique

[98] Manuscripts: London, BL, Sloane 2030, s. xii-xiii, fol. 93r; Kremsmünster, Stiftsbibl., CC30, *ca.* 1200, fols 33r-36v; Oxford, Bodleian Library, Ashmole 369, s. xiii, fol. 82r; Munich, Bayerische Staatsbibl., Clm 458, s. xv, fols 19v-21r; Paris, BNF, lat. 7349, s. xv, fols 85r-86r. A different recension appears in Oxford, Bodleian Library, Ashmole 345, s. xiv, fols 54v-55r.

signo unum annum tribue; cum autem defuerit annus, ibi se receptat Iuppiter. 18 Notandumque est quod cum euenit Saturnum et Iouem IIII signis Solem praecurrere non retrogradare, quia solitum calorem Solis longinquitate spatiorum nequeunt mutuare, et tunc Iuppiter qui antea erat mitis aliquantulum aduersabitur illis qui interim nascuntur, Saturnus uero multum minitabitur. 19 <Mars> Si autem in quo signo sit Mars diligenter inquiris, saepe fatos annos per annum et dimidium diuide, a Capricorno sumpto initio, et quod superfuerit per signa partire; et cui XLV deerunt, ibi Martem habeas. 20 <Venus> Ut uero satisfaciam lectori in difficilioribus quia et satisfeci in uilioribus. 21 Si quis curat scire quo in signo splendida rotetur Venus, supputationem longissimam et multo errore inuolutam, set nunc sollerti indagatione adbreuiatam, sic colligat: annos ab initio mundi per VIII computans semper eiciat donec ad VIII peruenire nequeat, et quicquid infra remanserit per trecentos diuidat, et ubi hic numerus defuerit XL addat, et cuilibet signo XXV distribuat et a Libra incipiat; et cui hic numerus defuerit, ibi Venerem receptare cognoscat. 22 Ad haec, sciat Venerem Soli semper esse uicinam, siquidem in longiorem nunquam recedat ab eo regionem, ut uel praecedat uel, retrograda, subsequatur plus IIII uel tribus signis. 23 <Mercurius> De Mercurio autem, quia nec difficilis habetur quaestio, non duxi necessarium ut longa subsequeretur descriptio quia sic uicinus semper uidetur et habetur Soli, ut numquam uel praecedat uel subsequatur tantum quin aut in praecedenti signo aut in subsequenti aut certe in eodem facillime possit inueniri.

Quicumque nosse desiderat legem astrorum..., 9.1-4 and 14[99]

9. <Caput Draconis> 1 Post planetarum autem praedictam rationem, Draconis inserere placet cursus, conuersos immo retrorsum aduersos per singula. 2 Nam cum planetae omnes per directum suos cursus peragant, prout supra tractatum est, ut ab Ariete in Taurum, a Tauro in Geminos, Draco semper abire dic-

[99] Manuscripts: Paris, BNF, lat. 17868, s. x, fols 14v (chap. 9) and 15r (chap. 14, in a summarized form); Burgo de Osma, Archivo de la Catedral, 7, s. xi/xii, fols 102v and 104r; Paris, BNF, lat. 7299A, s. xi/xii, fol. 95v (chap. 9.2-5 only); Vatican City, BAV, Vat. lat. 4084, s. xiv, fols 2v and 9v; Vatican City, BAV, Reg. lat. 1324, s. xv, fols 43v-44r and 45r. The first two paragraphs of chapter 14 (on the luminaries) are perhaps a later addition, for they appear only in the two Vatican manuscripts

itur retrorsum, incipiens a Leone, decurrit in Cancrum, indeque egrediens, ingreditur Geminos, a quibus transiens, intrat in Taurum, indeque Arietem, a quo egressus, ingreditur Piscium signum, sicque per caetera. 3 Moratur in unoquoque signo XVIII mensibus, uidelicet anno integro et dimidio, lustrat autem omnia signa annis XVIII, est autem longitudo illius spatio signorum VII. 4 Si autem uis scire ubi est Caput Draconis, computa annos ab exordio mundi iuxta Hebraicam supputationem et diuide eos omnes per XVIII, et quod superfuerit, quod non ad XVIII poterit peruenire, tolle ex praedictis quae superfuerant, quae non ad perfectionem XVIII annorum peruenire potuerunt et diuide per menses, dans unicuique signo XVIII menses, et ubi defecerit eadem supputatio XVIII mensium, ibi erit Caput Draconis. <...>.

14. [1 <Sol> Set et hoc sciri oportet quia quinto decimo kalendarum Aprilis intrat Sol in Ariete, in quinto decimo kalendarum Mai intrat Sol in Tauro, in quinto decimo kalendarum Iunii intrat Sol in Geminis, in quinto decimo kalendarum Iulii intrat Sol in Cancro, in quinto decimo kalendarum Augusti intrat Sol in Leone, in quinto decimo kalendarum Septembris intrat Sol in Virgine, in quinto decimo kalendarum Octobris intrat Sol in Libra, in quinto decimo kalendarum Nouembris intrat Sol in Scorpione, in quinto decimo kalendarum Decembris intrat Sol in Sagittario, in quinto decimo kalendarum Ianuarii intrat Sol in Capricorno, in quinto decimo kalendarum Februarii intrat Sol in Aquario, in quinto decimo kal. Martii intrat Sol in Piscibus. 2 <Luna> Si uis scire in quo sit Luna prima, procul dubio scias quia in secundo signo a Sole, ita si Sol fuerit in Ariete, Luna prima erit in Tauro.] 3 <Mars> Si uis scire in quo signo degat Mars, computa annos a mundi principio et ipsos diuide per VII; et quod non peruenerit ad septenarium, computa quot dies ibi sint, et diuide illos per XLV dies, da primitus Leoni XLV, Virgini similiter XLV, et ita per ordinem; et in quo signo defecerint XLV, in eodem signo erit Mars. 4 <Iuppiter> Si uis scire in quo signo sit Iuppiter, computa eosdem annos a mundi creatione et diuide eos per XII; et ubi defuerit duodenus numerus, in eodem signo erit Iuppiter, item da Arieti integrum annum, et Tauro similiter, et ita per ordinem. 5 <Venus> Si uis scire in quo signo sit Venus, iunge eisdem annis LX et diuide eos per octonarium numerum; et quod non peruenerit ad supplementum octonarii, partire illos per dies

CCC; quod minus CCC fuerit, diuide item eos per XXV, et da unicuique signo XXV a Piscibus sumpto initio, sicque per singulos dies; et in quo signo XXV defecerint, in eodem Venus degit. 6 <Saturnus> Si uis scire in quo signo sit Saturnus, diuide eosdem annos per XXX; et quod non peruenerit ad tricenum numerum annorum; partire illos per annos et dimidium; et in quo duobus annis et dimidio anno, in eodem signo erit Saturnus, et da duos annos et dimidium Librae, similiter caeteris.