

## The Toulouse Tables: A List of Manuscripts.

Fritz S. Pedersen

A set of astronomical tables, including tables for planetary mean motions and syzygies computed for the meridian of Toulouse and for Christian years, were widely used and commented on during the late 13th and early 14th centuries. They have recently been edited by Emmanuel Poulle,<sup>1</sup> with a definitive technical analysis that shows their dependence on the Toledan tables. Poulle also lists the earlier treatments of the Toulouse tables and of their use in the 13th and 14th centuries. Considering the undoubted popularity of these tables, copies have been surprisingly difficult to find (as illustrated, e.g., by Birkenmajer's<sup>2</sup> engaging tale of his quest for manuscripts).

The present pages are intended to list the known copies, and to supply some extra references. These are mainly accidental findings from an inventory of the manuscripts of the Toledan tables, by the present writer. Three items are found with the *Tractatus de Semissis*, as inventarized by the late Olaf Pedersen and by myself.<sup>3</sup> The list is likely to be incomplete. It may, however, serve as a basis for a few closer guesses at the structure and extent of the tables, and furnish some instructive examples of their interaction with the Toledan tables. Some brief notes on these points will be found in the sequel.

A standard set of Toulouse tables, as suggested by Poulle (p. 57-58), comprises the three sets listed below. Poulle shows that all of them depend on the Toledan tables for their mean motion parameters and other specific features. All of them, too, have collected-year tables whose argument steps by 24 years; in the copies, the argument may begin with *radix* (to be called "AD 0" in the descriptions below) or later, and it may end variously. I list the standard set, mentioning two more features that may serve to distinguish our tables from the Toledan ones.

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1: E. Poulle, "Un témoin de l'astronomie latine du XIII<sup>e</sup> siècle, les tables de Toulouse", *Comprendre et maîtriser la nature au Moyen Âge, Mélanges d'histoire des sciences offerts à Guy Beaujouan*, Genève: Droz, 1994, p. 55-81.

2: A. Birkenmajer, "Pierre de Limoges commentateur de Richard de Fournival", *Studia Copernicana* 1 (1970) 222-249 (reprint from *Isis* 40 (1949) 18-31), especially pp. 224 and 229-32.

3: Cf. F.S. Pedersen, *Opera Petri de S. Audomaro* (= *Corpus philosophorum Latinorum medii Aevi* X,2, Copenhagen: Gad 1984), p. 654. Most of the manuscripts of the *Semissa* have been listed earlier by Olaf Pedersen, "Petrus Philomena de Dacia", *Cahiers de l'Institut du Moyen-Âge grec et latin* 19 (1976) 37-41.

CC\*:<sup>4</sup> mean motion tables for the Sun, for lunar motus and argument, for the node, and for the five planets. Each of these sets has sub-tables for collected years and for lower denominations down to minutes. The minute-tables generally show values corresponding to arguments 2, 4, ..., 60. However, the values for Mars and Mercury are for arguments 1, 2, ..., 30 almost everywhere.<sup>5</sup> Minute-tables that show this feature are noted as "normal" in the list below. The Toledan counterparts to these tables (CA\* = T28-T36) show various patterns of minute-tables, but not this one.

GB11-14: tables for mean conjunctions and oppositions of the Sun and Moon. With sub-tables for collected years (conjunctions and oppositions separately), expanded years, and months. The form is much the same as for the Toledan syzygy tables (GA11-14 = T52-T55).

PA21: a mean motion table for use with the trepidation tables ascribed to Thebit (cf. T81). Includes sub-tables for collected years, expanded years, months and days. Tables that show this set are noted as "normal" in the list below. The corresponding Toledan table (PA11 = T81,i) has sub-tables for collected years and expanded years only (Pouille p. 62).

CC\* and GB11-14 account for most of the tables that are expressly said to be for Toulouse. A further set of tables, located to Toulouse in mss. Du and A, is

QA11-12: tables of the sun's entrance into the cardinal points. These, too, rest on the Toledan solar mean motion, and on a radix derivable from CC\*, cf. below, and the collected-year values are also incremented by 24.

The rest of the tables that have been found to mention Toulouse (in mss. Ch Vp, at the end of the list), are transmitted differently from those above. They are left out of account, as are any items for Toulouse in tables of geographical coordinates.

#### *Full-scale collections; interaction with Toledan tables.*

In a number of cases, Toulouse tables occur alone, or else in contact with other small collections of tables for mean motions or equations. None of these conglomerates appears typical. The question of how the Toulouse tables enter into full-length collections (such as the Toledan-table types described by Toomer) appears more interesting.

In four witnesses (Lu Oj P Lw), standard sets of CC\* tables are embedded in such full sets of tables. In each case, there are traces enough to show that Toledan tables are in fact the substratum, and that their proper mean motion tables (CA\*) have been supplanted by CC\*. The other Toulouse mean motion

4: For future reference, I use the symbols to be employed in my forthcoming edition of the Toledan tables. If a table has been listed by G.J.Toomer ("A survey of the Toledan Tables", *Osiris* 15 (1968) 5-174) I also quote Toomer's number (e.g., number 81 as "T81").

5: In some copies, the argument is shown as "2...60" for Mars and Mercury too. This error is ignored where it occurs.

tables (GA\* and PA21) may also be present, more or less in the places expected for their Toledan counterparts.

In Lu, the CC\* tables occupy the places belonging to the Toledan mean motion tables. Like these, they alternate with the common tables of equations (EA\* =T37,39-41). Each CC\* table occupies two pages, normal for a Toledan table. To fit into this space, the CC\* collected-year tables are abridged to the range AD 600-1320; the remainders (which cover AD 0-600, 1320-1488) are placed near the end of the collection. Toledan mean motion tables are absent, but the Toledan BD11 (=T18, oblique ascensions) and HA11 (=T61, parallax) are present, in their expected places.

P is somewhat disordered. The CC\* tables are where expected, though not merged with equation tables; these, and the Toledan mean motion tables CA\* (plus BD11, HA11, cf. above, and PA11) are relegated to various places near the end of the collection. The minute-tables of the CA\* tables are similar to those of CC\*, but unlike these, the table for Mercury shows values corresponding to arguments 2, 4, ..., 60, so not even P is a probable source for the Toulouse minute-tables.

Oj mainly contains CC\* tables, alternating with EA\* tables, plus eclipse tables; there are no Toledan mean motion tables, but the Toledan HA11 is present, as is PA11.

In Lw, the Toledan mean motion tables stay intact and in place. Their minute tables are for arguments 2, 4, ..., 60 for the Sun and Moon; the rest are for 1, 2, ..., 30 though some of the entrances may show "2...60". The Toulouse tables CC\* have been prefixed to these, as a coherent block, complete with their own lower-denomination tables, which are the "normal" ones described above.

The substrate collections of Lu Oj P are of the vulgate Toledan type, whereas Lw joins another class.<sup>6</sup> If these two branches of the tradition have a common ancestor, then at least this is unlikely to be a Latin one; so the Toulouse tables, being Latin, cannot belong to both branches. Indeed, to judge from the variety of configurations described above, they may well have been interpolated into each witness individually.

Thus, all the known full-scale collections that may be thought to deserve the name "Toulouse tables" are in fact Toledan tables with the special tables CC\*, etc., grafted into them in diverse ways. None of the resulting configurations is known to have been copied. In this sense, then, there is no tradition of full-scale collections that can be called "Toulouse tables".

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6: Toomer (*op. cit.* pp. 12-13, 31 bottom, 32, 68 bottom, 110) noted the peculiarities of one manuscript of this class (Ou = Bodl. Savile 22, 13v-81r, "Sa" in Toomer). The others are Lw, as mentioned, and: Eh = Erfurt WAb CA Q 364, 32r-123v; Eg = Erfurt WAb CA Q 363, 1r-32r; Co = Cambridge U.L. Kk.I.1, 144v-172v; Cn = Cambridge U.L. Mm.III.11, 81r-106r. None except Lw contains Toulouse tables. On another occasion I will try to show that this type of collection is correlated with the canons Ca "Scito quod annus lunaris", and that, on a whole, both have been translated from the Arabic independently of the vulgate and of the two other canons.

*Extent of restricted collection.*

Conversely, a restricted set of tables for Toulouse, plus perhaps some others, are likely to have been transmitted as a unity. It may not have contained more than CC\*, GB11-14, and PA21;<sup>7</sup> if there were any extra items, they are probably among those to be mentioned below.

In any case the CC\* tables appear to have travelled complete with their lower-denomination tables. It is true that these are basically the same as the Toledan ones,<sup>8</sup> but as was said, there is no known source for the very configuration they show, and where both sets occur (in Lw and P, above) they do not seem to have interacted.

*The tables QA11-12.*

Tables QA11-12 often occur when Toulouse tables are present, and I have not seen them elsewhere. As was said above, they have the same apparent characteristics as the mean motion tables. Sample, from ms. Lu:

**QA11:** "Tabula ad inveniendum diem et horam introitus solis in imaginem arietis, cancri, librae et capricorni".

(Aries)						(Cancer)					
AD	mon	d	h	m	s	AD	mon	d	h	m	s
600	0	18	7	54	26	600	3	20	0	56	0
624	0	18	11	40	0	624	3	20	4	41	34
1200	0	22	5	53	50	1200	3	23	22	55	24
1224	0	22	9	39	24	1224	3	24	2	40	58
1296	0	22	20	56	8	1296	3	24	13	57	42

**QA12:** "Tabula ad inveniendum ascendens ad horam introitus solis in imaginem arietis, librae, cancri et capricorni".

AD	°	'	"	'''	AD	°	'	"	'''
600	208	34	0	0	600	194	0	0	0
624	264	57	38	24	624	250	23	38	24
1200	178	25	0	0	1200	163	51	0	0
1224	234	48	38	24	1224	220	14	38	24
1296	43	59	33	36	1296	29	25	33	36

Both tables have sub-tables for Libra and Capricorn too, and for expanded years from 1 to 24, not shown here. A gloss in the expanded-year table of QA11, ms. Lu, says that the tabular difference for 24 years is 0 months 0 days 3;45,34,33,36 hours.

QA12 shows values for excess revolution that are compatible with the Toledan tables. The time values of QA11 (meant to be those for which the sun enters the cardinal points according to true motion) seem to be consistent with

7: It can, of course, be doubted whether even these tables have been made all at once; but since this question does not seem decidable from the material, I refrain from discussing it.

8: Poule p. 63.

the Toulouse mean motion tables plus the normal tables of equations.<sup>9</sup> Thus no doubt QA11-12 have been made from the Toulouse tables, and it is tempting to assume that they are original or at least an early accretion.

*Other tables and values that are possibly relevant.*

For a guess at what other tables may have followed the transmission of the Toulouse tables (at least part of the way) I have tried to look at those which are both in the branch (Lw) and in the branch (Lu Oj P) or at least in some of the latter, and are rare in other witnesses for the Toledan tables.<sup>10</sup> Indeed, if the two branches are independent within the tradition and do not show any obvious interaction, then any table they share should be in the whole tradition; if it is not, then it is from an extraneous source, thus possibly from a collection of Toulouse tables. The items selected in this way are:

DA02: Apogees of Sun and Venus: 2s17°;50,10. In Lu Oj P Lw, and in one or two witnesses for the Toledan tables. The rest of the apogees are as in the Toledan tables.

DD\*: "Medius cursus Geuzaar", equal to 360° minus the longitude of the node, for each of the five planets. In Lu Oj Lw, and in one Toledan collection (Ep). The corresponding node values (DC\*2) are as in Alkhwarizmi, ch. 19, Suter p. 15, and both nodes and "medius motus Geuzaar" are in the canons Cb166.<sup>11</sup>

JF11: Albatenian "rose" for azimuth of ascendent (Albattani, Nallino II p. 92). In Lu P Lw, and in the Toledan witness Fj2; two further ones (Ey Fc) may show different traditions.

PB11f: Equation table for the eighth sphere. The values are the same as in Thebit or in the tables T81:(iii)+(ii); but the tables are joined together and provided with a common quadruple entrance (5,355,175,185) ... (90,270,90,270). In Lu Oj P Lw, and (repeated?) in the Toledan section of P (134v).

QA11-12: entrance of sun into cardinal points, see above. In Lu Oj Lw, and in the Toledan witness Vz.

RA42: astrological, "Termini Chaldeorum et Ptolomei". In Lu P Lw. From the Tetrabiblos, and found, e.g., in Albumasar, Introductorius. The consensus of Lu P Lw differs, however, rather much from the likely sources. Sample, some of the odd readings underscored:

Ari °	Iup 6	Ven 8	Mer 7	Mar 5	Sat 4
Tau	Ven 8	Mer 7	Iup 7	Sat 2	Mar 6
Psc	Ven 8	Iup 6	Mer 6	Mar 5	Sat 5

RE11: astrological, "Quot in signo planeta dignitates habeat". In Lu P Lw, and in Cn (secondary). Sample:

Signa Sat Iup Mar Sol Ven Mer Lun

9: In QA12, the excess revolution for 1 year is 92;20,59,6° exactly, corresponding to 6;9,23,56,24 hours, and thus to a sidereal year of 365 days plus 6;9,23,56,24 hours, or 365;15,23,29,51 days. During this interval, the sun will travel 360° given a mean motus of 0;59,8,11,28,22... °/d. This compares well with the parameter of 0;59,8,11,28,27 °/d found by Toomer (p.44) from the Toledan solar mean motion table. In QA11, the values for AD 600 are fairly well reproducible using the Toulouse mean motion table for the sun plus the normal tables of equations; for reasons of space it must be left to the reader to check this. The values for Aries in QA11 are 10 seconds off consistency with QA12; otherwise the two tables are compatible.

10: For this purpose I ignore other witnesses for the Toulouse tables, except that I have registered QA11-12 in the manuscript list in order to make their relevance plausible.

11: F.S. Pedersen, "Canones Azarchelis ...", *Cahiers de l'Institut du Moyen-Âge*... 54 (1987) 179.

Ari	5	5	8	8	3	2	0
Tau	3	2	5	0	10	4	8
Psc	3	8	6	0	9	2	3

Likely candidates for inclusion are the DA\* and DD\* values; in fact they cohere physically with the CC\* tables, which could explain their transmission.<sup>12</sup> PB11f is meant to be served by PA21, and is not seen to cohere with any others like it. QA11-12 have been discussed above. The rest are more or less astrological. Of these, at least the copies of RA42 and RE11 have a lot of peculiarities in common, suggesting that they belong to some special tradition. One might like to speculate whether such a tradition could be identified, and if so, whether this would also throw light on the transmission of the Toulouse tables.

### *List of manuscripts.*

Symbols for tables, see above. "Canons Ca/Cb" refer to the canons "Scito quod annus lunaris" and "Quoniam cuiusque actionis", respectively.

References to modern writers are kept to a minimum. I try to cite the earliest references to the Toulouse tables where they are quoted as such. For tables found in manuscripts of Toledan tables, I quote the manuscript reference in Toomer's list, *op. cit.* p. 160 ff., or else in T(horndike) & K(ibre)'s catalogue of incipits from 1963. For other literature, the reader is referred to Poulle's edition.

Cw : Bernkastel/Kues, Cusanusstift, 214. Vellum, 25 1/2 x 18 1/2, ff.50, 14th c. Poulle 1994, 66-67. — 10r-18v, early 14th c., *mean motion* tables, CC\*: "Medius motus solis in annis Christi solaribus ad <\*> civitatis THOLOSE" (Sun: AD 1008(24)1464. Minute-tables, normal.). — Context: 1ra-9rb, Peter of S. Omer, *Semissa* ch. 1-3.

Da : Darmstadt, Hessische Landes- und Hochschulb., 765. Vellum, folio, ff.218, 12th-14th c. Zinner<sup>13</sup> p. 772; Harper<sup>14</sup> p. 65 n. 10. — 146v-154v [Da4], late 13th c., *mean motion* tables, CC91: "Medius cursus solis ad annos domini nostri Ihesu Christi ad medium diem civitatis THOLOSE secundum distantiam solis a puncto vernali<s> equinoctii" (Sun: AD 600(24)1544. Minute-tables, 2(2)60 for Sun, Moon, Saturn and Jupiter). The tables for Mars, Venus, Mercury and the node are gone. The values of the lunar argument are the normal ones. The other tables rest on mean velocity parameters that are greater than usual by a precession of 51"/year, thus making the values into tropical coordinates, cf. the heading quoted. — Context: Alternating with planetary equation tables (EA\*; T37,39-41), and interspersed with other matter, thus (146v, 149r) *notes* on verifying the tables and on making almanacs, (151v-152r) canons Cb, 141a-159. The collection forms an isolated part of the manuscript.

Du : Dublin, Trinity Coll., D.4.30 (444). Vellum, ff.92, 13th c. Harper, *loc. cit.* ("fols. 34r-42r"). — 24r, late 13th c.: QA11-12, "Tabula ad inveniendum diem et horam introitus solis in arietem, cancrum, libram atque capricornum, ad longitudinem civitatis TOLOSE, que est 40 gradus et minuta 30 ab occidente", collected years AD 1200(24)1320. 25r-29v: *mean motion* tables CC\*, and PA21 rounded to seconds, all in parallel: "Tabule mediorum cursuum et portionum VII <\*> et capitis super annos

12: The node values DC\*2 may be included here, since they are present where DD\* are. They are not in the list, since they also occur in many witnesses for the Toledan tables. These, however, all belong to the late parts of the tradition; so possibly they have received these values from the Toulouse collections. A number of other such cases are ignored here.

13: E. Zinner, "Die Tafeln von Toledo (Tabulae Toletanae)", *Osiris* 1 (1936) 747-774.

14: R. I. Harper, "Prophatius Judaeus and the Medieval Astronomical Tables", *Isis* 62 (1971).

domini Ihesu Christi collectos ad medium diem civitatis PARISIUS (*sic*, in fact Toulouse) cuius longitudo est ab occidente gradus 40'a minuta 30'a" (AD 600(24)1296. All the minute-tables have a common entrance of 2(2)60, but the values for Mars and Mercury are in fact for 1(1)30.) 30r-31r, *mean syzygy* tables, GB11-14: "Tabula coniunctionis solis et lune per medium cursum ad annos domini Ihesu ad medium diem civitatis TOLOSE". 30r, *note* on using *syzygy* table. — Context: 4r-23v, canons Cb; 24v, tables BC21, BC11 (=T16,T15); 31r-32v, miscellany including the sine table BA12 (=T13) and some "Tabule Arzarkel Hispani qui dictus est Albategni...", chronological, not unlike AC11a+b (T07+06). 33r-80v, Novara tables.

Ek : Erfurt, Wissenschaftliche Allgemeinb., CA Q 369. Vellum, 4'o, ff.242, ca. AD 1325. Zinner, *loc. cit.*; Poulle 1994, 64-65. — 31v-40r [Ek1]: *mean motion* tables CC\*: "Medius cursus solis ad annos Christi ad meridiem THOLOSE, cuius latitudo est 42 graduum et 45 minutorum, et distat ab ARIM 50 gradus in occidente" (Sun: AD 0(24)1416. Tables for hours and minutes in common, with sexagesimals down to 4ths, all for arguments 1(1)30: much as in a set of Novara tables on ff. 219v-228v). — Context: 16ra-28rb, canons Cb; 28rb-30va, Ricardus Anglicus, "Minutiarum vulgarium". 41r-118v, Toledan tables.

127r-128v: *mean syzygy* tables, GB11-14: "Tabula coniunctionis solis et lunae in annis Christi ad meridiem TOLOSE", AD 720(24)1416. — Context: miscellany of texts and tables between 118v (end of Toledan collection, cf. above) and 144r, ending in (142v-144r) QA11-12: "Quomodo invenitur hora introitus solis in initia 4 signorum cardinalium secundum distantiam a medio mundi 50 grad(0)", for AD 600(24)1296.

A : Firenze, B. Medicea Laurenziana, Ashb. 211 ("137 (211-143)" Cat.). Vellum, 22 x 16, ff.306, 13th and 14th c. Toomer, *op. cit.* 168 no. 102. — 189r-193r [A1], late 13th c.: *mean motion* tables CC\*: "Medius cursus solis ad annos Christi ad medium diem civitatis TOLOSE, que distat ab Arim 50 gradibus versus occidentem" (Sun: AD 1224(24)1416. No tables for days, hours or minutes). 193v-194r: *mean syzygy* tables GB11-14: "Tabula coniunctionis solis et lune per medium cursum ad annos Christi ad meridiem civitatis TOLOSE", AD 1200(24)1416. With a *note* (193v). 194v: QA11: "Tabula ad inveniendum diem et horam <\*> in imaginem arietis cancri libre et capricorni ad meridiem TOLOSE", AD 1200(24)1320. — Perhaps an isolated part of the manuscript, including some more notes and tables in various hands. A Toledan collection ("A", in an older hand) is on f. 196+.

T : Firenze, B. Nazionale Centrale, II.III.24 (Magl. XI,117). Vellum, 33 x 22 1/2, ff.303, 14th c. F. S. Pedersen, *op. cit.* p. 655. — 228ra-232va, early 14th c.: *mean motion* tables CC\*: "Medius motus solis in annis Christi solaribus" (Sun: AD 1008(24)1464. Minute-tables, normal). — Context: 225ra-228ra, Peter of St. Omer, Semissa, cf. ms. Cw.

\$FN : Firenze, B. Nazionale Centrale, c.s. J.IV.20 (San Marco 182). Paper, 29 x 22, ff.229, 15th c. Bjørnbo 1912<sup>15</sup> p. 111-114. — 188r-207r, 15th c.: *mean motion* tables CC\*: "Tabula med(0) cursus solis ad annos solares a<d> medium die<m> civitatis THOLOSE" (Sun: AD 1272(24)1440. Minute-tables, normal). — Context: The mean motion tables alternate with equation tables of the usual type (EA\* = T37,39-41), but the equation tables for the moon and planets are abridged so as only to contain the equations of centre, the lunar latitude, and the planetary stations. On the stretch 186r-211r there are some 10 extra tables of various types, mainly common ones.

Lu : Laon, B. Municipale, 425. Vellum, 4'o, 13th c. Reference from librarian, 1988. — 3r-93v, first half of 13th c.: Full collection of tables like the usual Toledan ones, including: 31v-60r, *mean motion* tables CC\*: "Medius cursus solis ad annos Christi solares ad medium diem civitatis TOLOSE" (Sun: AD 600(24)1320. Minute-tables, normal). These tables alternate with the corresponding equation tables (EA\* = T37,39-41), as is normally the case for Toledan mean motion tables, which are absent. 86v-87v, *remainders* of collected-year tables CC\* (cf. 31v-60r): "Medius cursus solis et lune et argumentum lune ad annos domini nostri Ihesu Christi solares ad medium diem civitatis TOLOSE", and

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15: A. A. Bjørnbo, "Die mathematischen S. Marcohandschriften in Florenz", *Bibliotheca Mathematica* 3. Folge 12 (1912) 193-224.

corresponding tables for the node and the planets, all for AD 0(24)600 and AD 1320(24)1488. 66r-67v, *mean syzygy* tables GB11-14: "Tabula coniunctionis solis et lune per medium cursum ad annos domini nostri Ihesu Christi solares ad medium diem civitatis TOLOSE" (AD 600(24)1320 (+1344, secondarily)). 88r-v, *remainders* of GB11-12: "Tabula ... TOLOSE (:as before. Added, perhaps by the same hand:) qui locus distat ab Arin in occidentem 49 gradibus et 45 minutis" (AD 0(24)600 and AD 1320(24)1488). 84r-v, eighth sphere, PA21: "Motus portionis accessionis et recessionis 8<sup>e</sup> spere ad annos domini nostri Ihesu Christi solares" (AD 0(24)1656; normal sub-tables). 92r-93v: QA11-12: "Anni domini collecti; Ad arietem", no main heading (AD 600(24)1296 (-1368, secondarily)).

Lw : Leiden, B. der Rijksuniversiteit, Scal. 64. Vellum, 15 x 9, ff.132, 13th-14th c., same hand throughout. Toomer, *op. cit.* 168 no. 99. — 1r-132v: full collection of Toledan tables, including: 41r-54r, *mean motion* tables CC\*: "Medius motus [[lune]] (!) in annis domini nostri Ihesu Christi ad meridiem TOLOSE, que distat ab Arim in occidentem 50 gradibus et a Toletu 11 gradibus" (Sun: AD 0(24)1416. Minute-tables, normal). The usual Toledan mean motion tables (CA\* = T28-36) follow, on f. 55r-68r, then the equation tables (EA\* = T37,39-41), on 68v ff. 91r-96v, *mean syzygy* tables GB11-14: "Tabula coniunctionis solis et lune per medium cursum ad annos dei (!) ad meridiem TOLOSE" (AD 0(24)1416). The usual Toledan mean syzygy tables (GA\* = T52-55) follow, on ff. 97r-100v. 130r-v, eighth sphere, PA21: "Portio accessionis et recessionis octave spere ad annos domini nostri Ihesu Christi" (AD 0(24)1512; normal sub-tables). Followed, on 131rb, by the analogous Toledan table (T81,i = PA11) and by one perhaps attributable to William of Marseille.<sup>16</sup> 132r-v, QA11-12: "Tabula ad inveniendum diem et horam introitus solis in imaginem arietis cancri libre et capricorni" (AD 600(24)1296); in both cases, only the tables for Aries, Cancer and Capricorn are present.

\$OB : Oxford, Bodl.L., Bodl. 464. Vellum, 28 x 19 1/2 C, ff.209, ca. AD 1318, Canterbury. Birkenmajer, *l.c.* p. 231 with n. 51. — 75v-80r: Birkenmajer quotes the incipit "Medius cursus Solis ad annos Christi ad meridiem civitatis THOLOSE (fol. 75v)" and the explicit "Tabula de equacionibus dierum in circulo directo (fol. 80r)". I have not seen this part of the manuscript. — Context: 71v-75r, Peter of Dacia's calendar plus astrological diagrams; 80v+, Petrus Peregrinus, *De magnete* (acc. to Summary Cat., no. 2458).

Oj : Oxford, Bodl.L., Bodl. 613. Vellum, 12 1/2 x 8 1/2 L, ff.X+165, English; the relevant section is ff. 88-163, 13th c. Toomer, *op. cit.* p. 166 no. 77. — 104r-163r: collection of tables much like a standard Toledan one, though lacking chronological and trigonometrical tables. Including: 104r-132v, *mean motion* tables CC\*: "Medius motus solis ad annos domini nostri Ihesu Christi solares ad medium diem civitatis TOLOSE cuius latitudo est 42 gra et 45 minutorum. et distat ab Arim in occidentem 50 <-->" (Sun: AD 0(24)1416. Minute-tables, normal). Written alternately with the corresponding equation tables (EA\* = T37,39-41). The usual Toledan mean motion tables (CA\* = T28-36) are absent. 137v-140r, *mean syzygy* tables GB11-14: "<\*, supplemented in a late hand> Crisi ad medium diem civitatis TOLOSE" (AD 0(24)1416). The usual mean syzygy tables (GA\* = T52-55) are absent. 145r-v, eighth sphere, PA21 "Portio accessionis et recessionis 8<sup>e</sup> spere ad annos domini nostri Ihesu Christi" (AD 0(24)1512; normal sub-tables). The usual table (PA11 = T81,i) is present too, on 149v. 156r-157v, QA11-12: "Tabula ad inveniendum diem et horam introitus solis in imaginem arietis et cancri et libre atque capricorni secundum distantiam quinquaginta graduum versus occidentem a medio mundi", AD 600(24)1296. — Context: Canons Ca, on 88r-103v.

Oq : Oxford, Bodl.L., Digby 114. Vellum, 23 x 16, ff.229, 14th c. T&K col. 1614. — 25r-29v [Oq2], 14th c., English: *mean motion* tables CC\*: "Medius cursus solis in annis collectis ad meridiem TOLOSE" (Sun: AD 24, 48, 1272(24)1440, 0). Intermingled with Toledan tables (CA\* = T28-36) and with tables for London attributable to Robert of Chester<sup>17</sup>. The minute-tables are common to all these sets of

16: The latter (for AD 1160(20)1260) has a counterpart in Edinburgh Obs., Cr.2.5, 96v; it accompanies a set of mean motion tables ascribed to William of England (92r).

17: Mercier 1987, 108-09 and note 61. The present tables are for the sun and for the lunar motus and argument only.



tables, and may have been fetched from one of the non-Toulouse sets; their entrances run "2(2)60", but the values for Saturn, Jupiter, Mercury and the node are really for 1(1)30. — Context: miscellaneous tables in the same hand until 32v, some for Oxford.

**\$BL** : Oxford, Bodl.L., Laud.misc. 594. Vellum, c.32 x c.21, ff.160, 14th and 15th c. Thorndike, *Speculum* 14 (1939) 102, acc. to Birkenmajer, *loc. cit.*, 231 n. 51. Harper, *loc. cit.*; Poulle 1994, 65-66. — 154rc-155r, 14th c.: *mean motion* tables CC\*: (154rc-v:) Sun and Moon: "Medius motus solis in annis Christi solaribus(?) ad meridiem(?) Thol(ose)" (Sun: AD 1008(24)1464). (155r:) node, and rudiments of Saturn, Jupiter, Mars, and Venus. 157v-158r: more tables CC\*: (157v:) Mercury; (158r:) full sets for Saturn, Jupiter, Mars, Venus. — The minute-tables are normal, but all entrances show "2(2)60" or are blank. — Context: 154ra-b, Peter of St. Omer, *Semissa*, ch. 2 ff. (selection), ch. 8,4; 8,7-16. 155v-157v and 158v+: miscellaneous, including velocity table JA54, latitude table T47, and astrological notes and extracts.

**P** : Paris, B. Nationale, lat. 16658. Vellum, 18 x 12 1/2 L, ff.140. From the Sorbonne (Peter of Limoges, 1v). Birkenmajer, *loc. cit.* p. 232 and n. 56 ff.; Poulle 1994, 63-64. — 40r-137r, second half of 13th c.: collection of tables much like a normal Toledan one, given that ff. 118-125 belong between ff. 109 and 110, and that ff. 64-69 are secondary. The usual places for mean motion tables are occupied by Toulouse tables as listed below. Tables that are ostensibly for Toledo are gathered at the end of the collection (ff. 115-17, 126-137). The collection includes: 70r-78v, *mean motion* tables CC\*: "Medius cursus solis ad annos Christi solares ad medium diem civitatis TOLOSE, latitudo eius 42 graduum et 45 minutorum, et distat ab Arin in occidente 50 gra <<et a Toieto in oriente 11 gra et 3<-> minutis>>" (Sun: AD 0(24)1416. Minute-tables, normal (entrance of Mars table, "2(2)60")). 79r-81v, *mean syzygy* tables GB11-14: "Tabula coniunctionis solis et lune per medium cursum ad annos domini nostri Ihesu Christi ad medium diem civitatis TOLOSE", AD 0(24)1416. 82v-83r, eighth sphere, PA21: "Tabula de motu portionis accessionis et recessionis 8'e spere ad annos domini nostri Ihesu Christi" (AD 0(24)1512; normal sub-tables). — Context of collection: 2r-31v, canons Ca; 31v-39v, horoscope diagrams, and a Southern French calendar.

**G** : Princeton, N.J., Princeton University L., Garrett 99. Vellum, 28 x 19 1/2, ff.236, 13th-14th c. Toomer, *op. cit.* p. 170 no. 127. — 83v-92r [G2]: *mean motion* tables CC\*: "Medius motus solis in annis Christi solaribus ad medium diem civitatis THOLOSE" (Sun: AD 1152(24)1464. Minute-tables, normal). 92v, *syzygy* table GB11: "Tabula coniunctionis solis et lune in annis Christi solaribus ad meridiem civitatis THOLOSE" (AD 1008(24)1320; part of the values are blank). No other syzygy tables present. — Context: Appended to canons Cb (1r-8r) and Toledan tables (8v-83r). Followed (93r-94v) by a "Tabula ad habendum medium argumentum Martis in diebus horis et minutis hore", and corresponding tables for lunar elongation, Saturn and Jupiter (CH14, DG21), not found elsewhere.

**UI** : Ulm, Stadtarchiv, H Schad 65 (earlier Stadtb., Sch 13887). Modern foliation 247-267, 14th c. Zinner, *loc. cit.* ("Stadtb. 13883", but Zinner's "Verzeichnis" of 1925 has "13887"). — 258r-266v, *mean motion* tables CC\*: "Medius cursus solis ad annos Christi ad meridiem THOLOSE, cuius latitudo est 42 graduum et 45 minutorum, et distat ab Arim 50 gradus in occidente" (Sun: AD 0(24)1416. Tables for hours and minutes in common, with sexagesimals down to 4ths, all for arguments 1(1)30). 267r-v, eighth sphere, PA21: "Medius motus octave spere ad annos Christi ad medium diem THOLOSE" (AD 0(24)1416; normal sub-tables). 267v, *note* on using "tabulas THOLOSANAS ad coniunctionem vel preventionem..."; the syzygy tables are not in my film. — Context: 247r-257v, tables of mean motions and syzygies for Novara, plus some other common tables, mainly for eclipses.

*Notes only.* Accidental findings. Notes are also found in the witnesses listed above.

**Eb** : Erfurt, Wissenschaftliche Allgemeinb., CA Q 352. Vellum and paper, 4'o, ff.157, 13th and 14th c. Toomer, *op. cit.* 163 no. 37. — 72r-92r, first half of 14th c.: canons Cb, including: 82v and on an inserted slip, *notes* in secondary hands on finding syzygies "...per tabulas factas ad annos Christi super meridiem civitatis TOLOSE...".

**Ef** : Erfurt, Wissenschaftliche Allgemeinb., CA Q 355. Vellum, 4'o, ff.130, late 13th and 14th c. Toomer, *op. cit.* 163 no. 38. — 35v-37v, mid 14th c., miscellaneous notes including: 35v, on finding syzygies "...per tabulas THOLOSANAS...". — Context: notes on finding hour of conception; extract from Albumasar; horoscopes, one dated 1351; etc.

**H** : Oxford, Bodl.L., Digby 20. Vellum, ff.227. The relevant section is ff.1-61, 17 x 10 1/2, 13th c. Toomer, *op. cit.*, p. 166 no. 80. — 33v, short note on finding syzygy "...per tabulam que est ad annos domini ad meridiem TOLOSE..." (CbA.G31). — Context: miscellaneous non-standard rules appended to canons Cb, which are on ff. 4r-22r.

**Xn** : Paris, B. Nationale, lat. 7411. Vellum, 17 1/2 x 13. The relevant part is the first one, ff.21, late 13th c. Reference from notes by E. Pouille. — 19r, longish note on finding syzygy "...per tabulas factas ad annos Christi super medium diem civitatis THOLOSE...". Much the same text, though with extensions, is in Eb.82v and Ef.35v. — Context: miscellaneous rules appended to canons Cb, which are on ff. 1r-18r. The second part of the manuscript, about as old as that mentioned, contains Novara tables.

**Xp** : Paris, B. Nationale, n.a.l. 693. Vellum, 18 1/2 x 13, ff.204, 14th c. — 23r-60v, an almanach, canon "(T&K 82:) Aliqui astrologiam calumniantur". 29r, note "Nota quod secundum Profatium Iudeum Saturnus plus motus est secundum motum medium quam ponunt tabule THOLOSANE per 1 gra et 15 m'a..." (etc. The corrections are really by William of St. Cloud. For the numbers cf. also Peter of St. Omer's *Semissa*, ch. (2,21)). Another note in same hand, mentioning AD 1316. Secondary note: "Istud almenak componitur secundum tabulas THOLOSAN(AS)", no doubt occasioned by the preceding note.

*Tables that mention Toulouse but are ignored.*

**Ch** : Cambridge, U.L., Hh.VI.8 (1684). Vellum, 4'o, ff.213, 13th and 14th c. Birkenmajer, *loc. cit.* p. 231 n. 51; Mercier<sup>18</sup>, 103-4. — 13v-20r, early 13th c., mean motion tables CE15: "Medius cursus planetarum secundum SEVASORTHA ad medium <\*> civitatis TOLOSE" (Sun: AD 1109(20)1369). On 7r there is one "T. ad medium civitatis TOLOSE ad sciendam nativitatem lune". These tables are different from the rest of those considered here. — Context: collections by Abraham b. Hiyya (Savasorda), for which see Mercier *loc. cit.* They contain much matter that is otherwise peculiar to the Toledan tables, thus, on 15v, the set of planetary apogees DB11, listed by Toomer, *op. cit.* p. 45.

**Mp** : Montpellier BIU Section Médecine, H 323, 276v-295r. A rubric on 276v, "Super canones Thole(n)nos secundum Cremon(ensem)" is quoted by T&K col. 308 as "super canones Tholesanos..." and indexed as if for the Toulouse tables. In fact the piece is a collection of glosses on canons Cb for the Toledan tables; Christian tables are cited once (285ra, on Cb139), but the Toulouse tables are not mentioned explicitly.

**Vp** : Vatican City, B. Apostolica Vaticana, Pal.lat. 1414. Vellum, 20 1/2 x 15, ff.225, late 13th c. Toomer, *op. cit.* — 86r-140r: Toledan tables, including: 96r-97v, BE30: "Tabule ascensionum signorum et temporum horarum inequalium et quantatum horarum equalium in civitate TOLOSE, cuius latitudo est 42 graduum et 45 minutorum, et distat ab Arim 50 gra et a Toletto 11 gra et 30 m()". 98r-100v, BH30: "Equatio domorum ad signum arietis ad latitudinem TOLOSE". I have not seen either of these tables elsewhere. The values seem to fit with a latitude of about 42°45'.

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18: R. P. Mercier, "Astronomical Tables in the Twelfth Century", *Adelard of Bath*, ed. Ch. Burnett, London: Warburg Institute 1987, 87-116.