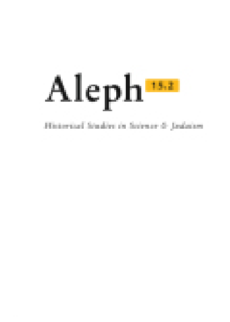
The Astrological and Calendar Section of the Earliest Maḥzor Vitry Manuscript (MS ex-Sassoon 535)

Sacha Stern, Justine Isserles



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Abstract

The earliest known *Maḥzor Vitry* manuscript, MS ex-Sassoon 535, includes a section with astrological and calendar texts that are the oldest found in any extant manuscript from Franco-Germany. An edition of the text of this section, whose main part constitutes an almost complete treatise on the Jewish calendar, is offered, along with an annotated translation. The introduction includes a description of the manuscript, a summary of the contents, and some general comments on the arithmetic content of the calendar treatise and on its talmudic and other rabbinic citations. The text of the treatise is full of errors, some of which indicate that it was a copy of a copy of the original. On the basis of the calendrical data and palaeographical and codicological criteria, the earliest date for the composition of the calendar treatise can be established as 1123/4, and the latest date for the present manuscript as 1154/5. This shows that the treatise was copied repeatedly in a relatively short period. Clearly distinct from the contemporary calendar treatises by Jacob b. Samson (1123/4) and Samuel b. Meir (Rashbam, 1129/30), it provides further evidence of the developing interest in Jewish calendar computation in northern France in the early twelfth century, especially within the school of Rashi.

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The Astrological and Calendar Section of the Earliest *Maḥzor Vitry* Manuscript (MS ex-Sassoon 535)

The astrological and calendar texts that appear for the first time in this article belong to the earliest known manuscript of a *maḥzor* (liturgical compendium) from Franco-Germany, which is also the earliest known manuscript of the *Maḥzor Vitry*. The manuscript, ex-Sassoon 535 (Paris, private collection), can be dated to the second quarter of the twelfth century and is of northern French provenance. The astrological and calendar texts within it are probably the earliest in any extant manuscript from Franco-Germany. These texts, which are presented in this article, shed important light on the early diffusion of astrological and calendrical knowledge in Hebrew, together with related disciplines (e.g., mathematics and astronomy), in twelfth-century France, and also contain some new materials unparalleled in other sources.[1]

1 The manuscript is currently owned by a private collector who wishes to remain anonymous; it is therefore referred to by the catalogue entry of its previous owner, David Solomon Sassoon (D. S. Sassoon, *Ohel David: Descriptive Catalogue of Hebrew and Samaritan Manuscripts in the Sassoon Library* [London: Oxford University Press, 1932], vol. 2, pp. 305–313). The manuscript was acquired by its present owner in 1975 and remains inaccessible to the public. The owner has kindly

The French liturgical-halakhic compendium known as *Maḥzor Vitry,* attributed to Simḥa ben Samuel of Vitry (d. before 1105) of the school of Rashi, has been preserved in ten other manuscripts besides MS ex-Sassoon 535.[2] These manuscripts date from the thirteenth and fourteenth centuries and originate from France as well as Ashkenaz; they are actually compendia that vary considerably in length and in contents, incorporating a variety of liturgical as well as halakhic materials, which are sometimes separate halakhic treatises independent from the halakhic core of *Maḥzor Vitry*.

Calendar sections or treatises are a common feature of the *Maḥzor Vitry* manuscripts, as they are of other medieval Hebrew liturgical manuscripts. They describe and explain the workings of the Jewish calendar, with lists of dates of the main festivals, *moladot* (new moons), and *tequfot* (equinoxes and solstices), all of which were of critical relevance to the annual liturgy and other aspects of daily Jewish life.[3] Astrological sections, as in MS ex-Sassoon 535, are rare in the later *Maḥzor Vitry* manuscripts, although they are well attested in other liturgical compendia.[4] Again, calendar and astrological sections vary considerably from one manuscript to the next, and to a large extent may be regarded, in each case, as distinct literary compositions.

Our purpose in this introduction is not to present a detailed study of the astrological and calendar texts in MS ex-Sassoon 535, but only to provide some basic information about the manuscript and texts and point in possible directions of future research.

The Manuscript: MS ex-Sassoon 535

Other than its twelfth-century northern French provenance, little is known of the history of manuscript ex-Sassoon 535. Pages 197 to 201 contain twenty-one owners' notes with their respective genealogies: the earliest mentions Cracow and the date 1542; the latest Tutchin (Ukraine)

allowed us, however, to access a microfilm reproduction of the manuscript held by the British Library (Or. Mic. 2792) and to publish a section of it; and he has also supplied us with two images, which are published with this article. We are grateful to the owner, as well as to Ms Ilana Tahan, Lead Curator of Hebrew and Christian Orient Studies at the British Library, for her assistance. This article was researched and written with the financial support of a Leverhulme Trust project at University College London (UCL) on "Medieval Christian and Jewish Calendar Texts from England and Franco-Germany" (Justine Isserles) and of an ERC Advanced Grant project at UCL on "Calendars in Antiquity and the Middle Ages: Standardization and Fixation" (Sacha Stern). We are grateful for the useful comments and suggestions of the anonymous *Aleph* readers and the copyeditor.

2 See Justine Isserles, *Maḥzor Vitry: Étude d'un corpus de manuscrits hébreux ashkénazes de type liturgico-légal du XIIe au XIVe siècles* (2 vols, doctoral dissertation, EPHE Paris and University of Geneva, 2012). The ten other manuscripts are: Parma, Biblioteca Palatina, MS 2574 (De Rossi 159), late twelfth–early thirteenth c.; Moscow, Russian State Library, Guenzburg Collection, MS 481, late twelfth–early thirteenth c.; Oxford, Bodleian Library, MS Opp. 59 (cat. Neubauer 1100), late twelfth–mid fourteenth c.; New York, Jewish Theological Seminary, MS 8092, dated 1204; Cambridge, Cambridge University Library, MS Add. 667.1, ca. 1218–1237; London, British Library, MS Add. 27200-01, ca. 1242; Paris, Alliance Israélite Universelle, MS 133H, ca. 1280–1300; Oxford, Bodleian Library, MS Opp. Add. Fol. 14, dated 1332; Oxford, Bodleian Library, MS Opp. 649, ca. 1352–1408; Warsaw, University Library, MS 240, thirteenth–fourteenth c. There are two editions of the *Maḥzor Vitry* manuscripts: Simon Hurwitz, *Maḥzor Vitry le-Rabbenu Simḥah,* 2nd ed. (Nuremberg: Bulka, 1923), based solely on MS London, and a composite edition of seven of the manuscripts by Arieh Goldschmidt, *Maḥzor Vitry by Rabbenu Simḥah of Vitry, a Disciple of Rashi's,* 3 vols (Jerusalem: *Otzar ha-Posqim*, 2003) (Hebrew).

3 Four of the surviving *Maḥzor Vitry* manuscripts do not contain calendar sections: MS Parma, MS Paris, MS Warsaw, and MS New York, but the first three appear to have originally included them. Calendar sections in the other *Maḥzor Vitry* are as follows: MS Moscow, fols. 101v–102r; MS Oxford Opp. 59, fols. 164r, 170v–171r, 172v–173r; MS Cambridge, fols. 185v–188v, 189r–190v; MS London, fols. 267v–268v; MS Oxford

and 1832. After that, we know that David Solomon Sassoon (1880–1942) acquired it at some point during his lifetime. In 1975, his son Solomon David (1915–1985) sold it at public auction to its present owner.[5]

MS ex-Sassoon 535 has never been published, although it was used by Goldschmidt for his composite edition of *Maḥzor Vitry,* and very little has been written about it.[6] As the original manuscript was not available to us for viewing, the description that follows is based almost entirely on the black-and-white microfilm.[7] The manuscript measures at most 195 × 157 mm,[8] and currently has 299 folios or 598 pages, with some pages and quires missing.[9] Its parchment is of mediocre quality, with many holes and stitches, which may indicate that the manuscript was intended for personal or didactic use. Unfortunately it is not possible to count the quires from the microfilm, but the catchwords through most of the manuscript indicate that it must have been made up originally of quaternions (four bifolia sewn together into eight leaves), which was the most common quire composition in medieval Ashkenaz.[10] There are traces of hardpoint ruling[11] and outer prickings;[12] the text is laid out in a single column (i.e., full page), with 35–36 written lines for 36–37 ruled lines or 39 written lines for 40 ruled lines.[13] The pages are numbered with Hebrew foliation in ink at the top left of each recto side, and modern Arabic numeration, in pencil or ink, at the bottom center of each page (recto and verso); the latter will be used for the present edition.

In terms of palaeography, MS ex-Sassoon 535 comprises two types of writing: a large and medium module of northern French square script, mainly used for prayers and initial words and headings, and a medium module of northern French semi-cursive script, used for the long halakhic sections of the manuscript and various explanatory notes to the prayers, including most of the astrological-calendar section. Some of the texts are vocalized, but not the astrological-calendar section. The principal scribe of MS ex-Sassoon 535 is named Gamaliel, as indicated in several places where the word "Gamaliel" appears and where dots have been written above the name;[14] his hand wrote most of the astrological-

Opp. Add. Fol. 14, fols. 142v–143r; MS Oxford Opp. 649, f. 397v. Calendar sections in other liturgical manuscripts are also very common and not listed here.

4 *Maḥzor Vitry* manuscripts: only one folio in MS Oxford Opp. 59, fols. 282r–282v, and one very brief reference to medical astrology in MS London, fol. 268v, at the end of the calendar cycles (fols. 267v–268r). For astrology in other liturgical (and other) manuscripts, see Reimund Leicht, *Astrologumena Judaica, Untersuchungen zur Geschichte der astrologischen Literatur der Juden* (Tübingen: Mohr Siebeck, 2006); idem, "Toward a History of Hebrew Astrological Literature: A Bibliographical Survey," in Gad Freudenthal, ed., *Science in Medieval Jewish Cultures* (Cambridge: Cambridge University Press, 2011), pp. 255–291, especially 260–262; idem, "The Reception of Astrology in Medieval Ashkenazi Culture," *Aleph* 13 (2013): 201–234, esp. 214.

5 See Sotheby's *Catalogue of Thirty-Eight Highly Important Hebrew and Samaritan Manuscripts from the Collection formed by the Late David Salomon Sassoon* (Zurich: Sotheby's & CO. A.G., 1975), pp. 80–83 (lot 24).

6 See the very brief description in Colette Sirat, "Le livre hébreu: rencontre de la tradition juive et l'esthétique," in Gilbert Dahan, Gérard Nahon, and Elie Nicolas, eds., *Rachi et la culture juive dans la France du Nord au Moyen Age* (Paris and Louvain : Peeters, 1997), pp. 243–59, on 244; and the short article on an ink drawing in the manuscript in a later, thirteenth-century hand (fol. 100v) by Victor Klagsbald, "Le lion et le chien; à propos d'un dessin retrouvé dans un manuscrit du Mahzor Vitry," *Jewish Art* 15 (1989): 6–13. See Goldschmidt, *Maḥzor Vitry*.

7 See above, n. 1. On the codicology and palaeography of the manuscript, see further Isserles, *Maḥzor Vitry,* pp. 34–37, 293–298.

8 So according to Klagsbald ("Le lion et le chien," p. 9), who had access to the manuscript; he also describes the binding as early twentieth century and red leather. These measurements are similar to those of Sassoon, *Ohel David*, p. 313: 7 11/16" × 6 3/16".

9 E.g., one or two pages at the beginning of the manuscript. Several stubs in the manuscript indicate that the quires are incomplete: e.g. pp. 21, 32, 101, 102, 220, 230, 242, 246, 248, 355, 356. A quire is missing from the astrological-calendar section (see below).

10 In the astrological-calendar section, catchwords appear on p. 453 (followed by a missing quire, as the text does not follow) and p. 469. See in more detail Isserles,

calendar section (pp. 453–475; see for example Fig. 2). Three other scribes contributed very short sections to the manuscript, including the first two pages of the astrological section (pp. 451–452, the only section by this scribe; see Fig. 1). The participation of several scribes in the production of this manuscript (even within single quires), suggesting a certain element of teamwork, is not uncommon in medieval Hebrew codices. Throughout the manuscript there are also numerous short notes by later hands, in various Franco-German semi-cursive and cursive scripts, e.g., at the bottom of p. 452 (Fig. 1) and at the end of the calendar section (p. 475); these poorly legible notes are not included in our edition.

Our text, the astrological-calendar section, covers pp. 451 to 475 of the manuscript. It comes after a text of tractate *Avot* (pp. 422–450) and is followed by a section on laws and formularies for divorce, marriage, and deeds of partnership (pp. 476–485), which is in turn followed by laws of festivals and liturgical sections (pp. 486–596).

Within the astrological-calendar section, a whole quire appears to be missing between pages 453 and 454. This is evident from the discontinuity of the text, as well as from the mismatch between the catchword at the bottom of p. 453 and the first word on p. 454. The next catchword appears eight folios later, on p. 469, which suggests that p. 454—where the break occurs—is the beginning of a new quaternion (i.e., quire of 4 bifolios or 8 folios, which as we have seen, seems to be characteristic of the quiring of the whole manuscript). This suggests that a whole quaternion could be missing between here.[15]

Date

The dating of the manuscript to the twelfth century is based largely on palaeographical and codicological criteria. The use of hardpoint ruling is characteristic of the twelfth century,[16] as is the full-page layout (later liturgical compendia from Franco-Germany tend to be arranged in two

or three columns). Its pre-Gothic, northern French handwriting is also indicative of the twelfth century.

A more precise date, in the second quarter of the twelfth century, may be determined from calendrical data in our text. First, 1123/4 CE, the first year of the 258th cycle, is used as a paradigm for the calculation of the *molad*. Second, our text includes a calendar roster running from 1154/5 to 1176/7 CE, which is likely in fact to have started earlier, given that the entry for 1154/5, at the beginning of p. 454, follows the missing quire. If, as argued above, this quire was a full quaternion, there would have been enough space for the roster to have started as early

Maḥzor Vitry, p. 294, and Malachi Beit-Arié, *Hebrew Codicology. Tentative Typology of Technical Practices employed in Hebrew Dated Medieval Manuscripts,* 2nd ed. (Jerusalem: The Israel Academy of Sciences and Humanities, 1981), pp. 43 and 48.

11 E.g., pp. 312–313, 318–319, 320–321, 382–383, 388, 466, 530, 587, 588, 589. Hardpoint ruling was common practice in Ashkenaz until it was gradually replaced by pencil ruling during the thirteenth century. See Beit-Arié, *Hebrew Codicology*, pp. 72–73.

12 E.g., pp. 24–25, 346–377.

13 On page layouts in Jewish (Hebrew) and Christian (Latin and vernacular) manuscripts of liturgical-halakhic type, see Justine Isserles, “Les parallèles esthétiques des manuscrits hébreux ashkénazes de type liturgico-légal et des manuscrits latins et vernaculaires médiévaux,” in Nicholas de Lange and Judith Olszowy-Schlanger, eds., *Manuscrits hébreux et arabes: Mélanges en l’honneur de Colette Sirat* (Turnhout: Brepols, 2014), pp. 77–114.

14 See Sassoon, *Ohel David*, vol. 2, p. 311, and Klagsbald, “Le lion et le chien,” p. 6; but the references they supply are erroneous. Sassoon identifies another scribe named Samson (on pp. 241–242), but the handwriting there is clearly that of the scribe Gamaliel.

15 *Pace* Klagsbald (“Le lion et le chien,” p. 9), who suggests that only a 4-folio quire (two bifolios sewn together) is missing.

16 See above, n. 11.

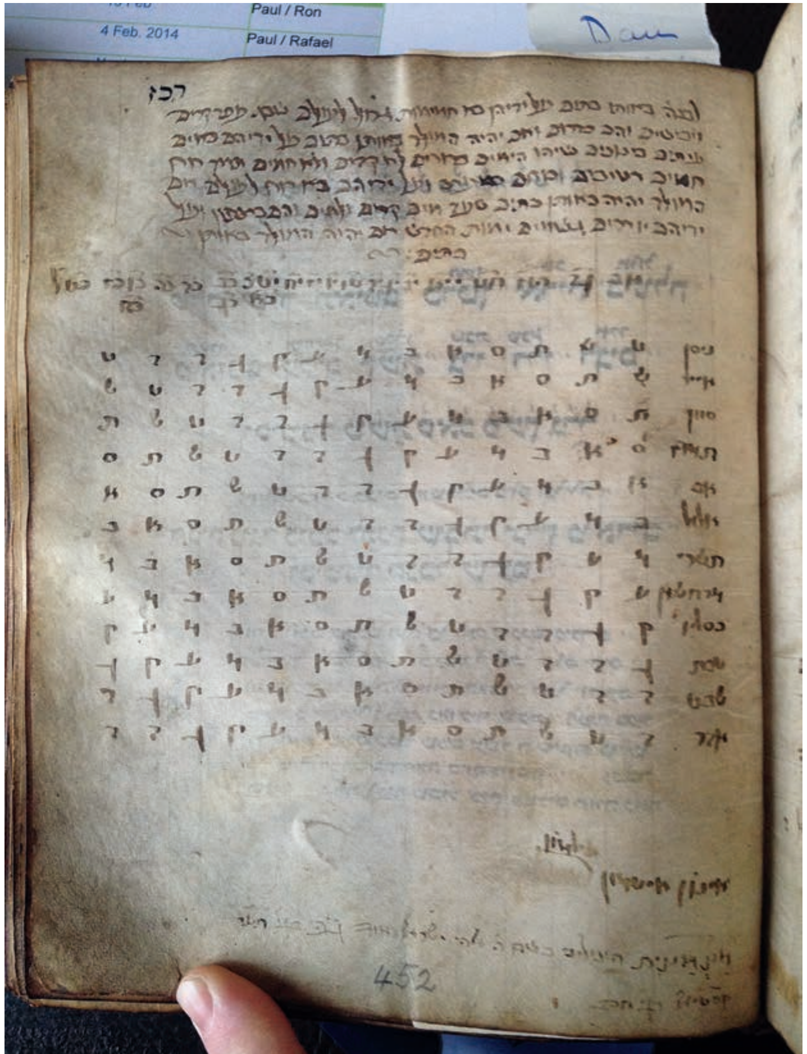

Figure 1: MS ex-Sassoon 535, page 452, courtesy of the owner.

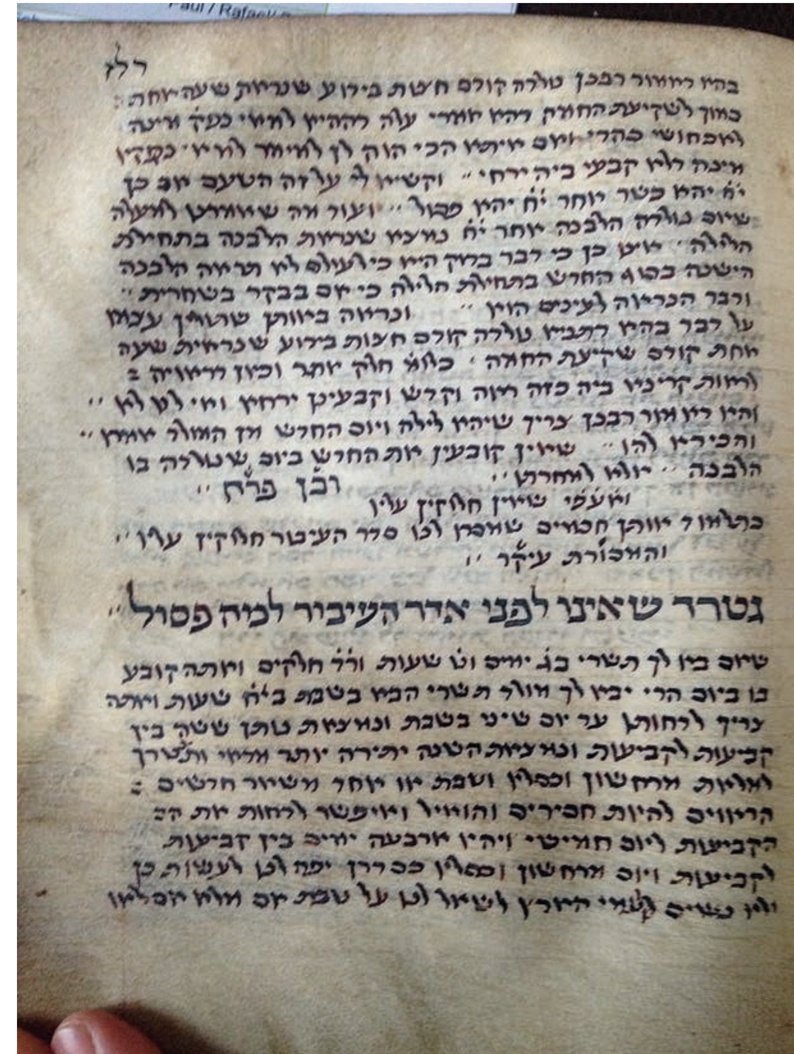

Figure 2: MS ex-Sassoon 535, page 472, courtesy of the owner.

as 1123/4, the first year of the 258th cycle.[17] Alternatively, however, it may have started from the beginning of the next 19-year cycle in 1142/3. Moreover, although it seems logical that the roster started from the beginning of one of these cycles, it is entirely possible that it began in the year when the scribe or author happened to be writing, which remains completely unknown. How much of the roster is missing, therefore, remains a matter of speculation.

The use of the year 1123/4 as paradigm for the *molad* calculation suggests that the text, and thus the manuscript, could not be much earlier than this date. However, the same date is used as paradigm by both Abraham bar Ḥiyya and Jacob bar Samson in their calendar monographs;[18] this seems to correspond to the date when they were actually writing,[19] whereas there is no evidence of the date of composition in our present text. It could be argued, therefore, that for the author of our text, the 1123/4 paradigm was as a literary or calendrical *topos,* because of its use in the aforementioned monographs—but not the year in which he was actually writing.

More significant, however, are the years of the calendar roster. Given the practical nature of the information that it conveys, it seems unlikely that a scribe would have copied out in such detail a roster that was out of date. This suggests that the manuscript was copied around 1154/5 CE at the latest, but possibly much earlier, as the beginning of the roster is missing. On this basis, both text and manuscript could be dated to between 1123/4 and 1154/5 CE.[20]

The Astrological-Calendar Section

Although MS ex-Sassoon 535 deserves a study as a whole, we have chosen to restrict ourselves to its astrological-calendar section, because of its historical significance: it is one of the earliest texts from Franco-Germany on both astrology and calendars; in fact, probably the earliest

manuscript. The text also includes some interesting sidelines: the peculiar arithmetic that is employed in the calendar section will be of interest to historians of mathematics, and the citations of early rabbinic sources and early medieval talmudic commentaries will be of interest to talmudists (see further below, after the summary of the contents).

The astrological section, or more precisely what survives of it in our manuscript, is brief and simplistic, with little more than basic astrological correspondences and weather predictions. The calendar section, in contrast, and in particular the long section headed "Explanation of the Calendar," constitutes a complete and comprehensive treatise on the Jewish calendar. It is clearly intended not as a popular or easy-to-read handbook, but rather as a scholarly work, as is evident if only from its complex arithmetical procedures. The treatise aims to provide not only useful, practical arithmetical tools for calculating the calendar (especially

17 Assuming, on the basis of the roster that is extant, five or six entries per page, a starting date in 1123/4 would have taken up six or seven sides, i.e., three or four folios.

18 Abraham Bar Ḥiyya: *Sefer ha-'Ibbur* 2:6 (*molad* calculation), and in several tables appended to his *Sefer ha-'Ibbur*. Jacob b. Samson: chs. 26–27 (fols. 89b–90b), ch. 29 (fols. 92b–93a) (Oxford, Bodleian, MS Opp. 317, fols. 88a–99b). Critical editions and studies of these works are in preparation by Ilana Wartenberg and Israel Sandman as part of an AHRC-funded research project at UCL.

19 Abraham Bar Ḥiyya: *Sefer ha-'Ibbur* 3:3 ("this cycle 258"), 3:5 ("until the end of cycle 257, in which in which we are now"), and *finis* ("from the beginning of cycle 258, which will begin for us next year"). Jacob b. Samson: ch. 27 (fol.90a) ("for we have already completed the 257th and entered the 258th cycle"). The coincidence of two monographs on the same topic written independently of each other in the same year is intriguing, but cannot be discussed here. There is no particular calendrical significance to the beginning of the 258th cycle.

20 Note also an eschatological reference to the end of the 259th cycle in year 1160/1 of the roster (p. 455), which confirms at least that the text was redacted before this date.

the *molad*), but also an account of the rules that underlie the Jewish calendar and an explanation of the rationale behind them, based largely on talmudic sources. Furthermore, a brief allusion in the text (p. 469) suggests that advanced knowledge of the Jewish calendar, as provided in this treatise, will help students debating Christians about calendrical issues.[21]

In general terms, the astrological and calendrical contents of MS ex-Sassoon are standard and similar to what can be found in other medieval works. But worthy of note, is an original explanation, found at the end of the calendar treatise, as to why the months of Marḥeshvan and Kislev were chosen to be variable, i.e., sometimes defective and sometimes full. This explanation, that the choice of these months was designed to prevent a breach of the postponement rule of *molad zaqen* (see summary of contents below), is almost without parallel in Jewish calendrical literature, certainly in the twelfth century.[22] Similarly unparalleled is the attribution of the 19-year cycle to the Great Assembly (p. 458).

Abraham Grossman has suggested that the calendar treatise comes from the monograph on the Jewish calendar by Jacob bar Samson (northern France, 1070–1140), also of the school of Rashi, which, as we have seen, dates from around 1123/4 CE and has survived only in part.[23] Careful comparison of the two texts reveals, however, that they do not belong to the same work. On the one hand, they do have some features in common, which suggest a shared, perhaps specifically northern French, body of traditions about the Jewish calendar and how to calculate it. Thus a common feature, quite frequent in both works, is the substantivation of complex numbers, such as יכארד (10-21-204, i.e., 10 days, 21 hours, and 204 parts, the difference between the solar and the lunar years), which when multiplied is treated as a plural noun, יכארדין (translated here as "10-21-204s"). Both works, as we have seen, also use the same year as paradigm—1122/3 or 1123/4 CE, i.e., the end of the

257th cycle or beginning of the 258th—for example, for the calculation of the *molad*. On the other hand, the ex-Sassoon treatise lays out its arithmetical operations in far greater detail than Jacob bar Samson does and generally confines itself to astrology and computus, whereas Jacob bar Samson frequently digresses into biblical and midrashic exegesis and seems to display broader thematic interests. Above all, the relative comprehensiveness of the calendar treatise in ex-Sassoon suggests that it

21 On contemporary Jewish-Christian debates about the calendar, see C. Philipp E. Nothaft, *Medieval Christian Latin Texts on the Jewish Calendar: A Study with Five Editions* (Leiden: Brill, 2014), pp. 51–54.

22 The normal explanation relates to the prevention of errors in the dates of the festivals: see Abraham bar Ḥiyya, *Sefer ha-'Ibbur* 2:8, and Jacob bar Samson, ch. 36 (fols. 97b–98a, with yet another, alternative explanation). The explanation provided in MS ex-Sassoon is attested only once, to our knowledge—in a French astrological-calendrical treatise preserved in a fourteenth-century northern French codex, Berlin, Staatsbibliothek, Preussischer Kulturbesitz, MS Or. Oct. 352 (fols. 11c–12a). This treatise itself dates from 1299/1300 CE (it uses the year 5060 as paradigm [fols. 3c–8b]). Although very different from the text of MS ex-Sassoon 535, this much later treatise includes similar content it (e.g., its exposition of the four postponements in fols. 8b–10b and of the planetary hours and the *molad* on fols. 25v–26v, on which see below, n. 26).

23 Abraham Grossman, *The Early Sages of France, Their Lives, Leadership and Works* (Jerusalem: The Magnes Press, 1995), p. 418 (Hebrew). On Jacob bar Samson's monograph, see above, n. 18; this work is also known as *Sefer ha-'Elqoshi*, but this is probably the subtitle of another, noncalendrical section of the same monograph (see Ilana Wartenberg, "The Hebrew Calendrical Bookshelf of the Twelfth Century: The Cases of Abraham bar Ḥiyya and Jacob bar Samson," in Charles Burnett and Sacha Stern, eds., *Time, Astronomy, and Calendars in the Jewish Tradition*, [Leiden: Brill, 2013], pp. 97–111).

is a self-standing work, rather than the fragment of another; moreover, several themes are covered in both works, such as the calculation of the *molad* and the exposition of the postponements and their rationale, which would be duplicate if they belonged to the same work. The different treatments of these same themes, finally, firmly preclude the possibility that they belong to the same work.

The same conclusion can be drawn with regard to the calendar treatise by Samuel b. Meir (Rashbam), a grandson of Rashi, composed in Reims (רומש המדינה) in 1129/30, as preserved in Moscow MS Guenzburg 365/9 within a much larger (and later) compilation of works on the Jewish calendar.[24] Like our work, this short treatise presents a simplified method of calculating the *molad*, using the author's own year as paradigm. Substantivation of numbers is also quite common. In this work, however, the arithmetic is not explicated at length or in detail and there is no textual overlap with MS ex-Sassoon 535, which suggests that it is a totally separate work.

The calendar text of MS ex-Sassoon is thus not to be identified with the contemporary calendar treatises by Jacob bar Samson and Rashbam. But precisely for this reason, it provides evidence, together with the other two works, of a developing interest in Jewish calendar computation in early twelfth-century northern France, particularly within the circle of Rashi's school.

Summary of the Contents

Because of the complexity of the text of MS ex-Sassoon, especially through most of the calendar section, the following summary of its contents may be helpful to the reader. As we shall see, the text falls broadly into three parts: an astrological part (section 1 below), a calendar roster (section 2), and a calendar treatise (sections 3–8).

1. Astrology (pp. 451–453)

The astrological part begins with a list of the planets and the houses (zodiac signs) in which they serve, and a list of the zodiac signs and each of the four elements from which they derive. On the basis of these two lists, it is shown how the planetary hour in which the *molad* (the conjunction of sun and moon or "new moon") occurs indicates the weather that will characterize that month (hot/cold, dry/wet, wind, and dominant cardinal point), depending on the houses (zodiac signs) over which that planet rules and the four elements with which they are associated. This, incidentally, constitutes an astrological application of the calculation of the *molad* (pp. 451–452).

Next comes a table of the twelve Jewish months, indicating the position of the moon in the zodiac on each day of the month. The days of the month are grouped together in twos or threes, resulting in a total of thirteen columns, of which the last contains days 29 and 30 of the month (p. 452). This table assumes an ideal model in which all months have 30 days, the year has 360 days, and the moon traverses the zodiac in a uniform motion and completes 13 full circuits of the zodiac in one year. The first column, for days 1 and 2 of the month, is also indicative of the sun's position in the zodiac (since day 1 presumably represents the conjunction, when sun and moon are at the same longitude and hence in the same position in the zodiac); this implies, in turn, an ideal lunisolar calendar in which the solar and lunar years are of the same length and the lunar months are in stable

24 Rashbam's short treatise begins on fol. 171r, but it is difficult to establish where it ends, especially as one or more folios seem to be missing between fols. 171 and 172. It is unlikely, however, that the treatise goes beyond fol. 172r, where another author, Jacob ha-Levi, is cited. Within the treatise, the paragraph on fol. 171r attributed to Menaḥem ha-Qadosh (on the fractions of 1080) is likely to be a later interpolation.

relationship with the sun and solar year. This ideal calendar goes back to ancient Mesopotamia; the scheme presented in this table, or rather an analogous version of it, is already found in Qumran scroll 4Q318, although not in tabular form as here; similar tables are well attested in later medieval manuscripts.[25]

Starting on p. 453, the handwriting is that of the manuscript's main scribe, Gamaliel. On p. 453 we find a simple list of the zodiac signs with their corresponding (lunar) months and a list of the planets and their acronyms. This is followed by an explanation of the hours of the planetary week, familiar already, for example, from *Pirqei de-Rabbi Eliezer,* chs. 6–7.[26] The explanation is cut short, however, at the point where an entire quire appears to be missing (see above).

2. Calendar Roster (pp. 454–458)

The manuscript resumes on p. 454, probably one quire later, in the middle of a calendar roster that starts in the year (4)915 (1154/5 CE) and it runs until (4)937 (1176/7 CE), on p. 458. For every year, we are given the year's position in the 19-year cycle, and then, in approximate chronological order, the *molad* of Tishri, the weekdays on which the New Year and Passover fall out, whether the year is defective, regular, or full, whether it is intercalated, the date and time of the *tequfot*, and the date of the beginning of the liturgical request for rain (60 days after the *tequfah* of Tishri). From the year (4)922 (beginning of the 260th cycle) onwards, certain elements are gradually left out: the *molad*, the weekday of Passover, sometimes the intercalation; then, from (4)970, the weekday of the New Year and the quality of the year (defective etc., intercalated); from (4)974, the weekday of the request for rain (although the rest of the date is stated); and in (4)976, the request for rain is omitted altogether. It is as if the author and/or scribe lost patience and abbreviated the contents of the roster as they went along.

3. The Lunisolar Cycle (pp. 458–461)

Next comes a section entitled "Explanation of the Calendar," a complete treatise on the calendar that takes us to the end of the entire passage (pp. 458–475). It begins by introducing the general principle of a lunar calendar, the need to celebrate festivals in their proper seasons, and intercalations in a 19-year cycle, which is attributed to the Great Assembly. Citing B *Rosh ha-Shanah* 25a, it gives the length of the lunation (29 days, 12 hours, 793 parts) and of plain and intercalated years, the latter obtained by multiplying the lunation by the number of months in the year (pp. 458–459).

25 Jonas C. Greenfield and Michael Sokoloff, with Ada Yardeni and David Pingree, "318. 4QZodiology and Brontologion ar," in Philip S. Alexander et al., eds., *Qumran Cave 4. 26: Cryptic Texts and Miscellanea Part I* (Discoveries in the Judaean Desert 36; Oxford: Clarendon Press, 2000), pp. 259–274. Medieval manuscripts include the Hamburg Miscellany (early fifteenth century) and Hamburg MS Cod. Hebr. 37, fol. 121r. On similar tables found in medieval Latin sources (but with reference to Julian calendar months), see Jose Chabás and Bernard R. Goldstein, *A Survey of European Astronomical Tables in the Late Middle Ages* (Leiden: Brill, 2012), pp. 86–88, with additional references.

26 This system of allocation of planets to the hours and days of the week is well known in astrology, and first attested in Vettius Valens (2nd c.), *Anthologiarum Libri* 9.1.10; in Jewish sources, it is implicit already in the Babylonian Talmud (*Berakhot* 59b, *Shabbat* 156a, *Eruvin* 56a). This common system is reflected in the planetary names of the weekdays, e.g. English Sunday, Monday, etc. See further Solomon Gandz, "The Origin of the Planetary Week or the Planetary Week in Hebrew Literature," *Proceedings of the American Academy for Jewish Research* 18 (1948/1949): 213–254; Leicht, "Reception of Astrology", 206–212. A more detailed account of the planetary week is found, for example, in Berlin MS Or. oct. 352, fol. 26v, where there is also a more extensive account of the astrological effect of the planetary hour of the *molad* (fol. 25v).

It then turns to the length of the solar year, which is 365¼ days, divided into four seasons or *tequfot*, in accordance with the scheme of Samuel presented in B *Eruvin* 56a. The difference between the solar and lunar years is then calculated. The excess of the solar over the lunar year, which is compensated for through intercalation, is then calculated for every year of the 19-year cycle; the excess (or, in some cases, deficit) obtained for the end of each year is expressed through a mnemonic rhyme. This elaborate calculation, which is attested in many other sources, often with similar (but not identical) mnemonic rhymes, runs from pp. 459 to 461. At the end of the cycle, the remaining excess is 1 hour and 485 parts.

4. The Calculation of the Molad (I) (pp. 461–467)

The calculation of the *molad* is the longest and most intricate section of our text. The epoch—the *molad* in the first year of the era of Creation which serves as reference point for all *molad* calculations—is first given as *BaHaRaD* (2 days, 5 hours, 204 parts). Then we are told to calculate the number of years that have elapsed until the present—for which the paradigm of 257 cycles (4883 years), is used. The procedure of casting out sevens is then explained: all multiples of seven days can be cast out, as it is sufficient to know the *weekday* of the *molad* for its date to be established (p. 461).

The result obtained from the calculation—the *molad* of the beginning of the 258th cycle—is first given, before the computation is explained in great detail (p. 461). The first step is to calculate the remainder of a full 19-year cycle. For this purpose, all the lunations in a cycle (a total of 235) need to be added up, and the resulting number of days must then be reduced modulo seven. The procedure adopted here is not to add up 235 lunations, but first to calculate the remainder of a lunar year (plain and intercalated: e.g., the length of a plain year is 354 days, 8 hours, and 876 parts, so after casting out sevens, the remainder

is 4 days, 8 hours, and 876 parts). The remainders of the plain and intercalated years within the 19 year cycle are added up, and sevens are cast out; this leaves a remainder for the entire cycle of 2 days, 16 hours, 595 parts (pp. 461–462).

An alternative procedure for the same calculation is then presented, based on the solar year. The solar year of 365¼ days is multiplied by 19, and then all sevens are cast out. The solar years, as seen above, exceed the lunar 19-year cycle by 1 hour and 485 parts. Subtracting this excess from the foregoing result yields the excess of the 19-year lunar cycle, which is 2 days, 16 hours, 595 parts (pp. 462–463).

Now, to calculate the *molad* of the beginning of the 258th cycle, this remnant needs to be multiplied by 257 and reduced modulo seven. The result is 5 days, 5 hours, and 635 parts. This elaborate calculation takes us to the top of p. 464.

Before adding the result to the epoch (which is the final step in the calculation of the *molad* and will be carried out on p. 467), an alternative calculation of the above is offered, which is intended as a simplification, although it is explained in excruciating detail and ends up looking rather complicated.[27] The procedure consists in converting all the years that have elapsed since the Creation into 12-month years, without intercalation. For this purpose, all the intercalary months must be removed, added together, and divided into units of 12 months. The resulting 12-month years are added to the total number of years since the Creation. Then, the current *molad* could be calculated by multiplying the length of a 12-month year (354 days, 8 hours, and 876 parts; or, more simply, its remainder, i.e., 4 days, 8 hours, and 876 parts) by the number of years so obtained, and then casting out sevens. But there is a simpler method.

27 This alternative method is also found in Abraham Bar Ḥiyya's *Sefer ha-ʿIbbur*, 2:6, although it is presented very differently.

This method consists in counting and adding up one day for every 2 years, one day for every 3 years, one day for every 30 years, and one hour for every 90 years, using the total number of 12-month years obtained above (e.g., if the total number of 12-month years is 90, one must add up 45 days + 30 days + 3 days + 1 hour). After sevens are cast out, this is the remainder of the *molad* for the current year: for example, if the total number is 90 years, the result is 78 days + 1 hour, which, after casting out sevens, equals 1 day + 1 hour. The text explains the rationale of this simple method: the 4 days of the plain year yield a remainder modulo seven of one day after 2 years; the 8 hours of the plain year length yield a remainder of one day after 3 years; 864 parts of the plain year length yield a remainder of one day after 30 years; and the remaining 12 parts of the plain year length (864 + 12 = 876) yield a remainder of one hour after 90 years (p. 464).

The method is then illustrated with reference to the beginning of the 258th cycle. First, the number of years in 257 cycles is calculated: 4883 years. All the intercalary months are extracted, turned into 12-month years, and added to the total number of years. For every 90 years, add 1 day + 1 hour (pp. 464–465). Take the years that are left (i.e., the remainder of years modulo 90), add one day for every 2 years, one day for every 3 years, one day for every 30 years, and 12 parts for every year. When a remainder is less than 30 years, add one day for every 2 years, one day for every 3 years, and 876 parts for every year (which are calculated separately as 864 + 12 parts). When a remainder is less one year (in this case, 11 months), add up the lunations within it. As the calculation proceeds in this laborious fashion, days, hours, and parts are added up and sevens cast out; the final result, as in the previous method, is 5 days, 5 hours, and 635 parts (pp. 464–467).

Finally, to obtain the *molad* of Tishri or Nisan of the first year of the 258th cycle (4884 = 1123/4 CE), this result is added to the epoch, i.e., the *molad* of Tishri and Nisan (respectively) of the first year of Creation (p. 467).

5. Excursus: The Calculation of the Tequfah and of the 19-Year Cycle (pp. 467–468)

The *tequfah* of Nisan in the same year is calculated by adding to the *molad* of Nisan (just calculated) the excess of the solar year over the lunar year, which (as seen above) is 1 hour and 485 parts per 19-year cycle. However, 7 days, 9 hours, and 642 parts must be subtracted from the result, because the epoch of the *tequfah* calculation is earlier than the epoch of the *molad* by that amount.

In a digression, a *baraita* is cited that recounts the dispute between the Sages and R. Eliezer regarding the distribution of intercalated years in the 19-year cycle. The opinion of the Sages conforms to the current Jewish calendar, and that of R. Eliezer to the calendar of the nations, which is the Christian 19-year Easter cycle.

Returning to the date of the *tequfah*, the text states that in the eighth, eleventh, and nineteenth years of the cycle (all intercalated), the *tequfah* of Nisan occurs early, in Adar II.[28]

6. The Calculation of the Molad (II) (pp. 468–469)

This short section is designed to further facilitate the calculation of the *molad*; the author hints that fluency in this calculation will help Jews in debates with Christians about the calendar.[29]

Another method of calculating the *molad* is given. It consists in counting and adding up the years since the Creation as if they were solar years of 365¼ days, casting out sevens, and then subtracting the

28 This is correct for the eleventh to fifteenth centuries. Until the cycle beginning in 1180/1 CE, however, the *tequfah* of the third year, too, occurred in Adar II, although at the end of the month and after the *molad* of Nisan; this may be why the author does not include it.

29 Debates of this kind are referred to more explicitly by Abraham Bar Ḥiyya, *Sefer ha-ʿIbbur* 2:5 and 3:10.

accumulated excess of the solar years over the lunar years, a value already calculated above. The result must then be added to the epoch of the *molad* calculation in order to obtain the present *molad*.

An explanation is then given of how to calculate the *molad* of Tishri of any year within the 19-year cycle, on the basis of the *molad* of its first year. Again, the paradigm of the 258th cycle is used to illustrate the procedure for the first three years. The same principles apply to the calculation of the *molad* of Nisan and of any other month within the 19-year cycle (p. 468).

Summing up, the values for calculating one *molad* on the basis of another *molad* are given at intervals of one month (this is the lunation, which modulo 7 is 1 day, 12 hours, 793 parts), half a plain year, half an intercalated year (i.e., 7 lunations), a plain year, an intercalated year, and a 19-year cycle, all in a mnemonic rhyme (p. 469).

7. The Postponements (pp. 469–475)

This section explains the rules of postponements, whereby the New Year (1 Tishri) and 1 Nisan are sometimes postponed from the day of the *molad*.

The four postponements of Tishri are listed in a mnemonic rhyme and then explained in detail (pp. 469–470), followed by the four postponements of Nisan (pp. 470–471).

The rationale of the postponements is then explained. The rule of *lo-ADU* (that the New Year cannot fall on Sunday, Wednesday, and Friday) is based on passages from the Babylonian Talmud, B *Sukkah* 43b–44a (with the gloss by Rabbenu Ḥananel, including his citation from J *Sukkah* 4:1 [54b]) and B *Rosh Hashanah* 20a, which are cited and discussed (p. 471).

The rule of 18— the New Year is postponed if the *molad* occurs after 18 hours—is based on an obscure passage in B *Rosh Hashanah* 20b, which the author needs to explain. The first explanation can be

identified as that of Rashi; an objection is then leveled against it, and another explanation is provided, as found in the Tosafot ad loc. (pp. 471–472; see below).

The other two rules are then explained. What is stressed here is the rabbinic desire to keep the calendar simple, with only two variable months (Marḥeshvan and Kislev), so as to avoid errors by “women” or the “common people.” This pursuit of simplicity is further illustrated by another talmudic passage that lays down that “Adar adjacent to Nisan is always defective” (B *Rosh ha-Shanah* 19b) (pp. 472–473).

Next comes an explanation of the postponements of Nisan, which are all derivatives of the postponements of Tishri (pp. 473–474). This raises the question of why the postponements are based on Tishri, rather than on Nisan; the answer, as cited from B *Rosh ha-Shanah* 27a, is that we rule in accordance with R. Eliezer that the world was created in Tishri (p. 474).

8. The Variable Months

Finally, the question is asked why Marḥeshvan and Kislev were chosen to be variable. The answer is that this safeguards the rule of 18 for every month of the year (i.e., that no month should begin on a day when the *molad* is after 18 hours). This explanation is demonstrated in some detail (pp. 474–475). For some reason, however, the text is truncated at this point; the scribe appears to have omitted the end of the treatise, although probably not much is missing, as by now the calendar has been comprehensively explained.

Arithmetic in the Calendar Treatise

A detailed study of the mathematical aspects of the calendar treatise is beyond our expertise, but a few general observations can nevertheless be made, in particular about its arithmetic. As can be expected of a twelfth-century Hebrew text, its terminology is inconsistent: for example, several verbs are used interchangeably for addition (צירף; הוסיף; הותיר; שם + preposition על) and subtraction (השליך ; גרע;הוציא); these terms have not been distinguished in our translation.[30] As Gad Ben-Ami Sarfatti has noted, the arithmetical terminology of Abraham b. Ḥiyya and Abraham Ibn Ezra (both contemporary with our manuscript) is similarly inconsistent and the same terms are found in their works[31]—with the exception of שם + preposition על, which may perhaps be original to our calendar treatise.

Equally inconsistent, in our treatise, are the arithmetical procedures employed. Many pages—often to the point of tedium—are devoted to explaining how to calculate the *molad* and related values. The author insists on detailing all the steps of his arithmetical operations, which consist in breaking up all large numbers into smaller components and resorting to a range of simplifications. When written out in words, these methods look quite complicated. However, they might work well for mental computation, which is probably what the author has in mind: this is evident, indeed, from the mnemonics that he regularly devises for the successive steps of his calculations. These complicated arithmetical procedures, which do not follow consistent patterns and appear somewhat chaotic, are attested in later medieval sources as well,[32] but they are particularly extensive and complex in our manuscript.

Talmudic and Other Rabbinic Citations

Among the interesting features of the calendar treatise, especially in its second half, are citations from talmudic and other rabbinic texts. Those from the Babylonian Talmud, which are most frequent, may be valuable as textual witnesses, even if, as expected, they may sometimes be paraphrases rather than as exact citations. Detailed textual study

of these and other citations is beyond our scope, but we will mention some points of interest.[33]

The *baraita* with the dispute between the Sages and R. Eliezer regarding the distribution of intercalated years in the 19-year cycle is cited (on p. 468). This *baraita* is not found in early rabbinic literature, but has a parallel in *Pirqei de-Rabbi Eliezer*, ch. 8 (8th century?) and closer parallels in two early fourteenth-century works, Isaac Israeli's *Yesod Olam* 4:2 (1310 CE) and a French astrological-calendrical treatise (1300 CE).[34] The *baraita* in MS ex-Sassoon may thus represent a missing link between these eighth- and fourteenth-century sources, the implications of which will be discussed in more detail elsewhere.

The passage prominently marked *Yerushalmi* (Jerusalem Talmud) on p. 471 is not a direct citation from J *Sukkah* 4:1 (54b), but taken from Rabbenu Ḥananel's gloss on B *Sukkah* 44a, in which this passage is cited (see further note nn on the text). A conspicuous feature of this indirect citation is the omission of one significant word that appears in our *textus receptus* of the Jerusalem Talmud, דמחשבין (after לאילן); as a

30 In rare cases, השליך seems to be used for addition; it is also commonly used for casting out.

31 Gad B. Sarfatti, *Mathematical Terminology in Hebrew Scientific Literature of the Middle Ages* (Jerusalem: Magnes Press, 1968), pp. 87–88 and 133 (Hebrew). The verb הותיר (found only once in our work, on p. 468) is attested in earlier, rabbinic sources: ibid., pp. 23–4.

32 E.g., in the mid-thirteenth-century *Maḥzor Vitry* manuscript, MS London (see above, n. 2), as edited by Abraham Berliner in his appendix to Hurwitz, *Maḥzor Vitry le-Rabbenu Simḥah,* vol. 2, pp. 7–9; and in the northern French astrological-calendrical treatise of 1300, Berlin MS Or. Oct. 352, fols. 1c–8b, 17a–c, 18d, 20c–23a.

33 Note, in particular, the text cited from B *Rosh ha-Shanah* 20b on p. 472, which differs significantly from all Talmud manuscripts (see n. 114 on the translation).

34 The latter is Berlin MS Or. Oct. 352, fol. 2d. See notes on text and translation.

result, our text translates awkwardly as "R. Simon commanded those," rather than "R. Simon commanded those who calculate," which makes considerably more sense and is most likely the correct version.[35] The interesting point, however, about this lacuna is that it also appears in the manuscript of R. Ḥananel's commentary, MS Vat. Ebr. 126, where the word דמחשבין is missing (although it is inserted in the margin, in a different hand).[36] This error in the citation of the Jerusalem Talmud, common to our manuscript and to MS Vat. Ebr. 126, must either go back to the original text of R. Ḥananel's commentary or is at least derived from the same textual tradition. In spite of this, it is worth noting that in other respects the text of R. Ḥananel as it appears in our manuscript is considerably better than that of MS Vat. Ebr. 126: whereas our manuscript reads (before the citation from the Jerusalem Talmud) בזמן שלא נקבעו השנים כתיקנן היה כגון ימות השמד ("in a time when the years were not set in the proper manner, as in times of persecution"), MS Vat. Ebr. 126 has בזמן שלא נתקבעו השנים כתיקונן כגון יסוד השמד ("at a time when the years did not set themselves [!] in the proper manner, as in the foundation [!] of persecution")—which hardly makes sense.

Towards the end of the calendar treatise (pp. 471–472), an obscure passage in B *Rosh ha-Shanah* 20b is extensively discussed. The first explanation offered can be identified in substance as Rashi's, as it appears in the printed editions of the Talmud, although Rashi is not mentioned here by name. This explanation assumes that the crescent old moon can be sighted in the evening, which is patently wrong (the old moon is visible only at the end of the night/start of the morning) and demonstrates surprising ignorance of basic astronomical facts. Accordingly, this explanation is refuted and another explanation is provided; both the refutation and the alternative explanation are found in the Tosafot (ibid.).[37]

Considering the later date of the composition of the Tosafot, our early twelfth-century calendar treatise must be the earliest attestation of this refutation and alternative explanation. Although they are cited

anonymously here (just as they are later, in the Tosafot), this refutation and alternative explanation are evidently earlier than the Tosafists; given the *Maḥzor Vitry* context of our manuscript, they may well emanate from the school of Rashi, where the explanation attributed to Rashi may already have been subjected to severe criticism. The anonymous use of these explanations in our calendar treatise says something about the anonymity of the exegetical traditions that circulated in Rashi's school.

The Text, Its Authorship, and Its Transmission: The Evidence of Textual Errors

The text of MS ex-Sassoon 535 is riddled with errors that can easily be identified on astrological, calendrical, and/or mathematical grounds. These errors may shed some light on the manuscript's authorship and transmission. While the majority of errors are scribal, some are better attributed to the author. The distinction between scribal and

35 The word דמחשבין appears in the unique manuscript of the Jerusalem Talmud, Leiden MS Or. 4720 (dated 1289 CE), as well as in citations of this passage in the various extant versions of the Tosafot on B *Sukkah* 43b (*s.v. Lo*).

36 On this manuscript, identified as late thirteenth-century Ashkenazi, see Benjamin Richler, ed., *Hebrew Manuscripts in the Vatican Library: Catalogue* (Vatican: Biblioteca Apostolica Vaticano, 2008), p. 91 (http://web.nli.org.il/sites/NLI/Hebrew/collections/Documents/vaticanhebmss.pdf, accessed 11 August 2013). This manuscript was used for the first edition of R. Ḥananel's commentary, in the 1881 Vilna edition of the Talmud, where the word דמחשבין is correctly placed in square brackets. See also the new edition by David Metzger, *Perushei Rabbenu Ḥananel: Rosh ha-Shanah, Sukkah* (Jerusalem: Wagschal, 1994), p. 86.

37 The alternative explanation is also astronomically problematic, but the author's ignorance of this is more excusable (see note on translation).

authorial errors is often unclear, but it may be assumed that errors due to confusion of graphically similar letters or textual features such as homoioteleuton are scribal, whereas errors of miscalculation are the author's. On this basis, it may be possible to draw some conclusions about the way the text was composed and transmitted.

Computation errors, which we may assume are the author's, are particularly common in the calendar roster. To cite just a few examples, in year 4915, the date of the *tequfah* of Tevet is given as the 15th of the month, whereas it should be the 18th; the substitution of טו for יח is unlikely to be scribal and more apt to result from some miscalculation.[38] In year 4924, the beginning of the request for rain is dated Monday 27 Kislev (בכ'ז' בכסליו ביום ב'), whereas it should be two days earlier, Saturday 25 Kislev (בכ'ה' בכסליו ביום ז'). Not only are the erroneous letters graphically quite different; the erroneous date "Monday 27 Kislev" is not the random outcome that would be expected of a scribal error but a real date (27 Kislev was indeed a Monday); the two-day discrepancy is more likely to be a computational error. Similarly, in the year 4925, the *tequfah* of Tishri is placed on Friday the 7th of the month, whereas it should be one day earlier; again, this is most likely a computational error. The frequency of computational errors in the calendar roster, some quite gross, is surprising, given the practical use that it was intended for; we can only conclude that the author of the roster was exceptionally careless.[39]

Errors of this kind are far less frequent in the astronomical section and the calendar treatise. The only errors that can be confidently identified as computational are on p. 465, where (line 7) the manuscript reads "14 cycles" instead of "7 cycles," and on the last line, "10 times" instead of "5 times"; such errors were probably not committed in the course of copying but are a result of faulty arithmetic. The relative absence of authorial errors in the astronomical section and the calendar treatise, in contrast with the calendar roster, raises the possibility that the latter was composed by a different person.

Scribal errors are much more common than authorial ones, especially in the calendar roster and the treatise, which confirms that the scribe of these passages (who, as seen above, is the main scribe of MS ex-Sassoon 535) was particularly careless. In many cases, however, the scribe corrects himself by overwriting erroneous letters, striking them through, or marking them for deletion with apostrophes. The sloppiness of the scribe is manifest on p. 461, line 17, where four words were erroneously copied from two lines above because of a homoioteleuton and then marked for deletion by the scribe. This error in itself is forgivable, as it is common occurrence in manuscripts, but what is interesting is that the last of these four erroneous words is spelled differently than two lines above, which says something about the scribe's general lack of attention to detail.[40]

In this same passage, the equivalent of one line of text has been apparently misplaced. This phenomenon occurs in several places in the manuscript. In this particular case, it is possible that the misplaced line is in fact an explanatory gloss that did not belong to the original text and was wrongly moved from the margin to the main text by a later scribe.[41] Another, slightly misplaced interpolated gloss can be found on p. 464, lines 17–18.[42] In another passage, the misplaced words are more likely to be part of the original text; their misplacement is best explained as the result of an erroneous omission that was corrected in a marginal note that was

38 In this case, however, an *Aleph* reader suggested that the error might have been result of a scribe's misreading יה (15) for יח (18).

39 See, for a further example, n. 14 on the Hebrew text. There is no need to enumerate all the cases of computation error in the calendar roster.

40 See note t on the text.

41 Ibid.

42 See n. 76 on the translation.

reincorporated into the main text by a later copyist, but in the wrong place (p. 474, lines 1–2).

From this last case, where the error occurred in two stages (first an omission with the correction in margin, and then reinsertion in main text), it is evident that our manuscript, or at least its calendar treatise (where this passage belongs), is the copy of a copy. This tells us something about the transmission of the text. Assuming, as argued above, that the earliest date for the *text* of the treatise is 1123/4, while the latest date for the *manuscript* as a whole is 1154/5, this calendar treatise must have been copied more than once in a relatively short period, which highlights the importance it must have held at least in the second quarter of the twelfth century.

The Text and the Translation: Introductory Notes

A. The Text

The edition presented here is a corrected version of the text. Erroneous letters or words in the manuscript that we have changed in our edition are indicated in the apparatus. Letters or words in the manuscript that appear to be superfluous, probably due to scribal error, have been retained in the edition but placed in parentheses. Letters and words that are not in the manuscript but appear to have been omitted by the scribe have been inserted in angle brackets. Errors that were corrected by the scribe himself, either by striking through the letters or by marking them for deletion with primes, have been retained in the main text as they appear in the manuscript. At the end of a line, the scribe frequently writes the first letter of the next; these “catch-letters” have been retained.

The layout, format, and style of the text in the manuscript, at least in the section written by the main scribe (i.e., the longest section, running from p. 453 to the end), is complex, with frequent use of indentations, spaces, bolded letters, large square letters, etc., not always warranted

by the contents of the text. Punctuation is very liberally used, but does not follow consistent rules. For technical reasons, it has not been possible to replicate these features or produce a “facsimile” edition. We have retained the pagination and lineation and have attempted to reflect some of the textual layout. In other respects, however, we have adopted layout, style, and punctuation that conform to modern usage.

B. The Translation

The translation is of our edited, corrected text on the facing pages. Superfluous letters or words in the manuscript have been ignored. Letters or words that are not in the manuscript and appear to have been omitted by the scribe have been inserted within angle brackets (they have also been inserted in angle brackets in our edition of the text). Numbers, words, or comments in parentheses have been added to the translation to facilitate comprehension. Our glosses, to elucidate the translation further, are in square brackets.

Numbers in the manuscript are sometimes represented by alphabetic numerals, sometimes by words, and sometimes by alphabetical numerals spelled out as words (e.g. *nun*, the name of the letter, for 50). An attempt has been made in this translation to reflect these various usages, but in some cases we have ignored the manuscript’s notation for the sake of clarity.

Three numbers joined by hyphens, such as 10-21-204 (starting on p. 459), represent days-hours-parts; here, 10 days, 21 hours, and 204 parts (an hour has 1080 parts). In the Hebrew text, this is commonly written as a single word (here יכארד).

The Text

[p. 451]

הרוצה לידע ולהבין יתן לבו לדעת באיזה בית הם משרתים ותמצ׳ כי החמה בין ביום בין בלילה משמש בבית אריה ואין לו רק בית אחד. ונוגה יש לו ב׳ בתים ביום בבית שור ובלילה בבית מאזנים כוכב יש לו ב׳ בתים ביום בבית (מאזנים) תאומים ובלילה בבית בתולה לבנה בין ביום בין בלילה משמש בבית סרטן שבתי יש לו ב׳ בתים ביום בבית גדי ובלילה בבית דלי צדק יש לו ב׳ בתים ביום ביום בבית קשת ובלילה בבית דגים מאדים יש לו ב׳ בתים ביום בבית טלה ובלילה בבית עקרב וסימניך ~ [a] ח׳א׳ נ׳ש׳ם׳ כ׳ת׳ב׳ לס׳ ש׳ג׳ד׳ צ׳ק׳ד׳ מ׳ט׳ע׳ ואילו יב׳ מזלות נחלקים לתולדותם אריה קשת טלה והסימן א׳ק׳ט׳ אש שור בתולה גדי תולדות עפר וסימן ש׳ב׳ג׳ תאומים מאזנים דלי תולדות רוח וסימן ת׳מ׳ד׳ סרטן עקרב דגים תולדות מים וסימן ס׳ע׳ד׳ ומעתה יבין באיזה שעה (אם) יהיה המולד החדש ואיזה

a This tilde may function as a colon.

Translation

[p. 451]

Whoever wants to know and understand should set his mind to know in which house they serve. And you will find that the sun serves both in the day and in the night in the house of Leo and has only one house. And Venus has two houses: in the day it is in the house of Taurus and in the night in the house of Libra. Mercury has two houses: in the day it is in the house of Gemini and in the night in the house of Virgo. (The) moon serves both in the day and in the night in the house of Cancer. Saturn has two houses: in the day it is in the house of Capricorn and in the night in the house of Aquarius. Jupiter has two houses: in the day it is in the house of Sagittarius and in the night in the house of Pisces. Mars has two houses: in the day it is in the house of Aries and in the night in the house of Scorpio. And this is a sign for you:[1] Su-♌ Ve-♉-♎ Me-♊-♍ Mo-♋ Sa-♑-♒ Ju-♐-♓ Ma-♈-♏. These 12 zodiac signs are divided according to their nature [i.e. one of the four elements]. Leo, Sagittarius, Aries—their sign is ♌♐♈— are Fire. Taurus, Virgo, Capricorn are of the nature of earth and their sign is ♉♍♑. Gemini, Libra, Aquarius are of the nature of air and their sign is ♊♎♒. Cancer, Scorpio, Pisces are of the nature of water and their sign is ♋♏♓.

And now one will understand[2] at which hour the conjunction of the month will occur and which zodiac sign will be serving at that

1 The names of the five planets, sun, moon and twelve signs of the zodiac are represented by initials in the Hebrew text, usually forming acronyms (as here). We have imitated this usage in the English translation, except for the zodiac signs, for which we have used the normal symbols: Aries ♈, Taurus ♉, Gemini ♊, Cancer ♋, Leo ♌, Virgo ♍, Libra ♎, Scorpio ♏, Sagittarius ♐, Capricorn ♑, Aquarius ♒, Pisces ♓ .

2 Perhaps: "work out."

מזל ישרת באותה שעה אם יהיה המולד בחמה החדש יהיה חם שחמה מנהיג אריה שהוא חם ואם המולד בנוגה יהיה קור ויבש לפי שמשרתי‹ו› תאומים ובתולה תאומים קור בתולה יבש אם המולד בלבנה יהיה גשם לפי שסרטן הוא מים ואם המולד בשבתי יהיה עפר ורוח כי משרתי‹ו› גדי ודלי גדי עפר ודלי רוח אם המולד בצדק החודש יהיה חם וגשם כי משרתיו קשת ודגים קשת חם ודגים ~~גשם~~ גשם ואם המולד במאדים יהיה החדש חם וגשם כי משרתיו טלה ‹ועקרב› טלה חם עקרב גשם וכאשר תבין ותדע מולד החדש באיזה יום ובאיזה שעה הגע עצמך מן המשרתים משמשים באותה שעה ובאיזה בית מן המזלות יהיה המולד החדש ואז תבין אם ימטר באותה חדש או יעשה שתים בינונים לא גשמים ולא דוכ (?) חמימות או רוח כי ט'א'ק' אש וחמים ויבשים וכוחם ~~במזוח~~ במזרח ואם יהיה המולי[b]

23 החדש] והחדש | 25 וחמים] ומים

b Abbreviation of מולד.

time. If the conjunction is in (the hour of) Sun,[3] the month will be hot, because the sun rules over Leo, which is hot. And if the conjunction is in (the hour of) Venus, it will be cold and dry, because its [Venus'] attendants are Gemini and Virgo: Gemini is cold, Virgo is dry. If the conjunction is in (the hour of) Moon there will be rain, because Cancer is water. And if the conjunction is in (the hour of) Saturn, there will be dust and wind, because its attendants are Capricorn and Aquarius: Capricorn is earth and Aquarius is air. If the conjunction is in (the hour of) Jupiter, the month will be hot and there will be rain, because its attendants are Sagittarius and Pisces: Sagittarius is hot and Pisces is rain. If the conjunction is in (the hour of) Mars, the month will be hot and there will be rain, because its attendants are Aries <and Scorpio>: Aries is hot, Scorpio is rain. And when you understand and know the day and hour of the conjunction of the month, note which attendants are serving at this hour and in which house of the zodiac signs the conjunction of the month will be. And then you will understand if it will rain during that month or if there will be two (zodiac signs) in combination, no rain and no heat or wind. For ♈♌♐ (Aries, Leo, Sagittarius) are fire and hot and dry and their strength is in the east, and if the conjunction of the

3 I.e., in an hour that is ruled by the Sun, according to the succession of planetary hours that determine the planetary week, as explained below (p. 453).

[p. 452c]

לבנה באותן בתים על ידיהן בא חמימות גדול לעולם ש׳ב׳ג׳ עפר קרים ויבשים והם בדרום אם יהיה המולד באותן בתים על ידיהם באים עיתים בינונים שיהו הימים ברורים לא קרים ולא חמים ת׳מ׳ד׳ רוח חמים רטיבים וכוחם במערב ועל ידיהם בא רוח לעולם אם המולד יהיה באותן בתים ס׳ע׳ד׳ מים קרים לחים והם בצפון ועל ידיהם יורדים גשמים ימות החודש אם יהיה המולד באותן בתים

	אב[d]	גד	הוז	חט	ייא	יביג	ידטו	יויזיח	יטכ כא	כב כג	כדכה	כוכז כח	כטל
ניסן	ט	ש	ת	ס	א	ב	מ	ע	ק	ג	ד	ד	ט
אייר	ש	ת	ס	א	ב	מ	ע	ק	ג	ד	ד	ט	ש
סיון	ת	ס	א	ב	מ	ע	ק	ג	ד	ד	ט	ש	ת
תמוז	ס	א	ב	מ	ע	ק	ג	ד	ד	ט	ש	ת	ס
אב	א	ב	מ	ע	ק	ג	ד	ד	ט	ש	ת	ס	א
אלול	ב	מ	ע	ק	ג	ד	ד	ט	ש	ת	ס	א	ב
תשרי	מ	ע	ק	ג	ד	ד	ט	ש	ת	ס	א	ב	מ
מרחשון	ע	ק	ג	ד	ד	ט	ש	ת	ס	א	ב	מ	ע
כסליו	ק	ג	ד	ד	ט	ש	ת	ס	א	ב	מ	ע	ק
טבת	ג	ד	ד	ט	ש	ת	ס	א	ב	מ	ע	ק	ג
שבט	ד	ד	ט	ש	ת	ס	א	ב	מ	ע	ק	ג	ד
אדר	ד	ט	ש	ת	ס	א	ב	מ	ע	ק	ג	ד	ד

c At the bottom of this page there are a few words in another hand, possibly much later insertions, which we have not been able to decipher or interpret.

d This row, which functions as the table header, is slightly detached from the table in the manuscript, but still reasonably well aligned with it (see Figure 1).

[p. 452]

moon is in these houses, they will bring great heat to the world. ♉♍♑ (Taurus, Virgo, Capricorn) are earth, cold and dry, and in the south; if the conjunction is in these houses, they will bring moderate weather,[4] (namely), the days will be clear, neither cold nor hot. ♊♎♑ (Gemini, Libra, Capricorn) are air, hot, wet, and their strength is in the west; and they will bring wind to the world, if the conjunction is in these houses. ♋♏♓ (Cancer, Scorpio, Pisces) are water, cold, humid, and they are in the north, and rain will fall on account of them (during) the days of the month if the conjunction is in those houses.

(Days) / (Months)	1,2	3,4	5,6,7	8,9	10,11	12,13	14,15	16,17,18	19,20,21	22,23	24,25	26,27,28	29,30
Nisan	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈
Iyar	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉
Sivan	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊
Tammuz	♋	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋
Av	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌
Elul	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍
Tishri	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎
Marḥeshvan	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏
Kislev	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐
Tevet	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
Shevat	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒
Adar	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓

[p. 453]

אילו שנים עשר מזלות ההולכים נגד החדשים מזל
בחדשו מזל בחדשו

אלול	אב	תמוז	סיון	אייר	ניסן
בתולה	**אריה**	**סרטן**	**תאומים**	**שור**	**טלה**

אדר	שבט	טבת	כסליו	מרחשון	תשרי
דגים	**דלי**	**גדי**	**קשת**	**עקרב**	**מאזנים**

וסימניך ט'ש'ת' ס'א'ב' מ'ע'ק' ג'ד'ד'

ואילו שבעה כוכבים המשרתים ביום ובלילה
חמה נוגה כוכב לבנה שבתי צדק מאדים
וסימניך ח'נ'כ'ל' ש'צ'ם'

וזה הילוכים כ'צ'נ'ש' ח'ל'ם' בלילות ‹ח'ל'ם'› כ'צ'נ'ש' בימים
וסימניך אם' כל' חי'.   כ'צ'נ'ש' לילות. ח'ל'ם' ימים.

3 תאומים] תאומם

[p. 453]

These are the 12 signs which go with the months,
each sign with its own month

Nisan	Iyar	Sivan	Tammuz	Av	Elul
Aries	**Taurus**	**Gemini**	**Cancer**	**Leo**	**Virgo**

Tishri	Marḥeshvan	Kislev	Tevet	Shevat	Adar
Libra	**Scorpio**	**Sagittarius**	**Capricorn**	**Aquarius**	**Pisces**

And their signs are ♈ ♉ ♊ ♋ ♌ ♍ ♎ ♏ ♐ ♑ ♒ ♓

Here are the seven planets that serve in the day and the night
Sun Venus Mercury Moon Saturn Jupiter Mars
And their signs are Su Ve Me Mo Sa Ju Ma

And this is their sequence: Me Ju Ve Sa Su Mo Ma in the nights,[5] <Su Mo Ma> Me Ju Ve Sa in the days,[6] and the sign is "mother of all life":[7]

4 The word in the Hebrew text is עיתים, used here in the Latin (*tempora*) or French (*temps*) sense of "weather."

5 Thus the first night of the week, which is the eve of Sunday (beginning at the end of the Sabbath, on Saturday night, as stated below), begins in the hour of Mercury; the second night (eve of Monday, beginning on Sunday night), in the hour of Jupiter; etc.

6 Thus the first day (which means specifically "daytime period") of the week, Sunday, begins in the morning in the hour of Sun; the second day, Monday, begins in the morning in the hour of Moon; etc.

7 The Hebrew text uses a well-known acronym based on Gen. 3:20: "Mother of all life" (אם כל חי). The words "all life" (כל חי) are the actual acronym but the word "mother" (אם) is kept for stylistic purposes and to help memorization. כ stands for: כ'צ'נ'ש' (MeJuVeSa); ל for: לילות (nights); ח for: ח'ל'ם' (SuMoMa); and י for: ימים (days).

ותדע בח'נ'כ'ל' ש'צ'ם' כי אמת הדבר הכל יודעים כי כוכב מתחיל לצאת במוצאי שבת. ועתה ספר דרך ח'נ'כ'ל' ש'צ'ם' כנגד שנים עשר ה' שעות שיש בלילה ותמצא שיבא חמה ביום ראשון.   וככה תמנה.   כוכב לבנה שבתי צדק מאדים חמה נוגה[e]

[p. 454]

שנת יג' למחזור ת'ת'ק'ט'ו' לעולם.   מולד תשרי ביום ה'   ב'ט'ו' שעות ות'ת'ר'ע'ח' י'ג'
חלקים.   ראש השנה בו ביום שלימין.   תקופת תשרי בט' שעות של

1 ות'ת'ר'ע'ח'] ת'ת'ר'ע'א'

e The catchword that follows—כוכב—does not correspond to the first word on p. 454, and the text is discontinuous (see Introduction).

MeJuVeSa for nights, SuMoMa for days.[8] And you can know (this) by means of SuVeMeMoSaJuMa.[9] For this is true, everyone knows that Mercury starts to come out at the end of the Sabbath. And now count through the sequence SuVeMeMoSaJuMa[10] of the twelve (hours of the night) the 5 (remaining) hours of the night[11] and you will find that Sun comes on the 1st day (Sunday). Count as follows: Mercury, Moon, Saturn, Jupiter, Mars, Sun, Venus, Mercury...[12]

[p. 454]

13th year of the cycle, (4)915 of the world era.[13] *Molad* of Tishri on the 5th day[14] at 15 hours and 1078 parts. New Year on that same day.

Inasmuch as the function of this "sign" (סימן) is mnemonic, it could equally be rendered "mnemonic"; on our translation of this term, see below n. 28.

8 MeJuVeSa is an abbreviation of the full sequence Me Ju Ve Sa Su Mo Ma, and SuMoMa of the full sequence Su Mo Ma Me Ju Ve Sa. The purpose of this repetition is to spell out the acronym more explicitly.

9 This is the consecutive order of the planets through all the hours of the week, starting with Sun in the first hour of Sunday morning.

10 But starting from Me (Mercury).

11 After the first seven hours of the night have been counted for each of the seven planets, another five remain to be counted.

12 The catchword "Mercury" is at the bottom of the page. The continuation of the text is presumably "Mercury, Moon, Saturn, Jupiter, Mars," followed by Sun in the first hour of Sunday morning.

13 The era counted from the Creation. This year is 1154/5 CE. The cycle year number is also indicated in the left margin of the manuscript (see text edition).

14 The 5th day of the week, i.e., Thursday, which begins on Wednesday evening and ends on Thursday late afternoon. Elsewhere in this text, a distinction is often made between day and night, so that "5th day" (for example) would mean specifically

יום ו' בי'ו' בחדש. שאלה בט'ו' בכסליו ביום ב'. תקופת טבת בד' שעות מחצה של ליל ז' בי'ח' בחדש. מולד ניסן ביום ז' בכ' שעות ות'ל'ו'. פסח ביום א'. תקופת ניסן בשעה ראשונה של יום ז' בכ'א' בחדש. תקופת תמוז בז' שעות ומחצה של יום ז' בכ'ג' בחדש. שנת יד' למחזור י'ד' ת'ת'ק'י'ו' לעולם מולד ‹תשרי› ביום ג' בת'ת'ע'ד' חלקים של שעה ראשונה ראש השנה בו ביום. כסידרן תקופת תשרי בג' שעות של ליל א' בכ'ז' בחודש. שאלה בכ'ז' בכסליו ביום ד'. תקופת טבת בי' שעות ומחצה של ליל א' בכ'ט' בחדש. עיבור. מולד ניסן ביום ו' בי'ז' שעות. ות'ת'ק'כ'ה' חלקים. פסח ביום ז' . תקופת ניסן בו' שעות של יום בב' בחדש. תקופת תמוז בשעה ומחצה של ~~א~~'[f] ליל ב' בה' בחדש. שנת ט'ו' למחזור ת'ת'ק'י'ז' לעולם. מולד תשרי ביום א' בכ'ב' ט'ו' שעות וש'פ'ג' חלקים. ראש השנה ביום ‹ב'›. שלימין. תקופת תשרי בט' שעות של ליל ב'ח'. בחדש.[g] שאלה בז' בכסליו ביום ה'

4 בי'ח] בט'ו' | ות'ל'ו'] ור'ל'ו' 9 בי'] בי'ב' 10 ו'] ז' 11 ות'ת'ק'כ'ה'] ות'ת'כ'ה' | בב'] בכ'

f An alternative reading might be **יו** (the beginning of **יום**, in error), struck through by the scribe.

g Three letters are erased in this space.

(The months are) full.[15] *Tequfah* of Tishri at 9 hours of the 6th day, the 16th of the month. Request (for rain) on the 15th of Kislev, on the 2nd day. *Tequfah* of Tevet at 4 and a half hours of the 7th night, the 18th of the month. *Molad* of Nisan on the 7th day at 20 hours and 436 parts. Passover on the 1st day. *Tequfah* of Nisan in the first hour of the 7th day, the 21st of the month. *Tequfah* of Tammuz at 7 and a half hours of the 7th day, the 23rd of the month.

14th year of the cycle, (4)916 of the world era. *Molad* <of Tishri> on the 3rd day, at 874 parts of the first hour. New Year on that same day. (The months are) regular.[16] *Tequfah* of Tishri at 3 hours of the 1st night, the 27th of the month. Request on the 27th of Kislev, on the 4th day. *Tequfah* of Tevet at 10 and a half hours of the 1st night, the 29th of the month. Intercalation.[17] *Molad* of Nisan on the 6th day at 17 hours and 925 parts. Passover on the 7th day. *Tequfah* of Nisan at 6 hours of of the 2nd day, the 2nd of the month. *Tequfah* of Tammuz at one and a half hours of the 2nd night, the 5th of the month.

15th year of the cycle, (4)917 of the world era. *Molad* of Tishri on the 1st day at 22 hours and 383 parts. New Year on the 2nd day. (The months are) full. *Tequfah* of Tishri at 9 hours of the 2nd night, 8th of the

the daytime period of Thursday, and "5th night" its night-time (extending from Wednesday evening to Thursday morning); day and night are each divided into 12 hours. This system is common in early medieval Hebrew calendrical works; it is used here, for example, for the date and time of the *tequfah*. In the context of the *molad*, however, night and day are not distinguished, and the "day"—extending from one evening to the following evening—is divided into 24 hours (thus here, for example, "15 hours" means halfway through the morning).

15 The months of Marḥeshvan and Kislev in this year are full (of 30 days).

16 Marḥeshvan is defective (29 days) and Kislev is full.

17 This means that at this point in the roster (between the *tequfah* of Tevet and the *molad* of Nisan), there is an intercalation, i.e., the insertion of a second month of Adar.

תקופת טבת בד' שעות ומחצה של יום ב' ט' בחדש. מולד ניסן ביום ד' בב' שעות (ומחצה) ות'ת'כ'א' חלקים. פסח ביום ה' תקופת ניסן בשעה ראשונה של ליל ג' בי'ג' בחדש. תקופת תמוז בז' שעות ומחצה של ליל ג' בט'ו' בחדש.

י'ו'

שנת י'ו' למחזור ת'ת'ק'י'ח' לעולם. מולד תשרי ביום ו' בז' שעות וק'ע'ט' חלקים. ראש השנה ביום ז'. חסירין תקופת תשרי בג' שעות של יום ג' בי'ח' בחדש. שאלה בי'ח' בכסליו ביום ו'. תקופת טבת ~~בא'~~[h] בי' שעות ומחצה של יום ג' בכ'א' בחדש. מולד ניסן ביום א'. בי'א' שעות ות'ר'י'ז' חלקים. פסח בו ביום. תקופת ניסן בו' שעות של ליל ד' בכ'ה' בחדש. תקופת תמוז בשעה ומחצ' של יום ד' בכ'ז' בחדש.

י'ז'

שנת י'ז' למחזור ת'ת'ק'י'ט' לעולם. מולד תשרי ליום ג'. בט'ו' שעות ות'ת'ר'נ'ה' חלקים. ראש השנה בו ביום. כסדרן תקופת תשרי בט' שעות של יום ד' בל' בחדש. שאלה בל' בכסליו ביום ז' תקופת טבת בד' שעות ומחצה של ליל ה' בד' בשבט עיבור מולד ניסן ביום ז' בט' שעות וק'כ'ו' חלקים. פסח בו ביום. תקופת ניסן בשעה

16 ב' ט'] ב'ט' 23 ות'ר'י'ז'] ותר'י'א' 26 ות'ת'ר'נ'ה'] ות'ת'ר'כ'ח' 28 בל'] בו'

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ראשונה של יום ה' בו' בחדש. תקופת תמוז בז' שעות ומחצ' של יום ה' בח' בחדש.

י'ח'

שנת י'ח' למחזור ת'ת'ק'כ' לעולם. מולד תשרי ביום ב' בי'ג' שעות ות'ק'ס'ד' חלקים. ראש השנה בו ביום. מליאין תקופת תשרי בג' שעות של ליל ו' בי'ב' בחדש. שאלה

h Unclear, struck through by the scribe.

month. Request on the 7th of Kislev, on the 5th day. *Tequfah* of Tevet at 4 and a half hours of the 2nd day, the 9th of the month. *Molad* of Nisan on the 4th day at 2 hours and 821 parts. Passover on the 5th day. *Tequfah* of Nisan at the first hour of the 3rd night, on the 13th of the month. *Tequfah* of Tammuz at 7 and a half hours of the 3rd night, the 15th of the month.

16th year of the cycle, (4)918 of the world era. *Molad* of Tishri on the 6th day at 7 hours and 179 parts. New Year on the 7th day. (The months are) defective. *Tequfah* of Tishri at 3 hours of of the 3rd day, on the 18th of the month. Request on the 18th of Kislev, on the 6th day. *Tequfah* of Tevet at 10 and a half hours of the 3rd day, the 21st of the month. *Molad* of Nisan on the 1st day, at 11 hours and 617 parts. Passover on that same day (of the week). *Tequfah* of Nisan at 6 hours of the 4th night, on the 25th of the month. *Tequfah* of Tammuz at one and half hours of the 4th day, on the 27th of the month.

17th year of the cycle, (4)919 of the world era. *Molad* of Tishri on the 3rd day at 15 hours and 1055 parts. New Year on that same day. (The months are) regular. *Tequfah* of Tishri at 9 hours of the 4th day, on the 30th of the month. Request on the 30th of Kislev, on the 7th day. *Tequfah* of Tevet at 4 and a half hours of the 5th night, on the 4th of Shevat. Intercalation. *Molad* of Nisan on the 7th day at 9 hours and 126 parts. Passover on that same day (of the week). *Tequfah* of Nisan at the first

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hour of the 5th day, on the 6th of the month. *Tequfah* of Tammuz at 7 and a half hours of the 5th day, on the 8th of the month.

18th year of the cycle, (4)920 of the world era. *Molad* of Tishri on the 2nd day at 13 hours and 564 parts. New Year on that same day. (The months are) full.[18] *Tequfah* of Tishri at 3 hours of the 6th night, on

18 Here and in the next entry, a different word is used for "full."

בי'א' בכסליו ביום ב'   תקופת טבת בי' שעות ומחצה של ליל ו'
בי'ג' בחדש.   מולד ניסן ביום ד' בי'ז' שעות ות'ת'ר'ב' חלקים.
פסח ביום ה'   תקופת ניסן בו' שעות של יום <ו'> בי'ו' בחדש.   תקופת
תמוז בשעה ומחצה של ליל ז' . בי'ט' בחדש   שנת
י'ט' י'ט' למחזור ת'ת'ק'כ'א' לעולם.   מולד תשרי ביום ו' וכב' שעות. וש'ס'
חלקים   ראש השנה ביום ז'.   מליאין.   תקופת תשרי בט' שעות
של ליל ז' בכ'ב' בחדש.   שאלה בכ'א' בכסליו ביום ג'.   תקופת
טבת בד' שעות ומחצה של יום ז' בכג' בחדש.   עיבור.
מולד ניסן ביום ג' בט'ו' שעות ות'ק'י'א' חלקים   פסח בה'
תקופת ניסן בשעה ראשונה של ליל א' בכ'ו' באדר השני.
תקפת תמוז בז' שעות ומחצה של ליל א' בכ'ט' בסיון.
בהשלמת מחזור ר'נ'ט'.   צמח לציון יחנט.

בעזרת קוני   אתחיל מחזור ר'נ'י'

א' שנת א' ת'ת'ק'כ'ב' לעולם.   ראש השנה ביום ז'   חסרין
תקופת תשרי בג' שעות של יום א' בב' בחדש.   שאלה בב'
בכסליו.יום ד'.   תקופת טבת בי' שעות וחצי ביום א'. ה' בחדש

14 השני] השיני

the 12th of the month. Request on the 11th of Kislev, on the 2nd day. *Tequfah* of Tevet at 10 and a half hours of the 6th night, on the 13th of the month. *Molad* of Nisan on the 4th day at 17 hours and 1002 parts. Passover on the 5th day. *Tequfah* of Nisan at 6 hours of the <6th> day, on the 16th of the month. *Tequfah* of Tammuz at an hour and a half of the 7th night, on the 19th of the month.

19th year of the cycle, (4)921 of the world era. *Molad* of Tishri on the 6th day and 22 hours and 360 parts. New Year on the 7th day. (The months are) full. *Tequfah* of Tishri at 9 hours of the 7th night, on the 22nd of the month. Request on the 21st of Kislev, on the 3rd day. *Tequfah* of Tevet at 4 and a half hours of the 7th day, on the 23rd of the month. Intercalation. *Molad* of Nisan on the 3rd day at 15 hours and 511 parts. Passover on the 5th day. *Tequfah* of Nisan at the first hour of the 1st night, on the 26th of the second Adar. *Tequfah* of Tammuz at 7 and a half hours of the 1st night, on the 29th of Sivan. At the completion of the 259th cycle, may the shoot bud for Zion![19]

With the help of my Creator, I start the cycle "rejoice" (260)[20]

1st year of the cycle, (4)922 of the world era. New Year on the 7th day. (The months are) defective. *Tequfah* of Tishri at 3 hours of the 1st day, on the 2nd of the month. Request on the 2nd of Kislev, on the 4th day. *Tequfah* of Tevet at 10 and a half hours of the 1st day, on the 5th of the

19 The "shoot" is a reference to the Messiah (see Jer. 23:5, 33:15, Zech. 3:8, 6:12). The word יחנט, translated here as "may … bud" (although it refers more accurately to the first formation of the fruit), rhymes with the number 259. This eschatological exclamation confirms that the text was composed before the end of the cycle, i.e., before 1160/1.

20 The Hebrew word for "rejoice" has the numerical value of 260, the number of the next cycle. This line also rhymes.

תקופת תמוז[i] בא׳ שעה ומחצה של יום ב׳ בי״א׳ בחדש.
ב׳ שנת ב׳ למחזור ת׳ת׳ק׳כ׳ג׳ לעולם. ראש השנה
ביום ג׳ כסדרן. תקופת תשרי בט׳ שעות של יום ב׳ בי״ד׳ בחדש
שאלה בי״ד׳ בכסליו יום ה׳. תקופת טבת בד׳ שעות ומחצה
של ליל ב׳ בי״ז׳ בחדש. תקופת ניסן בא׳ שעה[j] של יום ג׳
בכ׳ בחדש. תקופת תמוז בז׳ ע׳[k] שעות ומחצה של יום ג׳ בכב׳
ג׳ בחדש. שנת ג׳ למחזור ת׳ת׳ק׳כ׳ד׳ לעולם.

24 ה׳] א׳ 25 בי״ז׳] בי״ו׳ 26 בכב׳] כ׳ג׳

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ראש השנה ז׳ שלימין. תקופת תשרי בג׳ שעות של ליל ד׳ בכ׳ו׳ בחדש.
שאלה. בכ׳ה׳ בכסליו ביום ז׳.[l] תקופת טבת בי׳ ‹ומחצה› שעות של ליל ד׳ .
בכ׳ז׳ בחודש. תקופת ניסן בו׳ שעות של יום ד׳ בכ׳ט׳ בחודש ‹אדר שני›.
תקופת תמוז בשעה ראשונה ומחצה של ליל ה׳ בג׳ בחודש. ד׳
שנת ד׳ למחזור ת׳ת׳ק׳כ׳ה׳ לעולם. ראש השנה ביום
ז׳ שלימין תקופת תשרי בט׳ שעות של ליל ה׳ . בו׳[m] בחודש. שאלה.
ביום א׳ בה׳ בחודש. תקופת טבת בד׳ שעות ומחצה של יום ה׳.
בז׳ בחדש. תקופת ניסן בשעה ראשונה של ליל ו׳ בי״א׳ בו .
תקופת תמוז בז׳ שעות ומחצה של ליל ו׳ בי״ג׳ בחודש. ה׳
שנת ה׳ למחזור ת׳ת׳ק׳כ׳ו׳ לעולם. ראש השנה יום ה׳

2 בכ׳ה׳ בכסליו ביום ז׳] בכ׳ז׳ בכסליו ביום ב׳ 3 בכ׳ז׳] בכ׳ו׳ 6 ליל ה׳ . בו׳] ליל ו׳ בז׳ 7 א׳ בה׳] ה׳ בו׳ 9 בי״ג׳] בז׳

i The scribe has omitted the *tequfah* of Nisan.

j The form בא׳ שעה is ungrammatical and possibly due to French influence. It should be בשעה א׳.

k Letter written in error, marked for deletion with a prime.

l The manuscript reading is apparently a miscalculation.

m The manuscript reading is apparently a miscalculation.

month. *Tequfah* of Tammuz[21] at 1 and a half hour of the 2nd day, on the 11th of the month.

2nd year of the cycle, (4)923 of the world era. New Year on the 3rd day. (The months are) regular. *Tequfah* of Tishri at 9 hours of the 2nd day, on the 14th of the month. Request on the 14th of Kislev, on the 5th day. *Tequfah* of Tevet at 4 and a half hours of the 2nd night, on the 17th of the month. *Tequfah* of Nisan at the first hour of the 3rd day, on the 20th of the month. *Tequfah* of Tammuz at 7 and a half hours of the 3rd day, on the 22nd of the month.

3rd year of the cycle, (4)924 of the world era.

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New Year on the 7th day. (The months are) full. *Tequfah* of Tishri at 3 hours of the 4th night, on the 26th of the month. Request on the 25th of Kislev, on the 7th day. *Tequfah* of Tevet at 10 <and a half> hours of the 4th night, on the 27th of the month. *Tequfah* of Nisan at 6 hours of the 4th day, on the 29th of the month <of the second Adar>. *Tequfah* of Tammuz at the first hour and a half of the 5th night, on the 3rd of the month.

4th year of the cycle, (4)925 of the world era. New Year on the 7th day. (The months are) full. *Tequfah* of Tishri at 9 hours of the 5th night, on the 6th of the month. Request on the 1st day, on the 5th of the month. *Tequfah* of Tevet at 4 and a half hours of the 5th day, on the 7th of the month. *Tequfah* of Nisan at the first hour of the 6th night on the 11th of it.[22] *Tequfah* of Tammuz at 7 and a half hours of the 6th night, on the 13th of the month.

5th year of the cycle, (4)926 of the world era. New Year on the

21 The scribe has omitted the *tequfah* of Nisan.

22 I.e., of the aforementioned month, or of the month of the same name (Nisan).

כסדרן.   תקופת תשרי יום ו' ג' שעות יום ‹י'ו'› בו.   שאלה ביום ב'
י'ו' בכסליו.   תקופת טבת יום ו' י' שעות ומחצה י'ח' בחודש.
תקופת ניסן ‹ו' שעות› של ליל ז' בכ'ב' בחדש.   תקופת תמוז בשעה ראשונה
ומחצה של יום ז' בכ'ד' בו.   שנת ו' למחזור   ו'
ת'ת'ק'כ'ז' לעולם.   ראש השנה ביום ב' חסירין.   תקופת תשרי בט'
שעות של יום ז' בכ'ז' בו.   שאלה ביום ג' בכ'ז' בכסליו.   תקופת
טבת בד' שעות ומחצה של ליל א' . בב' בשבט.   תקופת ניסן בשע'
ראשונה של יום א' בד' בחודש.   תקופת תמוז בו' שעות ומחצה
של יום א' בו' בו.   שנת ז' למחזור ת'ת'ק'כ'ח' .   ז'
לעולם.   ראש השנה ביום ז'.   שלימין.   תקופת תשרי בג' שעות
של ‹ליל› ב'. בי' בחודש.   שאלה ביום ה' בט' בכסליו.   תקופת טבת
בי' שעות ומחצה של ליל ב' בי'א' בחדש.   תקופת ניסן בו' שעות
של יום ב' בי'ד' בחדש.   תקופת תמוז בשעה ראשונה ומחצה.
של ‹ליל› ג' בי'ז' בחדש.   שנת ח' למחזור ת'ת'ק'כ'ט'   ח'
לעולם.   ראש השנה ‹ביום› ה' חסירין.   עיבור.   תקופת תשרי בט'
שעות של ליל ג' כ' בחדש.   שאלה בכ' בכסליו. ביום ו'.
תקופת טבת' בד' שעות ומחצה של יום ג' . בכ'ג' בחדש.   תקופת
ניסן בשעה ראשונה של ליל ד' ' בכ'ו' בחדש ‹אדר שני›.   תקופת תמוז ' בז' שעות
ומחצה של ליל ד' בכט' בסיון.   שנת ט' למחזור   ט'
ת'ת'ק'ל' לעולם.   תקופת תשרי בג' שעות של יום ד' בב' בחדש.

11 כסדרן] שלימין   11-12 ביום ב' י'ו'] ביום א' בו'   13 ז'] ו'   16 ג'] ה'   21 בט'] בי'
26 ו›] ה›   30 בב'] בל'

5th day. (The months are) regular. *Tequfah* of Tishri on the 6th day, 3 hours, day <16> of it. Request on the 2nd day, on the 16th of Kislev. *Tequfah* of Tevet on the 6th day at 10 and a half hours, on the 18th of the month. *Tequfah* of Nisan at <6 hours> of the 7th night, on the 22nd of the month. *Tequfah* of Tammuz at the first hour and a half of the 7th day, on the 24th of it.

6th year of the cycle, (4)927 of the world era. New Year on the 2nd day. (The months are) defective. *Tequfah* of Tishri at 9 hours of the 7th day, on the 27th of it. Request on the 3rd day, on the 27th of Kislev. *Tequfah* of Tevet at 4 and a half hours of the 1st night, on the 2nd of Shevat. *Tequfah* of Nisan at the first hour of the 1st day, on the 4th of the month. *Tequfah* of Tammuz at 6 hours and a half of the 1st day, on the 6th of it.

7th year of the cycle, (4)928 of the world era world. New Year on the 7th day. (The months are) full. *Tequfah* of Tishri at 3 hours of 2nd <night>, on the 10th of the month. Request on the 5th day, on the 9th of Kislev. *Tequfah* of Tevet at 10 and a half hours of the 2nd night, on the 11th of the month. *Tequfah* of Nisan at 6 hours of the 2nd day, on the 14th of the month. *Tequfah* of Tammuz at the first hour and a half of the 3rd <night>, on the 17th of the month.

8th year of the cycle, (4)929 of the world era. New Year on the 5th <day>. (The months are) defective. Intercalation. *Tequfah* of Tishri at 9 hours of the 3rd night, on the 20th of the month. Request on the 20th of Kislev, on the 6th day. *Tequfah* of Tevet at 4 and a half hours of the 3rd day, on the 23rd of the month. *Tequfah* of Nisan at the first hour of the 4th night, on the 26th of the month <of the second Adar>. *Tequfah* of Tammuz at 7 and a half hours of the 4th night, on the 29th of *Sivan.*

9th year of the cycle, (4)930 of the world era. *Tequfah* of Tishri at 3 hours of the 4th day, on the 2nd of the month.

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שאלה בב'[n] בכסליו ביום ז'. תקופת טבת בי' שעות ומחצה של יום ד'
בד' בחדש. תקופת ניסן בו' שעות של ליל ה' בח' בחדש.
תקופת תמוז בשעה ראשונה ומחצה של יום ה' ' בי' בחדש.
י' שנת י' למחזור ת'ת'ק'ל'א' לעולם. תקופת תשרי
בט' שעות של יום ה' בי'ג' בו. שאלה בי'ב' בכסליו ביום א'.
תקופת טבת בד' שעות ומחצה של ליל ו' בט'ו' בחדש. תקופת
ניסן בשעה ראשונה של יום ו' בי'ח' בו. תקופת תמוז בז' שעות
י'א' ומחצה של יום ו' בכ' בחדש. שנת י'א' למחזור
ת'ת'ק'ל'ב' לעולם. תקופת תשרי בג' שעות של ליל ז' בכ'ד' בו.
שאלה בכ'ג' בכסליו ביום ג'. תקופת טבת בי' שעות ומחצה של
ליל ז' בכ'ה' בחדש. תקופת ניסן בו' שעות של יום ז' בכ'ה' באדר <שני>
תקופת תמוז בשעה ראשונה ומחצה של ליל א' בא' בחדש.
י'ב' שנת י'ב' למחזור ת'ת'ק'ל'ג' לעולם. תקופת תשרי
בט' שעות של ליל א' ' בד' בחדש שאלה ביום ד' בד' בכסליו.
תקופת טבת בד' שעות ומחצה של יום א' ו' בחדש. תקופת ניסן
בשעה ראשונה של ליל ב' בי' בחדש. תקופת תמוז בז' שעות
י'ג' ומחצה של ליל ב' בי'ב' בחדש. שנת י'ג' למחזור
ת'ת'ק'ל'ד' לעולם. תקופת תשרי בג' שעות של יום ב' בט'ו' בחדש
שאלה בט'ו' בכסליו. תקופת טבת בי' שעות ומחצה של יום
ב' בי'ח' בחדש. תקופת ניסן בו' שעות של ליל ג' בכ'ב' בחדש.
תקופת תמוז בשעה ראשונה ומחצה של יום ג' בכ'ד' בחדש.
י'ד' שנת י'ד' למחזור ת'ת'ק'ל'ה' לעולם. תקופת תשרי
בט' שעות של יום ג' בכ'ז' בחדש. שאלה בכ'ו' בכסליו.

1 בב' בכסליו ביום ז'] בל' בכסליו ביום ו' 5 שאלה בי'ב'] שאלה בי'ג' 8 ו'] ז' 10 בכ'ג' בכסליו ביום ג'] בכ'ד' בכסליו ביום ב' 11 ליל ז'] ליל ו' 14 ביום ד'] ביום ג' 20 בי'ח'] בה'

n The manuscript's error in the day of the month (ל') is consistent with its previous error, suggesting a calculation error or an erroneous scribal correction.

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Request on the 2nd of Kislev, on the 7th day. *Tequfah* of Tevet at 10 and a half hours on the 4th day, on the 4th of the month. *Tequfah* of Nisan at 6 hours of the 5th night, on the 8th of the month. *Tequfah* of Tammuz at the first hour and a half of the 5th day, on the 10th of the month.

10th year of the cycle, (4)931 of the world era. *Tequfah* of Tishri at 9 hours of the 5th day, on the 13th of it. Request on the 12th of Kislev, on the 1st day. *Tequfah* of Tevet at 4 and a half hours of the 6th night, on the 15th of the month. *Tequfah* of Nisan at the first hour of the 6th day, on the 18th of it. *Tequfah* of Tammuz at 7 and a half hours of the 6th day, on the 20th of the month.

11th year of the cycle, (4)932 of the world era. *Tequfah* of Tishri at 3 hours of the 7th night, on the 24th of it. Request on the 23rd of Kislev, on the 3rd day. *Tequfah* of Tevet at 10 and a half hours of the 7th night, on the 25th of the month. *Tequfah* of Nisan at 6 hours of the 7th day, on the 25th of <the second> Adar. *Tequfah* of Tammuz at the first hour and a half of the 1st night, on the 1st of the month.

12th year of the cycle, (4)933 of the world era. *Tequfah* of Tishri at 9 hours of the 1st night, on the 4th of the month. Request on the 4th day, on the 4th of Kislev. *Tequfah* of Tevet at 4 and a half hours of the 1st day, on the 6th of the month. *Tequfah* of Nisan at the first hour of the 2nd night, on the 10th of the month. *Tequfah* of Tammuz at 7 and a half hours of the 2nd night, on the 12th of the month.

13th year of the cycle, (4)934 of the world era. *Tequfah* of Tishri 3 hours of the 2nd day, on the 15th of the month. Request on the 15th of Kislev. *Tequfah* of Tevet at 10 and a half hours of the 2nd day, on the 18th of the month. *Tequfah* of Nisan at 6 hours of the 3rd night, on the 22nd of the month. *Tequfah* of Tammuz at the first hour and a half of the 3rd day, on the 24th of the month.

14th year of the cycle, (4)935 of the world era. *Tequfah* of Tishri at 9 hours of the 3rd day, on the 27th of month. Request on the 26th of

תקופת טבת בד' שעות ומחצה של ליל ד' בכ'ט' בחדש. תקופת ניסן בשעה ראשונה של יום ד' בב' בחדש. תקופת תמוז בז' שעות ומחצה של יום ד' בד' בחדש. שנת ט'ו' למחזור ת'ת'ק'ל'ו' לעולם. תקופת תשרי בג' שעות של ליל ה' בח' בחדש. תקופת טבת בי' שעות ומחצה של ליל ה' בי' בו. תקופת ניסן בו' שעות של יום ה' בי'ג' בחדש. תקופת תמוז בשעה ראשונה ומחצה של ליל ו' בי'ו' בחדש.

ט'ו'

23 שאלה בכ'ו] שאלה בכ'ז' 25 בב'] בכ'

[p. 458]

שנת י'ו' למחזור ת'ת'ק'ל'ז' לעולם. תקופת תשרי בט' שעות של ליל ו' בי'ט' בו. שאלה בי'ח' בכסליו. תקופת טבת בד' שעות ומ' ומחצה של יום ו' בכ' בחדש. תקופת ניסן בשעה ראשונה של ליל ז' בכ'ד' בו. תקופת תמוז' בז' שעות ומחצה של ליל ז' בכ'ו' בחדש.

י'ו'

זהו פירוש העיבור.

צרכין אנו לחשב חשבון הלבנה על פי הראייה דא' מר כזה ראה וקדש ולהשוות חשבון הלבנה לחשבון החמה כי התבואה גדילה לסדר התקופה כדי שיבא לך פסח בחדש האביב דכת' שמור את חדש האביב ועשית פסח ליי. עצרת בזמן ביכורים. סוכות בזמן אסיף. לכך סימנו לנו כנסת הגדולה.

2 בי'ח'] בט' 4 ליל ז'] ליל ו' 5 בכ'ו'] בכ'ז'

Kislev. *Tequfah* of Tevet at 4 and a half hours of the 4th night, on the 29th of the month. *Tequfah* of Nisan at the first hour of the 4th day, on the 2nd of the month. *Tequfah* of Tammuz at 7 and a half hours of the 4th day, on the 4th of the month.

15th year of the cycle, (4)936 of the world era. *Tequfah* of Tishri at 3 hours of the 5th night, on the 8th of the month. *Tequfah* of Tevet at 10 and a half hours of the 5th night, on the 10th of it. *Tequfah* of Nisan at 6 hours of the 5th day, on the 13th of the month. *Tequfah* of Tammuz at the first hour and a half of the 6th night, on the 16th of the month.

[p. 458]

16th year of the cycle, (4)937 of the world era. *Tequfah* of Tishri at 9 hours of the 6th night, on the 19th of it. Request on the 18th of Kislev. *Tequfah* of Tevet at 4 and a half hours of the 6th day, on the 20th of it. *Tequfah* of Nisan at the first hour of the 7th night, on the 24th of it. *Tequfah* of Tammuz 7 and a half hours of the 7th night, on the 26th of the month.

This is the explanation of the calendar[23]

We need to reckon the count of the moon on the basis of its sighting, as the talmudic sage said: "see (a crescent) like this and sanctify" (B *Rosh ha-Shanah* 20a); and (we need) to equalize the count of the moon with the count of the sun, because the crops grow according to the order of the solstices and equinoxes, so that Passover falls in the month of spring, as it is written: "observe the month of *aviv*, and keep the Passover unto the Lord,"[24] Pentecost at the time of the first fruits, Tabernacles at the

23 Or: "calendar calculation," or again, "intercalation."

24 Deut. 16:1. *Aviv* means spring; more precisely, the ripeness of the crop.

ג'ו'ח' י'א' י'ד' י'ז' י'ט'. וסימן שלש שלש שתים. שלש שלש שלש שתים.

שנת לבנה ש'נ'ד' ש'נ'ד' ימים ח' שעות ת'ת'ע'ו' חלקים. שכן עולה לחשבון רבן' גמליאל דא' לסוף פרק שיני דראש השנה כך מקובלניד מבית אבי אבא שאין חדשה של לבנה פחותה מכ'ט'.יום וחצי ושתי ידות שעה וע'ג' חלקים. ואנו יודעים שיש י'ב' חדשים בשנה כדכת' ויהי לשלמה שנים עשר נציבים על כל ישר' וכלכלו המלך[o] ואת ביתו חדש [ב]שנה יהיה על אחד לכלכל. ועתה יש לנו למנות י'ב' פעמים כ'ט' יום וחצי ושתי ידות שעה וע'ג' חלקים. ועכשיו חשוב י'ב' פעמים ל' ימים הם ש'ס' ימים. העבר מכל חדש חצי יום שהם ששה ימים וישארו ש'נ'ד' ימים. השתי ידות שעה עולים לי'ב' חדשים כ'ד' ידות. שלש ידות עושים שעה הרי ח' שעות. וי'ב' פעמים ע'ג' חלקים עולים ת'ת'ע'ו'. היאך י'ב' פעמים נ' הרי ו' מאות י'ב' פעמים כ' הן ר'ם' י'ב' ג' הן ל'ו' הרי לך

[p. 459]

ת'ת'ע'ו' חלקים נמצא כי שנים עשר' חדש עולין לחשבו' ש'נ'ד' ימים ח' שעות ת'ת'ע'ו' חלקים.

זו היא שנת לבנה.

שנת חמה. אנו יודעים שיש בשנה ד' תקופות כאשר הוזכרו במסכת עירובין.

o The verse (1 Kgs 4:7) in the Masoretic version reads differently, as follows: ולשלמה שנים עשר נצבים על כל ישראל וכלכלו את המלך ...

time of harvest. The Great Assembly gave us a sign for this: 3, 6, 8, 11, 14, 17, 19, and the sign three, three, two, three, three, three, two.

The lunar year is 354: (more precisely), 354 days 8 hours 876 parts. For this derives from the calculation of Rabban Gamaliel, who said at the end of the second chapter of (B) *Rosh ha-Shanah* (25a): “So I have received from the house of my father’s father, that the lunar month is no less than 29 and a half days and two-thirds of an hour and 73 parts.” And we know that there are 12 months in a year as it is written (1 Kings 4:7): “Solomon had twelve officers over all Israel, who provided victuals for the king and his household; each man had to make provision for a month in the year.” And now we must count 12 times 29 and a half days and two-thirds of an hour and 73 parts. And now calculate 12 times 30 days, and this equals 360 days. Deduct from each month half a day, which equals 6 days, and you are left with 354 days. In 12 months, the two-thirds of an hour equal 24 thirds of an hour. Three thirds make one hour, so this makes 8 hours. And 12 times 73 parts make 876. How? 12 times 50 equals 600, and 12 times 20 equals 240, 12 times 3 equals 36, behold, you have

[p. 459]

876 parts. As a result, 12 months come to the count of 354 days, 8 hours and 876 parts.

That is the lunar year[25]

Solar year: We know that in a year there are 4 *tequfot,* as mentioned in tractate *Eruvin* (56a): the *tequfah* of Nisan, the *tequfah* of

25 This title ends the previous section rather than heading the next one.

תקופת ניסן. תקופת תמוז. תקופת תשרי. תקופת טבת. ועולין ש׳ס׳ה׳ ימים ורביע יום. דא׳ שמואל ירחינאה אין בין תקופה לתקופה אלא צ׳א׳ יום ושבע שעות ומחצה . וכך תמנם ד׳ פעמים צ׳ הן שס׳ ימים וד׳ פעמים א׳ הם ד׳ ימים שים אותם על ש׳ס והיה ש׳ס׳ד׳ ימים וד׳ פעמים ז׳ שעות ומחצה הם יום אחד וו׳ שעות צרף אותו יום עם ש׳ס׳ד׳ ויהיה ש׳ס׳ה׳ הרי לך ש׳ס׳ה׳ ימים ורביע יום . שכך עולה שנת חמה. נמצא כי שנת חמה יתירה על שנת לבנה י׳כ׳א׳ר׳ד׳. י׳ ימים כ׳א׳ שעות ר׳ד׳ חלקים . כיצד כמה יש בש׳ס׳ה׳ יותר מב׳ש׳נ׳ד׳ י׳א׳ ימים וקח ח׳ שעות של ש שנת לבנה ושים אותם נגד הו׳ שעות של שנת חמה ונאשר בידך ב׳ שעות. וקח מי׳א׳ שיש לך יום אחד שיש בו כ׳ד׳ שעות קח מהם ב׳ שעות כנגד הב׳ שעות שיש לך וישארו לך כב׳ שעות וקח מהם שעה אחת והסר ממנה ת׳ת׳ע׳ו׳ חלקים וישאר ר׳ד׳ והי׳ ימים וכ׳א׳ שעות הרי י׳כ׳א׳ר׳ד׳. וראו חכמים שיותר מ׳ מדאי היה יתירה עונת חמה על שנת לבנה וציוו לעשות עיבור לג׳ שנים העולים לג׳ יכארדים וכך תמנה וקח ג׳ ~~ידין~~ יודין שהם ל׳ ימים והוצא מהם חדש אחד שיש בו כ׳ט׳ יום וחצי ושתי ידות שעה וע׳ג׳ חלקים שהם תש׳צ׳ג׳ ונותר לך יא׳ ור׳פ׳ז׳ י׳א׳ שעות ור׳פ׳ז׳ חלקים כי ת׳ש׳צ׳ג׳ ור׳פ׳ז׳ עושים שעה. צרף י׳~~כ~~[p] א׳ ר׳פ׳ז׳ עם הג׳ כארדים הנותרים ויעלה לך ג׳ב׳ ת׳ת׳צ׳ט׳ . היאך קח מן

9 א׳] ח׳

p An erroneous letter (not clearly כ) has been erased.

Tammuz, the *tequfah* of Tishri, the *tequfah* of Tevet; which come to 365 days and a quarter of a day. For Samuel Yarḥina'ah said: between one *tequfah* and the next, there are only 91 days and seven and a half hours (ibid.). And so you should count them: 4 times 90 equals 360 days, and 4 times 1 equals 4 days. Add them to the 360 and this equals 364 days. And 4 times 7 hours and a half equals one day and 6 hours. Add this day to the 364 (days) and this makes 365; and thus you have (in total) 365 days and a quarter of a day. For this is the total of the solar year.

As a result, the solar year exceeds the lunar year by 10-21-204: 10 days, 21 hours, 204 parts. How? How much is 365 is in excess of 354? 11 days. And take 8 hours of the lunar year and put them against the 6 hours of the solar year, and you are left with 2 hours. And take one day from the 11 (days) that you have, that is 24 hours; subtract 2 hours from them, to offset the 2 hours that you have, and you are left with 22 hours. And subtract from them [from the 22 hours] 1 hour, and subtract from it 876 parts, and 204 will remain, which with the 10 days and 21 hours equals 10-21-204.

And the Sages saw that the length of the solar year far exceeded the length of the lunar year, and they ordained to make an intercalation after 3 years, which amount to three 10-21-204s. And so you should count:

Take three 10s which equals 30 days, and subtract from them one month of 29 and a half days and two thirds of an hour and 73 parts, i.e. 793 (parts),[26] and you will be left with 11 and 287: 11 hours and 287 parts, because 793 plus 287 equals an hour. Add 11-283 to the remaining three 21-204s that are left, and this will come to 3-2-899. How? Take

26 This (29d 12h 793parts) is the length of the lunar month that is intercalated in the third year, which must be subtracted from the discrepancy between the lengths of the solar and lunar years that has accumulated (three times 10d 21h 204p).

הי״א׳ שעות ט׳ שעות והשלם הג׳ כא״ים הרי ג׳ ימים וב׳ שעות הנותרים מי״א׳ שעות הרי ג׳ב׳ ג׳ ימים וב׳ שעות (הנותרים מי״א׳ הרי ג׳ב׳ ג׳ ימים וב׳ שעות הנותרים)[q] והג׳ ר׳ד״ים הם ת׳ר״י׳ב׳ חלקים.

27 ג׳ב׳] ג׳כ׳

[p. 460]

צרף ת׳ר״י׳ב׳ ור׳פ׳ז׳ יחד. ויהיה ת׳ת׳צ׳ט׳ חלקים. וסמניך בשנת שלש לעיבור ג׳ב׳ ת׳ת׳צ׳ט׳ רבור[r]. לו׳ שנים תעשה עיבור ויעלו לג׳ב׳ ת׳ת׳צ׳ט׳. צרף יחד הב׳ גבין ת׳ת׳צ׳ט׳ין ותמצא ו׳ה׳ ת׳ש״י׳ח׳ ו׳ ימים ה׳ שעות תש״י׳ח׳ חלקים . היאך ב׳ פעמים ג׳ב׳ הם וד׳ ועשה מן הב׳

q The words in brackets are superfluous and repetitive, and probably a scribal error.
r Perhaps this is a scribal error for חבור ‘join’.

9 hours from the 11 hours, and add them up with the three 21s, this makes 3 days; and the 2 hours that remain from the 11 hours make 3-2: 3 days and 2 hours.[27] And three 204s equals 612 parts.

[p. 460]

Add together 612 and 287 and this equals 899 parts. And your sign is: “In the 3rd year of the intercalation (cycle), add (?) 3-2-899.”[28]

In the sixth year, make an intercalation, and this will amount to 3-2-899.[29] Add together the two 3-2-899s and you have 6-5-718: 6 days, 5 hours, and 718 parts. How? 2 times 3-2 equals 6-4, and from the two

27 The MS adds: “remaining from the 11 hours, thus 3-2: 3 days and 2 hours remaining” (this is probably an erroneous repetition).

28 This means that the solar year exceeds the lunar year, after the first three years of the 19-year cycle, by 3 days, 2 hours, and 899 parts. The word that we have translated “add” is textually problematic, but it is clearly intended to make a rhyme. It is unclear whether the purpose of this and the following rhymes or “signs” is specifically mnemonic, inasmuch as this is not a calculation that ever needed to be memorized or remembered. Instead, these signs could be serving the didactic purpose of highlighting the successive stages of the calculation. To avoid imposing any interpretation, we have consistently translated סימן not as “mnemonic” but as the more neutral “sign.”

29 I.e., the discrepancy between solar and lunar years that obtains from years 4–6 of the cycle, including the intercalation in year 6 (exactly the same as what has been calculated for the first three years of the cycle). The remainders of years 1–3 and of years 4–6 (both the same: 3-2-899) must be added together to obtain the total discrepancy that remains after the first 6 years of the cycle.

ת'ת'צ'ט'ין שעה אחת ושים אותה על הד' של ו'ד' ויהיה ו'ה' ועוד יש בידך ב' ת'ת'צ'ט'ין פחות ת'ת'ר'ף שלקחת מהם שעה נמצא ש' שנשאר ת'ש'י'ח' וסמניך ו'ה' ת'ש'י'ח' לעיבור שני להמשיח .

לח' שנים תעשה עיבור שלישי מן שני יכארדים ותקח מהן הב' יודין וב' כא' שהם ב' ימים מב' שעות וצרף עם הו' ימים וה' שעות של ו'ה' ת'ש'י'ח' ויהיו כ'ו' ימים ומ'ז' שעות וצרף יחד ב' פעמי' ר'ד' ות'ש'י'ח' ועשה מהם שעה ותראה מה ישאר בידך וחשוב כך קח ב' פעמים ר' והתיו של ת'ש'י'ח' הרי ת'ת' וקח ר'ף' מן השין הרי לך ת'ת'ר'ף' שהיא שעה שים אותה על מ'ז' ויהיו ב' ימים השלך אותם על כ'ו' ימים ויהיו כ'ח' ימים. וצרף ב' פעמים ד' חלקים שהם ח' עם הי'ח' ויהיו כ'ו' והכ' שנפרדת מן השין שלקחת ר'ף' הרי מ'ו' חלקים השלכם על כ'ח' ויהיה לך כחמו כ'ח' ימים מ'ו' חלקי' וסימניך ח'כ'מ'ו' לח' שנים עשר לא השלימו. ועתה אנו צריכין

9 וב' כא'] וב'יכא'

899s take one hour[30] and add it to the 4 of 6-4, and this makes 6-5; and you are left with the two 889s, less 1080 which you subtracted from them (to make up) an hour, which leaves as a result 718. And your sign is: “6-5-718 to measure the second intercalation.”[31]

In the 8th year, make a third intercalation, of two 10-21-204s[32]. Take from them the two 10s and two 21s which are 20 days 42 hours, and add (them) to the 6 days and 5 hours of 6-5-718, and this makes 26 days and 47 hours. Add together 2 times 204 and 718 and make up an hour from them, and see what you have left. And calculate like this: take 2 times 200 and the letter *taw* [ת = 400] from 718[33]—this equals 800; and take 280 from the *shin* [ש= 300]; and this [800+280 added together] gives you 1080 (parts), which is one hour; add it to (the) 47 (hours) and there are 2 days; add them to (the) 26 days and there are 28 days. And add together 2 times 4 parts, which makes 8, to the 18, and there are 26; and (with) the 20 that you separated from the *shin* [300] when you took 280, there are 46 parts. Add them to the 28 (days), and this makes 28-46: 28 days, 46 parts. And your sign is: “Be wise in the 8th year, the 12 (months) have not been completed.”[34] And now, we need to complete this (calculation with) the (intercalary)

30 I.e., subtract one hour (=1080 parts) from 2 × 899.

31 Again, in the Hebrew this makes a rhyme.

32 I.e., the discrepancy between solar and lunar years that has accumulated in the two years since the last intercalation.

33 It is conceptually easy for our author to break up 718 into components of 400 + 300 + 18, since 718 is written in Hebrew תשי"ח, representing 400+300+10+8.

34 The word חכמו (‘be wise”) is a rearrangement of the letters כ'ח'-מ'ו', 28-46. The meaning of this rhyme is obscure, but it is probably that the 12-month years that have been assumed so far for years 7–8 of the cycle have not completed the calculation, because year 8 is a 13-month year and the 13th (intercalary) month still needs to be accounted for.

להשלים על זה החדש א״ב׳ תש׳צ׳ג׳ פחות מ׳ו׳ חלקים הסר מ׳ו׳ מ׳ מת׳ש׳צ׳ג׳ וישאר לך ת׳ש׳מ׳ז׳ וסימנך א״ב׳ ת׳ש׳מ׳ז׳ לעיבור שלישי חסר רומז . לי״א׳ שנים עשה עיבור רביעי ונשאר לך מן הג׳ יכארדים ג׳ב׳ ת׳ת׳צ׳ט׳ הוצא מג׳ב׳ ת׳ת׳צ׳ט׳ א״ב׳ ת׳ש׳מ׳ז׳. והשלם החדש ונשאר א״ד׳ ק׳צ׳ב׳ . וסימניך א״ד׳ ק׳צ׳ב׳ לעיבור רביעי הועכב. ליד׳ שנים תעשה עיבור חמישי ונאשר לך מהג׳ יכארדים ג׳ב׳ ת׳ת׳צ׳ט׳. וא״ד׳ ק׳צ׳ב׳ שבידך צרף עמהם ויהיו ד״ו׳ ת׳ת׳ר׳נ׳א׳ ד׳ ימים י״ו׳ שעות ת׳ת׳ר׳נ׳א׳ חלקים. וסימניך ד״ו׳ ת׳ת׳ר׳נ׳א לעיבור חמישי חתור נא. ליז׳ שנים תעשה עיב׳עיבור ששי מג׳ יכארדים

20 לי״א׳] לי״א׳ ד׳

month:[35] 1-12-793[36] less 46 parts. Subtract 46 from 793 and you are left with 747. And your sign is: “For the third intercalation, 1-12-747 negatively hints.”[37]

In the 11th year, make a fourth intercalation. From the three 10-21-204s you are left with 3-2-899.[38] Subtract 1-12-747[39] from 3-2-89 and complete (thereby the calculation of) the month, and there remain 1-14-192. And your sign is: “1-14-192 at the fourth intercalation are retained.”

In the 14th year, make a fifth intercalation. From the three 10-21-204s you are left with 3-2-899. And add to them the 1-14-192 that you are holding and this will make 4-16-1051: 4 days, 16 hours, 1051 parts. And your sign is: “4-16-1051 at the fifth intercalation, dig now.”[40]

35 Here also the language is obscure, but the general meaning is clear. The 13th (intercalary) month of year 8 now needs to be accounted for in the calculation. In the 8th year, the excess of the solar year over the lunar year (28d 46 parts) is less than a lunar month, so that the subtraction of a whole lunar month from it (the intercalary month) will produce a negative result. Because medieval mathematics were not equipped to handle negative numbers, our author instead subtracts the remainder from the length of the month (i.e., the inverse operation), which yields the same result except that it is positive. Consequently, he must then explain that this positive result is really negative.

36 The length of the lunar month is 29d 12h 793 parts, but without explaining this, the author has already subtracted from it 28 days (of the remainder 28d 46 parts), yielding 1d 12h 793 parts—from which only 46 parts need now to be subtracted. The omission of this operation may be a scribal or authorial error.

37 “Negatively” (*lit.* “deficiently”) because 1-12-747 is really a negative value. Again, a rhyme.

38 Exactly as calculated for the first three years of the cycle.

39 As it is a negative value.

40 “Dig now” (Ezek. 8:8) appears to have no particular meaning in this rhyme.

ונאשר לך ג׳ב׳ ת׳ת׳צ׳ט׳ צרף ג׳ב׳ ת׳ת׳צ׳ט׳ ו׳ד״יו׳ ת׳ת׳ר׳נ׳א׳ יחד ויהיו ז׳ ימים וי״ט׳ שעות ת׳ת׳ע׳ חלקים. וסמיניך ז״יט׳ ת׳ת׳ע׳   לעיבור ששי נשתע.   לי״ט׳ שנים תעשה עיבור שביעי.   מב׳ יכארדים ונאשר לך שעה ות׳פ׳ה׳ .

[p. 461]

וכן חשוב צרף ב׳ יכארדים וז״יט׳ ת׳ת׳ע׳ הימים יעלו כ׳ז׳ ימים. ומן י״ט׳ שעות קח ו׳ שעות ותן על שני כ׳א׳ ויהיו ב׳ ימים הרי כ׳ט׳ ימים וי׳ג׳ שעות.   צרף ת׳ת׳ע׳ עם השני ר׳ד׳ין וכך חשוב הוצא מ׳ת׳ת׳ע׳ ת׳ש׳צ׳ג׳ ונשאר ע׳ז׳ צרף אותו ת׳ש׳צ׳ג׳ עם כ׳ט׳ ימים וי׳ג׳ שעות הרי לך עיבור החדש ושעה אחת יתירה.   צרף ע׳ז׳ עם שני ר׳ד׳ין ויהיה ת׳פ׳ה׳.   נמצא שעה ות׳פ׳ה׳ לעיבור שביעי הוסיפה התקופה   כך יתירה שנת חמה על שנת לבנה לי״ט׳ שנים שהוא סוף המחזור שעה ות׳פ׳ה׳.   החרש ואאלפך לדעת ולמצוא מולד שנה שאתה עומד בה כי על ידי מולד תדע על מרחשון‹וכסליו› אימתי מליאין אי מתי חסירין ואי מתי כסדר׳ וכל שאר חדשים לעולם לא ישתנו אחד מלא ואחד חסר דע כי

In the 17th year, make a sixth intercalation. From the three 10-21-204s you are left with 3-2-899.[41] Add 3-2-899 and 4-16-1051 and this will make 7 days and 19 hours 870 parts. And your sign is: "7-19-870 at the sixth intercalation is revered."[42]

In the 19th year, make a seventh intercalation from the two 10-21-204s, and you are left with one hour and 485.

[p. 461]

And so you should calculate: add two 10-21-204s to 7-19-870. The days equal 27 days. And from (the) 19 hours take 6 hours and add (them) to the two 21s, and this makes 2 days. This makes 29 days and 13 hours. Add 870 to the two 204s, and calculate like this: subtract 793 from 870 and the remainder is 77. Add this 793 to the 29 days and 13 hours and you get the intercalation of the month[43] and one extra hour. Add 77 to the two 204s and you get 485. Thus "in the seventh intercalation, the *tequfah* has added an hour and 485."[44] Thus after 19 years, which is the end of the cycle, the solar year exceeds the lunar year by one hour and 485 (parts).

"Be silent and I will teach you" (Job 33:33) how to know and find the *molad* of your current year, because from the *molad* you will know, regarding Marḥeshvan <and Kislev>, when they are full, when they are defective, and when they are regular. But all the other months never change, and they are full and defective in alternation.

41 The syntax is sloppy, but the meaning is clear.

42 *Lit.* "feared" (cf. Isa. 41:10), an unusual biblical verb used here to form a rhyme. We are grateful to Lenn Schramm for identifying this verb.

43 Intercalated in the 19th year, which must be subtracted from the remainder.

44 I.e., at the end of the seventh intercalation (and of the 19-year cycle), the *tequfah* (which tracks the solar year) exceeds the lunar cycle by 1h 485p. This sentence, again a rhyme, serves as the seventh and last sign.

מולד ראשון של תשרי של בריית עולם היה בליל ב' ה' שעו' ור'ד' חלקים לב'ה'ר'ד' סימן. צא וחשוב כל שנות העולם של ר'נ'ז' מחזורים והוציאם שבעה שבעה כי אילו היתה השנה שביעית היו כל השנים כולן מתחילין בשנה[s] ראשונה וכפי השנה יתירה על שביעיות כך היא נמשכת הלאה בתכלית שביעיות ה'יו' כ'ל' ה'שנים' כ'ו'לם.[t] ושנה של אחריה מתחלת מיד נמצא שבין שנה לשנה מונח אותו יתרון העודף על השביעיות וכפי אותו יתרון דולגת שנה מחברתה לכל חשבון מולד ותקופה עבר הכל שבעה שבעה ובתכלית כל שביעיותיך החזק ביתרון העודף ואחריהם תקבע תקופתך ומולדך .

נחזור על הראשונות.

צא וחשוב כל שנות העולם של ר'נ'ז' מחזורים ו'ה'וא'[u] והוציאם ז'ז' והפרט הנשאר בידך הוסף על לב'ה'ר'ד' ותדע באיזו יום ובאיזו שעה ובאיזה חלק ויבא לך מולד תשרי ראשון אשר בתחילת מחזור ר'נ'ח' ז'י' ת'ת'ל'ט' ואם לניסן אתה מונה על לד'ט' ת'ר'מ'ב' תוסיפהו ותמצא מולד ניסן ראשון

17 אחריה] אחרים 22 הראשונות] הראשותות 23 שנות] שעת | ר'נ'ז] ר'נ'ו'
26 ז'י'] זו

s Perhaps כשנה (suggestion of Lenn Schramm).

t These four words (ה'יו' כ'ל' ה'שנים' כ'ו'לם) are marked for deletion with primes; the scribe mistakenly copied them from two lines above, following the similar word שביעית/שביעיות, and then immediately realized his error. The fact that he copied the last of these words כולם, versus כולן two lines above, says something about the scribe's general lack of attention to detail. The scribe's error, however, appears to have gone much further (although this may have been a fault in his master copy), because the line preceding these four words (וכפי ... שביעיות) appears to belong at the end of this present line (after מיד). It seems that the full text should read as follows:

כי אילו היתה השנה שביעית היו כל השנים כולן מתחילין כשנה ראשונה ושנה של אחריה מתחלת מיד. וכפי השנה יתירה על שביעיות כך היא נמשכת הלאה בתכלית שביעיות

u An error; the letters are marked for deletion with primes.

Know that the first *molad* of Tishri of the Creation of the world was on the 2nd night, 5 hours, and 204 parts; the sign is n2-5-204.[45] Now add up (the lengths of) all the years of (the era of) the world through 257 cycles, and cast out all sevens.[46] For[47] if (the length of) the year were a (multiple of) seven,[48] every year would begin like the first year,[49] and the next year would start immediately (afterwards). But as much as the year exceeds the sevens, so it extends further, after casting out all sevens. As a result, between (the end of) one year and (the beginning of) the next there is an excess that remains over the sevens, and it is by that remainder that the year skips forward from the previous one, for every calculation of the *molad* and *tequfah*. Cast out all the sevens until all your sevens are finished, hold on to the remainder, and then determine your *tequfah* and your *molad*.

Let us go back to where we were

Calculate (the length of) all the years of (the era of) the world through 257 cycles, and cast out the (days) by sevens, and add the remainder that is left to n2-5-204, and you will know on which day and at which hour and which part (the *molad* will occur). And you will obtain the *molad* of the first Tishri that is at the beginning of the 258th cycle: 7-10-839. And if you count from Nisan, add it (the remainder) to

45 The "n" stands for "night" (translating ל in the text).

46 I.e., cast out all multiples of seven days. This can be done because we are seeking only to determine the day of the week of any given *molad*.

47 The text at this point is very faulty. The translation of the next two sentences follows our textual reconstruction (see note t on the Hebrew text), which remains somewhat obscure, although the general meaning is plain. The second sentence ("But as much …") appears tautological; its point is that the length of the year extends beyond an exact multiple of seven.

48 I.e., a multiple of seven days exactly, with no excess (of days, hours, or parts).

49 I.e., on the same day of the week and at the same time of the day as the first year.

שבתחילת מחזור ר'נ'ח' ב'ט'ו' ק'צ'ז' סימן. תחילה הוצא מחזור אחד ראשון ז'ז' ותדע כמה הוא מותיר על ז'ז' אחד כולם יחד. הרי אמרנו למעלה כי שנה הפשוטה

28 ק'צ'ז'] ק'צ'ד' 29 ותדע] ות'ת'ע'

[p. 462]

ש'נ'ד' ימים ח' שעות ת'ת'ע'ו' חלקים. הש'נ' ימים יוצאין ז'ז' ונשאר (דע) ד'ח' ת'ת'ע'ו'. לשנה מעוברת מוסיף כ'ט' ימים וחצי ות'ש'צ'ג' חלקים . הכ'ח' יוצאים ז'ז' ונשאר לך א'י'ב' ת'ש'צ'ג . הוסף א'י'ב' ת'ש'צ'ג' על ד'ח' ת'ת'ע'ו' ויהיה לך ה'כ'א' ת'ק'פ'ט'. וסימניך ד'ח' ת'ת'ע'ו'. לשנה הפשוטה הוקבעו. ה'כ'א' ת'ק'פ'ט' לשנה מעוברת חוק ומשפט. ובמחזור יש י'ב' פשוטין וז' מעוברין. הרי י'ב' ד'ח' ת'ת'ע'ו' וז' ה'כ'א ת'תק'פ'ט' צרף יחד והוצא ז'ז' וכן חשוב. י'ב' דלתין עושין מ'ח' ימים השלך מ'ב' ז'ז' ונ' ונשאר ו' ימים וקח י'ב' ח' שעות ג' חיתין עושין יום אחד כ'ד' שעות ליום. יב חיתין עושין ד' ימים צרף עם ו' ימים ויהיו י' ימים השלך ז' ונשארו ג' ימים. חשוב ה'כ'א' ת'ק'פ'ט' הז' ה' (אין) עושין ל'ה' ימים ויוציאים כלם ז'ז' והשליכם . תקח הז' כאין וחשוב הו' כאין עושין ו' ימים אלא שחסר מכל כא' ג' שעות שהן י'ח' שעות לו' כאין קח יח' שעות מן הכא השביעי

1 הש'נ'] השין 9 וקח] יקח 11 הז' ה'] הזה

n4-9-642 and you will obtain the *molad* of the first Nisan that is at the beginning of the 258th cycle: its sign is 2-15-197.[50]

First, cast out the 7s of one first cycle, and you will know how much it (a cycle) exceeds the sevens, once and for all.[51] We have said above that a plain year is

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354 days 8 hours 876 parts. The 350 days are cast out by 7s, and what remains is 4-8-876. For an intercalated year, add 29 days and a half and 793 parts. The 28 (days) are cast out by 7s, and you are left with 1-12-793. Add 1-12-793 to 4-8-876 and you will get 5-21-589. And the sign for you is: "4-8-876 for a plain year were fixed, 5-21-589 for an intercalated year is a statute and law."[52] There are 12 plain and 7 intercalated (years) in a cycle. This comes to twelve 4-8-876 and seven 5-21-589; add (them) together, and cast out 7s, and perform the calculation:

12 fours equal 48 days, cast out 42, i.e. by 7s, and the remainder is 6 days; and take 12 (times) 8 hours, (of which) three 8s make one day, i.e. 24 hours per day, twelve 8s make 4 days; add (them) to 6 days, and this makes 10 days; cast out the 7, and the remainder is 3 days.[53]

Calculate 5-21-589: the seven 5s make 35 days, and are all cast out by 7s, and cast them out. Take the seven 21s and calculate: six 21s make 6 days, except that for every 21 there are 3 hours short, which equal 18

50 The calculation will now be explained.

51 Conjectural translation; the meaning of the Hebrew is unclear.

52 In this context, the "sign" is clearly intended to be mnemonic. See above, n. 28.

53 This is the remainder of the twelve plain years in the 19-year cycle, obtained by adding up 4 days and 8 hours for each year (and casting out multiples of 7 days), but momentarily ignoring the 876 parts for each year (this will be calculated later).

הרי ו׳ ימים וג׳ שעות צרף עם הג׳ ימים שנשארו לך הרי ט׳
ימים וג׳ שעות השלך הז׳ ונשאר ב׳ ימים וג׳ שעות. ב׳ג׳ סימן.
חשבתי הימים והשעות צא וחשוב החלקים. דע
כי ת׳ת׳ע׳ו׳ ור׳ד׳ עושין שעה. ות׳ק׳פ׳ט׳ עושה שני רדין וק׳פ׳א׳ .
נמצא כי שני ת׳ת׳ע׳ו׳ ות׳ק׳פ׳ט׳ עושין שתי שעות וק׳פ׳א׳ .
י׳ב׳ ת׳ת׳ע׳ו׳ וו׳ ת׳ק׳פ׳ט׳ין עושין י׳ב׳ שעות וו׳ ק׳פ׳א׳ין ששה פעמים
ק׳פ׳א׳ עושין שעה וששה חלקים הרי לך י׳ג׳ וששה חלקים צרף
הששה חלקים עם ת׳ק׳פ׳ט׳ שביעי הנשאר לך הרי י׳ג׳ שעות
ות׳ק׳צ׳ה׳ חלקים . צרף עם ב׳ג׳ של מעלה הרי ב׳ ימים י׳ו׳ שעות
ת׳ק׳צ׳ה׳ חלקים. וסימניך בי׳ו׳ ת׳ק׳צ׳ה׳ (חלקים)[v]
לכל מחזור ומחזור נמצא.
חשבון אחר.
הרי ידעתי כי שנת חמה ש׳ס׳ה׳ ימים ורביע יום. ויוצאין
כולם ז׳ז׳ חוץ מיום ורביעי. לי׳ט׳ שנים של מחזור נשאר
י׳ט׳ ימים וי׳ט׳ רבעים הי׳ו׳ רביעים עושים ד׳ ימים ונשאר ג׳ רבעי
שהם י׳ח׳ שעות. צרף ד׳ ימים ליט׳ ימים הרי כ׳ג׳ ימים .

16 וג׳ (primus)] וב׳

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וי׳ח׳ שעות השלך כ׳א׳ ימים ז׳ז׳ וישאר ב׳ ימים וי׳ח׳ שעות בי׳ח׳ סימן .
הוצא שעה ות׳פ׳ה׳ ע׳ו׳ש׳י׳ן׳ ש׳עה׳ א׳חת׳[w] שיתירה החמה על

v This word is superfluous, as it breaks the rhyme, and probably an error.

w These three words (ע׳ו׳ש׳י׳ן׳ ש׳עה׳ א׳חת) are erroneous and marked for deletion with primes.

hours for the six 21s; take 18 hours from the seventh 21, this equals 6 days and 3 hours.[54]

Add this to the 3 days that were left, this equals 9 days and 3 hours; cast out the 7 and the remainder is 2 days and 3 hours: 2-3 is the sign.

I have calculated the days and the hours; now calculate the parts. Know that 876 and 204 make one hour, and 589 is two 204s plus 181. As a result, two 876s and 589 make two hours and 181; 12 (times) 876 and six 589s make 12 hours and six 181s. Six times 181 make an hour and six parts; thus you have 13 (hours) and six parts. Add the six parts to the seventh 589 that remains, this equals 13 hours and 595 parts.

Add (them) to the 2-3 from above, and the result is 2 days 16 hours 595 parts. And the sign for you is: “2-16-595 in every cycle is found.”[55]

A different calculation

I know that the solar year is 365 days and a quarter day. And they are all cast out by 7s except for one day and a quarter. For 19 years of the cycle the remainder is 19 days and 19 quarters; the 16 quarters make 4 days, and there remain 3 quarters, which are 18 hours. Add 4 days to 19 days, and this makes 23 days

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and 18 hours. Cast out 21 days by 7s, and the remainder will be 2 days and 18 hours; the sign is 2-18.[56] Subtract the one hour and 485 by which

54 Six days = six 21s (hours) + 18 hours; and three hours = 21h—18h.

55 I.e., this is the remainder of the *molad* calculation for every 19-year cycle. This value must be added to the first *molad* of the previous cycle to obtain the first *molad* of the next cycle.

56 The remainder of the solar year or *tequfah* calculation for every 19-year cycle. This value must be added to the *tequfah* of the beginning of the 19-year cycle to obtain the *tequfah* of the beginning of the next cycle.

הלבנה מי'ח' שעות ונשארו לך לי'ט' שני לבנה בעיבוריה ב' ימים י'ו' שעות ת'ק'צ'ה' חלקים כי ת'ק'צ'ה ותפה עושין שעה אחת.

ו'ם'[x] ועכשיו חשוב י'ט'[y] בי'ו' ת'ק'צ'ה'י'ן' לכמה עולה כשתוצ' כשתוציאם ז'ז' הב' של בי'ו' ת'ק'צ'ה' לר'נ'ז' מחזורים כשתוציאם פ' פרוטרוט נשאר לך ג' ימים. קח מן הי'ו' י'ב' שעות ועולים לך לר'נ'ז' מחזורים ר'נ'ז' חצאי ימים הרי ~~כר~~[z] ק'כ'ח' ימים וי'ב' שעות כשת' כשתוציאם פרוטרוט נשאר לך ב' ימים וי'ב' שעות. בי'ב' סימן.

צרפה עם הג' ימים הרי ה' ימים וי'ב' שעות קח הד' שעות שהפרדת מהי'ו' שעות ויעלו לך לר'נ'ז' מחזורים אלף וכ'ח' שעות. צרף עמהם הי'ב' שהיה לנו הרי אלף ומ' שעות האלף שעות עושין ‹מ'› יום ומ' שעות כי כל מאה שעות עושין ד' ימים וד' שעות. צרף הימים שהיה לנו עם המ' ימים הרי מ'ה' ופ' שעות והפ' שעות עושין ג' ימים וח' שעות הרי מ'ח' ימים וח' שעות השלך מ'ב' ז'ז' ונשאר לך ו' ימים וח' שעות. ‹ו'ח'› סימן חשוב ה'ת'ק'צ'ה'ין

8 ר'נ'ז'] ר'נ'ד' 9 פרוטרוט] פרוטרור 11 שעות שהפרדת] ימים שהפרדת

x This may be the end of a word which has been erased.

y This seems like an error; one would expect ר'נ'ז'. A small ר could have been read as י, and the sequence נז could have been read as ט. This error might have been reinforced by the calendrical significance of the number 19.

z An error. The scribe might have tried to write כ'ח', but then corrected himself mid-way.

the sun exceeds the moon[57] from the 18 hours, and the remainder for the 19 lunar years with intercalations is 2 days 16 hours 595 parts, because 595 and 485 equals one hour.[58]

And now calculate how much 257[59] 2-16-595s comes to.[60] When you cast out 7s (from) the 2s of 2-16-595 (that add up) through 257 cycles, when you cast them out, the remainder is 3 days.[61]

Take from the 16 [of 2-16-595] 12 hours, and for 257 cycles, they will come to 257 half days, which is 128 days and 12 hours; when you cast them [7s] out, the remainder you are left with is 2 days and 12 hours. 2-12 is the sign.

Add it to the 3 days, this equals 5 days and 12 hours.

Take the 4 hours which you separated from the 16 hours, and for 257 cycles they come to 1028 hours. Add to them the 12 (hours) that we are holding, this makes 1040 hours. The 1000 (of these 1040) hours equal <40> day(s) and 40 hours, because every 100 hours equal 4 days and 4 hours. Add the days that we had to the 40 days, this equals 45 (days) and 80 hours;[62] and the 80 hours equal 3 days and 8 hours. Now there are 48 days and 8 hours; cast out 42 by 7s and you are left with 6 days and 8 hours. <6-8> is the sign.[63]

57 As calculated earlier, this is the excess of the solar years over the lunar years at the end of the 19-year cycle.

58 This is the same result as obtained from the previous calculation (above, n. 55).

59 Following our textual conjecture. The MS reads "19."

60 The *molad* of the end of the 257th cycle—in which the author is presumably writing—is about to be calculated by multiplying the remainder of a single cycle (2 days 16 hours 595 parts) 257 times.

61 Because 2 × 257 (mod 7) = 3.

62 These 80 are the sum of 40 hours (of the 1040 - 1000 hours) + 40 hours (of the 40 days and 40 hours).

63 This is the result of the multiplication of the days (2) and hours (16) by 257. Now the parts (595) need to be multiplied by 257 and added to the intermediate result.

קח לך מכל ת’ק’צ’ה’ ת’ק’ם’ שהוא חצי שעה הרי לך לר’נ’ז’ מחזורים ק’כ’ח’ שעות נ’ה’ים ות’ק’ם’ ואחר כך חשוב הנשארים מת’ק’ם’ ויע’ ויעלו לך י’ג’ שעות וצ’ה’ חלקים. י’ג’ צ’ה’ סימן. צרף י’ג’ שעות עם ק’כ’ח’ (הרי ק’כ’ח’) הרי ק’מ’א’ . צרף צ’ה’ חלקים עם ת’ק’ם’ הרי ת’ר’ל’ה’ חלקים. נמצא ר’נ’ז’ ת’ק’צ’ה’ין ק’מ’א’ ות’ר’ל’ה’ חלקים. צרף הח’ שעות מ’ו’ח’ עם ק’מ’א’ שעות הרי ק’מ’ט’ ש’ שעות שהן ו’ ימים וה’ שעות. צרף עמהם ו’ ימים מ’ו’ח’ הרי יב’ וה’ שעות הוצא ז’ ימים ונשארו ה’ ימים וה’ שעות ות’ר’ל’ה’ חלקים. ה’ה’ת’ר’ל’ה’ סימן. הנ’ה’ין חשוב כך כ’ נ’ד’ין עושין שעה (כיצד כ’ נונין עושין שעה) כיצד כ’ נונין עושין אלף כ’ פ’ פעמים ד’ עושין פ’ הרי שעה נמצא ק’ נהין עושין ה’ שעות וק’ חלקים. ור’ נהין עושין י’ שעות ור’ חלקים. ור’נ’ נהין עושין יב’ שעות וחצי ור’נ’ חלקים נשארו ז’ נהים . צרף ז’ נונין ור’נ’ (יב’ שעות) הרי ת’ר’ הוצא ממנו ת’ק’ם’ להשלים י’ג’ שעות

24 ז’] ד’ 25 הנ’ה’ין] הינהין 28 ור’נ’] ור’ז’ 29 ור’נ’] ור’יו’ 30 ור’נ’] ור’ז’ י’ג’] י’ו’

[p. 464]

נשארו ס’ חלקים. צרף הס’ חלקים והז’ האין העושים ל’ה’ חלקים הרי צ’ה’ חלקים. וסימן י’ג’ ד צ’ה’.

דרך אחרת למצוא המולד.

1 והז’] והי’

Calculate the 595s. Take 540, which is half an hour, from every 595; for 257 cycles you have 128 hours, (the) 55s,[64] and 540.

And after that calculate the remainder from 540 [i.e. the 55s]; it comes to 13 hours and 95 parts.[65] 13-95 is the sign.

Add (the) 13 hours to 128, this makes 141. Add (the) 95 parts to 540, this makes 635 parts. The result of 257 times 595s (parts) is 141 (hours) and 635 parts.

Add the 8 hours of 6-8 to 141 hours; this equals 149 hours, or 6 days and 5 hours. Add to them (the) 6 days of 6-8; this equals 12 (days) and 8 hours. Cast out 7 days, and the remainder is 5 days and 5 hours and 635 parts. 5-5-635 is the sign.[66]

Calculate the 55s[67] thus. Twenty 54s equal an hour. How? Twenty 50s equal 1000, 20 times 4 equals 80; this [1000 + 80] equals an hour. As a result, a hundred 55s equal 5 hours and 100 parts. And two hundred 55s equal 10 hours and 200 parts. And two hundred and fifty 55s equal 12 and a half hours and 250 parts. Seven 55s remain. Add seven 50s to 250, which makes 600. From this take 540 [= half an hour], in order to complete 13 hours.

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What remains is 60 parts. Add the 60 parts to the 7 fives, i.e., 35, and this equals 95 parts. And the sign is 13-95.[68]

Another way of finding the *molad*

64 The remainder of 595 - 540. This mention of the 55s is slightly out of place.

65 How this result (of 257 × 55 parts) can be calculated will be explained very soon. The author is skipping this step now because he is anxious to reach the end of the calculation.

66 This is the result of 257 × 2-16-595, i.e., the remainder of the *molad* calculation after 257 cycles.

67 I.e., the step that was skipped earlier: 257 × 55 parts.

68 The result that was used above (see n. 65).

חשוב כל שנות העולם הם פשוטים והוצא חדשי עיבורייתן מתוכן ועשה מכל י'ב' חדשים שנה וראה לכמה שנים יעלו והוסיפם על שנות העולם ותבללם בכלל אחד והוצא מכל שנה ד'ח' ת'ת'ע'ו' והוציאם ז'ז' ותראה מה נשאר בידך וכן חשוב יום לב' יום לג' יום לל' ושעה לתשעים. יום לב' הד' של ד'ח' ת'ת'ע'ו' עושה ח' ימים לשתי שנים הוצא ז' נשאר יום אחד הרי יום לב' יום לג' הח' שעות של ד'ח' ת'ת'ע'ו' עושים יום אחד לשלש שנים הרי יום לג' יום לל' מ'ת'ת'ע'ו' חלקים הוצא י'ב' חלקים ונשאר ת'ת'ס'ד'. חמשה ת'ת'ס'ד'ין עושין ד' שעות.האיך חשוב ד' פעמים ת'ת'ר'פ' ד' פעמים ת'ת'ר' הם מ' מאות ויהיו מג' מאות[aa] הרי לך כי ד' שעות מ'ג' מאות ועשרים חלקים וחמשה פעמים ת'ת'ס'ד' עולה

5 י'ב'] י'ט'

aa The three words ויהיו מג' מאות appear to be erroneous and may be the result of homoioteleuton. Something appears to be missing here (see translation).

Calculate[69] all the years of (the era of) the world[70] (as if they were) plain, removing the intercalary months from them, and turn every 12 (of these intercalary) months into a year, and see how many years they [i.e. these made up years] come to. Add them [these made up years] to the years of the world, lump them all together, and deduct[71] 4-8-876 from each year and cast out 7s, and see what you are left with.

And so calculate: one day for 2, one day for 3, one day for 30, and one hour for 90.[72]

One day for 2 (years). The 4 of 4-8-976 come to 8 days every two years; cast out 7, the remainder is one day. That is, one day for 2 (years).

One day for 3 (years). The 8 hours of 4-8-976 come to one day every three years. That is, one day for 3 (years).

One day for 30 (years). Subtract 12 parts from 876 parts; the remainder is 864. Five 864s equal 4 hours. How? Calculate 4 times 1080:[73] 4 times 1000 is 4000,[74] so 4 hours are four thousand three hundred and twenty parts, and five times 864 come to the same result

69 Or: "Consider."

70 I.e. from Creation to the present.

71 If 4-8-876 is deducted from a plain year, the remainder is 350 days, a multiple of seven that is automatically cast out. So the text; but this deduction does not make much sense in context. What the author really means is that 4-8-876 should be taken for each of these years (since they have only 12 months) and summed; the final result, modulo 7, added to the *molad* of the Creation (the epoch), is the *molad* of the current year.

72 I.e., add up, for the calculation of the *molad*, one day for every 2 years, one day for every 3 years, one day for every 30 years, and one hour for every 90 years, using the total number of 12-month years that has been calculated above.

73 Rather than demonstrating his calculation through the multiplication of 864, he demonstrates it through his projected result: 4 days, or 4 × 1080 parts.

74 The text at this point is incomprehensible. One would expect to find: "and four times 80 is 320."

כך ותשכח. לשלשים שנה עושין הת׳ת׳ס׳ד׳ין יום אחד. כי בשלשים ת׳ת׳ס׳ד׳ין יש ו׳ פעמים ה׳ ת׳ת׳ס׳ד׳ ו׳ פעמים ד׳ שעות שהם כ׳ד׳ שעות הרי יום לל׳. ת׳ת׳ס׳ד׳ ור׳י׳ו׳ עושין שעה ת׳ת׳ס׳ד׳ עושין ד׳ פעמים ר׳י׳ו. שעה לתשעים היב׳ חלקים שהוצאת מת׳ת׳ע׳ו׳ עושים לתשעים שנה תתרף חלקים הרי שעה לתשעים. כיצד י׳ פעמים תשעים הרי אלף חסר מאה ונשארו שני פעמי׳ תשעים הוצא מהם מאה והשלם האלף ונשארו שמונים הרי אלף ושמנים וזהו שעה לתשעים שנה. יום לב׳ עושין לצ׳ שנה מ׳ה׳ ימים הוצא מ׳ב׳ ז׳ז׳ ונשארו ג׳ ימים. יום לג׳ עולה לתשעים שנה ל׳ יום הרי לג׳ ימים הוצא כ׳ח׳ ונשארו ה׳ ימים יום ל׳ל עושה לתשעים שנה ג׳ ימים כי בתשעים יש ג׳ תשעים שנה יוצאין כולן ז׳ז׳ חוץ מיום ושעה. ועכשיו חשוב כמה שנים יש ב׳ר׳נ׳ז׳ מחזורים ד׳ אלפים ות׳ת׳פ׳ג׳ שנים. היאך בר׳ מחזורים יש בו ר׳ פעמים עשרים שנה יותר מהם לכל מחזור ומחזור והם עשרים פעמים מאתים שנה שהם מ׳

– so you will find.[75] In thirty years, the 864s make up one day, because in thirty 864s there are 6 times five 864s, 6 times 4 hours, which is 24 hours. That is, one day for 30 (years).

864 plus 216 equals an hour; 864 equals 4 times 216.[76]

One hour for ninety (years). In 90 years, the 12 parts you subtracted from of 876 come to 1080 parts. That is, one hour for ninety (years).

How? 10 times ninety equals one thousand less one hundred; and the remainder is two times ninety; subtract one hundred from this and (use it to) complete the one thousand; the remainder is eighty. This makes one thousand and eighty, and this is one hour for ninety years.

In 90 years, one day for 2 (years) comes to 45 days. Cast out 42, by 7s and the remainder is 3 days.

In 90 years, one day for 3 (years) comes to 30 days. This makes (a total of) 33 days. Subtract 28 and the remainder is 5 days.

In 90 years, one day for 30 (years) comes to 3 days, because 90 is 3 times 30. This makes (a total of) 8 days; cast out 7 and the remainder is one day. As a result, 90 years are all cast out by 7s, except for one day and one hour.

Now calculate how the number of years in 257 cycles: 4883 years. How? In 200 cycles there are 200 times twenty, (assuming) one extra year for every cycle; and this is twenty times two hundred years, or 40

75 The calculation 864 × 5 = 4320 is not explained here but a few lines below (see next n.).

76 The function of this sentence is apparently to explain the calculation 864 × 5 = 4320 = four hours, referred to above (see previous n.): since 864 = 4 × 216, and since 5 × 216 = 1080 (1 hour), it follows that 864 × 5 = (4 x 216) × 5 = 4 × (216 × 5) = 4 hours. The shorthand style of this sentence, and also its location, suggest that this is an interpolated gloss.

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(מ׳) מאות שנה תקח מכל מחזור שנה שהיה בו יותר ונשאר לח׳ י״מים׳[bb] מאות שנה בר׳ מחזורים. הנ׳ מחזורים הם נ׳ פעמים עשרים שנה. ועשרים פעמים נ׳ הוא י׳ פעמים מאה שהם אלף שנים אלא שיש נ׳ שנה יותר שנה אחת לכל מחזור הרי לך הנ׳ מחזורים הם תשע מאו׳ וחמשים שנה. שים על ל׳ח׳ מאות שנה הרי לך כי ר׳נ׳ מחזורים עושין ד׳ אלפים ושבע מאות וחמשים שנה. חשוב ז׳ מחזורים שהם ז׳ פעמים עשרים אלא שיש שבע שנים יותר ועושין מאה וארבעים הסר השבע שנים הרי ק׳ל׳ג׳. שים מאה על שבע מאות הרי ת׳ת׳ שנים שים לג׳ שנים על החמישים שנה הרי ת׳ת׳פ׳ג׳ שנים נמצא ר׳נ׳ז׳ מ׳ מחזורים עושים ד׳ אלפים ות׳ת׳פ׳ג׳ שנים. כמה חדשי עיבור יש בהם שמנה עשר מאות חדשים חסר חדש אחד. כיצד כי לכל מחזור יש ז׳ חדשי עיבור וזהו ר׳נ׳ז׳ פעמים ז׳. חשוב ז׳ פעמי׳ ר׳ עושין י״ד׳ מאות וז׳ פעמים נ׳ הם ג׳ מאות וחמישים הרי לך י״ז׳ מאות וחמשים חדשים. ושבע פעמים ז׳ הם תשע וארבעים שים על חמשים הרי לך י״ז׳ מאות ותשעים ותשע חדשים נמצא כי בר׳נ׳ז׳ מחזורים יש שמנה עשר מאות חדשי עיבור חסר חדש אחד. והם מאה וחמשים חסר חדש כי לק׳ חדשים יש ח׳ שנים וד׳ חדשי׳ לג׳ מאות חדשים (יש ק׳ שנים לשמנה עשר מאות חדשים בו ח פעמים י״ב׳ חדשים וד׳ חדשים) יש כ׳ה׳ שנים לו׳ מאות חדשי׳ יש נ׳ שנים לי״ב׳ מאות חדשים יש ק׳ שנים לשמנה עשר מאות חדשים יש מאה וחמשים שנה נמצא שמנה עשר מאות חדשי עיבור חסר חדש עושים מאה וחמשים שנה חסר חדש אחד. הוסיפם על ד׳ אלפים ות׳ת׳פ׳ג׳ שנים הרי חמשת ~~ח~~ אלפים ולג׳ שנים (עשר) חסר חדש. הוציאם כולם תשעים תשעים וקח לכל תשעים שנה יום ושעה. והנשאר בידך מעל לתשעים תשעים הוצא יום לב׳ יום לג׳ . יום ל׳ל׳ . וי״ב׳ חלקים לשנה. כיצד החמש

5 ר׳נ׳] י״ז׳ 6 חשוב ז׳] חשוב י״ד׳ 8 ק׳ל׳ג׳] ול׳ג׳ 12 ז׳] ג׳ 15 בר׳נ׳ז׳] ב׳ר׳נ׳ז׳ 17 לק׳] לז׳ 26 הוצא] חוצא

bb This word is marked for deletion with primes.

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hundred years. Subtract the extra year from every cycle and the remainder is 38 hundred years in 200 cycles. The 50 cycles are 50 times twenty years; and twenty times 50 is 10 times a hundred, which is 1000 years, but there are 50 extra years, one year for every cycle, so the 50 cycles are nine hundred and fifty years. Add them to 38 hundred years and you get that 250 cycles equal four thousand seven hundred and fifty years. Calculate 7 cycles, which are 7 times twenty, except that there are seven years too many; and the total is 140; subtract the seven years, and the result is 133. Add a hundred to seven hundred, and this makes 800 years. Add 33 years to the fifty years; (the total) is 883 years. Thus 257 cycles equal 4883 years.

How many intercalary months are there in them [in 257 cycles]? Eighteen hundred months less one month. How? Because in every cycle there are 7 intercalary months, and that is 257 times 7. Calculate: 7 times 200 equals 14 hundred, and 7 times 50 is three hundred and fifty: the result is seventeen hundred and fifty months. Seven times 7 equals forty-nine; add (this) to (17)50; the result is seven hundred and ninety-nine months. Thus in 257 cycles there are eighteen hundred intercalary months less one month. This is 150 (years) less a month, because 100 months is 8 years and 4 months; 300 months is 25 years; 600 months is 50 years; twelve hundred months is 100 years; eighteen hundred months is one hundred fifty years. So 1800 intercalary months less a month equals 150 years less one month.

Add them to 4883 years; the result is five thousand and thirty three years less a month.

Cast out all the nineties, and for every 90 years take a day and an hour. And (of) what remains in your hand in excess of the nineties, take a day for 2 (years), a day for 3 (years), a day for 30 (years), and 12 parts for the year. How? The five thousand years equals fifty hundred

אלפים שנה עושים חמשים מאות שנים. חשוב חמשים פעמים תשעים וקח לכל תשעים שנים יום ושעה הרי חמשים יום וחמשי ' שעות. חמשים פעמים עשר שנים שנשארו מן הה' אלפים עושין ה' מאות שנים. קח מהם ה' פעמים תשעים הרי ה' ימים

30 קח מהם ה'] קח מהם י"

[p. 466]

וה' שעות הרי לך נ'ה' ימים ונ'ה' שעות ה' פעמים עשרה שנשארו מן הה' מאות שנים עולים נ' שנים . צרף ל‹ל'›ג' שנים חסר חדש. ויהיו פ'ג' שנים חסר חדש. עתה יש לנו נ'ה' ימים ונ'ה' שעות הנ'ה' שעות עושין ב' ימים וז' שעות צרף על נ'ה' ימים ויהיו נ'ז' ימים וז' שעות מן הנ'ז' ימים השלך נ'ו' ז'ז' ונשאר יום אחד וז' שעות.א'ז' סימן. ה'פ'ג' שנים חסר חדש הוציאם יום לב' יום לג' יום ל'ל וי'ב' חלקים לשנה. ה'פ'ב' שנים כשתוציאם יום לב' עושים מ'א' ימים צרף עמהם א'ז' הרי מ'ב' ימים וז' שעות. מ'ב' ימים יוצאים ז'ז' הנח אותם ונשאר לך ז' שעות. חזור והוציא הפ'ב' ~~של~~ שנים יום לג' לס' שנים כ' ימים לכ'א' שנים ז' ימים הרי כ'ז' ימים ולשנה אחת ח' שעות הרי כי הפ'ב' שנים יוצאים יום לג' כז' ימים וח' שעות וז' שעות שהיה לך הרי כ'ז' ימים וט'ו' שעות הוצא כ'א' ימים ז'ז' הרי ו' ימים וט'ו' שעות. וי'ה' סימן. חזור והוציאם יום לל' לס' שנים ב' ימים לכ'ב' שנים כ'ב' ת'

1 נ'ה'] נ'ח' 8 יוצאים] יוציאם 10 לג'] ל' 12 כ'ז'] כ'ו' 13 ו'] י'ו'

years; calculate fifty times ninety and for every ninety years take a day and an hour; the result is fifty days and fifty hours. Fifty times the ten years left over from the 5000 makes 500 years; subtract 5 times ninety; the result is 5 days

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and 5 hours. The total is 55 days and 55 hours. 5 times the ten left over from the 500 years comes to 50 years. Add (this) to the 33 years less one month, and the result is 83 years less one month.[77]

Now we have 55 days and 55 hours.[78] The 55 hours equal 2 days and 7 hours. Add (them) to 55 days, and this makes 57 days and 7 hours. From the 57 days cast out 56, by 7s, and the remainder is one day and 7 hours. 1-7 is the sign.

The 83 years less a month: take a day for 2 (years), a day for 3 (years), a day for 30 (years), and 12 parts for the year.

The 82 years, when you take a day for (every) 2 (years), make 41 days. Add to them 1-7; this makes 42 days and 7 hours. 42 days can be cast out by 7s; cast them out, and the remainder is 7 hours.

Go back (to) the 82 years and take a day for (every) 3 (years): for 60 years, 20 days; for 21 years, 7 days—this makes 27 days—and for one year 8 hours. Thus (counting) a day for 3 (years), the 82 years result in 27 days and 8 hours. And (with) the 7 hours that remained, the result is 27 days and 15 hours. Cast out 21 days, by 7s, and this makes 6 days and 15 hours. 6-15 is the sign.

Go back and take a day for (every) 30 (years): for 60 years, 2 days;

77 This is the remainder of years after all 90s have been cast out.

78 This is the intermediate result for the *molad* calculation.

ת'ת'ס'ד'ין העשרין ת'ת'ס'ד'ין עושין י'ו' שעות ה' ת'ת'ס'ד' ל'ד' שעות כמו שאמרת למעלה השני ת'ת'ס'ד'ין עושין ‹שעה› ות'ר'מ'ח' חלקים. נמצא כי פ'ב' שנים כשתוציאם יום לל' עושים ב' ימים וי'ז' שעות ות'ר'מ'ח' חלקים. בי'ז' ת'ר'מ'ח' סימן. צרף על וי'ה' הרי ט' ימים וח' שעות ות'ר'מ'ח' חלקים השלך ז' הרי ב' ימים וח' שעות ות'ר'מ'ח' חלקים. ב'ח' ת'ר'מ'ח' סימן. עוד נשאר פ'ב' פעמים י'ב' חלקים ושנה חסר חדש.שמנים פעמים י'ב' הוא ד' פעמים ר'ם' ועולין ת'ת'ק'ס' ו'ב' פעמים י'ב' הם כ'ד' חלקים שים על ת'ת'ק'ם' הרי ת'ת'ק'פ'ד' נמצא פ'ב' פעמים י'ב' עולין ת'ת'ק'פ'ד' ח' חלקים. שים על ת'ר'מ'ח' ויעלה לשעה אחת ות'ק'נ'ב' חלקים הרי לך ב' ימים וט' שעות ות'ק'נ'ב' חלקים. הוצא שנה חסר חדש ז'ז' ותראה מה ישאר העשתי עשר חדש יוצאין כולם ז'ז' חוץ מן א'י'ב' ת'ש'צ'ג'ים. הוצא הא'י'ב' ת'ש'צ'ג' ז'ז' עשתי עשר יום וע' ועשתי ‹עשר› פעמים י'ב' שעות עושין י'ו' ימים וי'ב' שעות. הוצא יום י'ד' ז'ז' ונשאר ב' ימים וי'ב' שעות. בי'ב' סימן. הוצא ~~יום~~ י'א' ת'ש'צ'ג'ים הה' ת'ש'צ'ג'ים עושין ה' שעו'

15 ת'ת'ס'ד'ין (*secundus*)] ת'ח'ס'ד'ין | ל'ד' שעות] לשעה 17 פ'ב'] ע'כ' 27 הא'י'ב'] הי'ב'

[p. 467]

אלא שחסר מהם ה' ר'פ'ז'ים כי ת'ש'צ'ג' ור'פ'ז' עושין שעה ומן הששה ת'ש'צ'ג'ים הנשארים תקח ה' ר'פ'ז'ים להשלים שעות ונשאר ת'ש'צ'ג' וה' פעמ'ים ק'ו' כי כשתקח מת'ש'צ'ג' ר'פ'ז' נשאר ~~ר'פ'ז'~~ ת'ק'ו'. תקח מאחד הת'ק'ו'ין ר'פ'ז' ושים על ת'ש'צ'ג' הנשאר ויהיה לך ו' שעות וד' ת'ק'ו'ין ור'י'ט' חלקים. הד' ת'ק'ו'ין עושין ב' שעות חסר ק'ל'ו' מ'

1 מהם ה'] הם

for 22 years, 22 864s (parts). The twenty 864s equal 16 hours, because 5 864s equal 4 hours, as you[79] said above. The two 864s equal <one hour> and 648 parts. As a result, 82 years, when you take a day for 30 (years), produce 2 days and 17 hours and 648 parts. 2-17-648 is the sign.

Add (this) to 6-15, this makes 9 days and 8 hours and 648 parts. Cast out 7s. This makes 2 days and 8 hours and 648 parts. 2-8-648 is the sign.

There still remain 82 times 12 parts, and one year less a month. Eighty times 12 is 4 times 240, and this comes to 960; 2 times 12 is 24 parts. Add (this) to 960, this makes 984. Thus 82 times 12 equals 984 parts. Add (this) to 648 and the result is one hour and 552 parts. Thus you have 2 days and 9 hours and 552 parts.

Cast out 7s from a year less a month and see what remains. The entire eleven months are cast out by 7s, except for 1-12-793s [for every month]. Cast out 7s from (the total of) 1-12-793(s). Eleven days and eleven times 12 hours equal 16 days and 12 hours; cast out 14 days, by 7s; the remainder is 2 days and 12 hours; 2-12 is the sign. Calculate[80]eleven 793s: the five 793s equal 5 hours,

[p. 467]

except that they are short of five 287s, because 793 and 287 equal an hour [i.e. 1080 parts]. From the six 793s that remain, take five 287s to complete the hours; what is left is 793 and 5 times 106, because when you subtract 287 from 793 the remainder is 506. Take 287 from one of the 506s, and add it to the 793 that is left; the result is 6 hours and four 506s and 219 parts. The four 506s equal 2 hours less 136 (parts). Take

79 The author seems to be addressing himself.

80 *Lit.* “take out.”

מר׳י׳ט׳ ת׳ק׳ח׳ ק׳ל׳ו׳ להשלים וישאר לך פ׳ג׳ שים על ו׳ שעות ויהיה לך ח׳ שעות ופ׳ג׳ חלקים. שים על ב׳ ימים וי׳ב׳ שעות ויהיה לך ב׳ ימים וכ׳ שעות ופ׳ג׳ חלקים. צרף על ב׳ ימים וט׳ שעות ות׳ק׳נ׳ב׳ חלקים. שים ב׳ ימים וכ׳ שעות על ב׳ וט׳ שעות ויהיה לך ה׳ ימים וה׳ שעות. שים פ׳ג׳ על ת׳ק׳נ׳ב׳ הרי ת׳ר׳ל׳ה׳ חלקים הרי לך ה׳ ימים וה׳ שעות ות׳ר׳ל׳ה׳ חלקים שלא יצאו ז׳ז׳ לסוף מחזור ר׳נ׳ז׳. ה׳ה׳ ת׳ר׳ל׳ה׳ סימן מעתה אם רצונך לדעת מולד תשרי בתחילת מחזור ר׳נ׳ח׳ הוסף ה׳ה׳ ת׳ר׳ל׳ה׳ על ל׳ב׳ה׳ר׳ד׳ ותמצא מולדך בז׳י׳ ת׳ת׳ל׳ט׳. ואם תרצה לדעה מולד ניסן של אחריו של תחילת מחזור ר׳נ׳ח׳ הוסף ה׳ה׳ ת׳ר׳ל׳ה׳ לד׳ט׳ ת׳ר׳מ׳ב׳ ותמצא המולד בב׳ט׳ו׳ ק׳צ׳ז׳. ואם תרצה למצוא תקופת החמה על ידי המולד הוסף ט׳ו׳ י׳ב׳ ת׳מ׳ה׳ על בט׳ו׳ קצ׳ז׳ כי כן עלו לך השעות והת׳פ׳ה׳ן׳ לר׳נ׳ז׳ מחזורים שרבתה החמה אחרי הלבנה אלא שתגרע ז׳ ט׳ ת׳ר׳מ׳ב׳ מן ט׳ו׳ י׳ב׳ ת׳מ׳ה׳ ונשאר ח׳ב׳ ת׳ת׳פ׳ג׳ הוסף ח׳ב׳ ת׳ת׳פ׳ג׳ על בט׳ו׳ ק׳צ׳ז׳ ושם ודאי תמצא תקופתך ביום ג׳ ביום תשיעי ‹מ›מולד ‹ניסן› בי׳ח׳ שעות ביום. ולמה אתה צריך לגרוע ז׳ט׳ ת׳ר׳מ׳ב׳ כבר הודעתיך טעמו של דבר כי בניסן של בריית עולם לא התחילה לבנה לשמש

the 136 from the 219 to complete (the 2 hours), and you are left with 83 (parts); add that to the 6 hours, and the result is 8 hours and 83 parts. Add that to the 2 days and 12 hours; the result is 2 days and 20 hours and 83 parts.

Add that to the 2 days and 9 hours and 552 parts: add 2 days and 20 hours to 2 (days) and 9 hours; the result is 5 days and 5 hours. Add 83 to 552; the result is 635 parts. Thus at the end of the 257th cycle you have 5 days and 5 hours and 635 parts that remain [*lit.* that were not cast out] after casting out all 7s. The sign is 5-5-635.

Now, if you wish to know the *molad* of Tishri at the beginning of the 258th cycle, add 5-5-635 to n2-5-204 and you will obtain your *molad*: 7-10-839.

And if you wish to know the *molad* of the subsequent Nisan, at the beginning of the 258th cycle, add 5-5-635 to 4-9-642 and you will find the *molad:* 2-15-197.

And if you wish to find the *tequfah* of the sun from the *molad*,[81] add 15-12-445 to 2-15-197, because this [the former] was the total of the (one) hours and 485s (parts) that the sun exceeds the moon for 257 cycles, except that you should subtract 7-9-642 from 15-12-445, which leaves 8-2-883. Add 8-2-883 to 2-15-197 and there you will surely find your *tequfah*, on the 3rd day (Tuesday), the 9th day <after> the *molad* <of Nisan>, at 18 hours of the day.

And why do you need to subtract 7-9-642? I have already told you the reason for this:[82] for in Nisan of the Creation of the

81 I.e., the *tequfah* of Nisan at the beginning of the 258th cycle, from the *molad* of Nisan that has just been calculated.

82 This has not been mentioned above. The author is referring either to a passage in our missing quire, or to a passage from a larger work of which this is possibly an extract; alternatively, this is a mistake.

(לשמש) עם החמה בתחילה ליל רביעי אלא קדמה חמה את המולד ז'ט' ות'ר'מ'ב' מתחלת ליל רביעי ועד לד'ט' ת'ר'מ'ב' יש ז'ט' ת'ר'מ'ב' מצינו בברייתא קביעות העיבורים שלש שלש שתים שלש שלש שלש שתים. ר' אליעזר או' (י') שלש שתים שלש שלש <שלש>[cc] שתים שלש. ישר' כרבנן ואומות העולם כר' אליעזר ומעברין שנת חמש ושנת שש עשרה. דבר בדוק כי בעיבור שנת שמנה וי'א' ושנת

cc The text is evidently missing one שלש, because the numbers should add up to 19; we have corrected this and inserted the missing word in this place on the basis of the parallel sources cited in Isaac Israeli, *Yesod Olam* 4:2 and in Berlin, MS Or. oct. 352, fol. 2d (the latter reads: וכן מצי' בברייתא כיצד מעברין שלש שלש שתים שלש שלש שלש שתים דברי ר' יהודה ר' אליעזר או' שלש שתים שלש שלש שלש שתים שלש ואומות העולם קובעין כר' אליעזר ואנן מעברין כר' יהודה). The superfluous י' (= 10) at the beginning of the line may be the result of a conflation of two sections of *Pirqei de-Rabbi Eliezer* (chap. 8), where another parallel to this *baraita* is attested: בשלשה מעברין ר' אליעזר אומר בעשרה ... מחזור העיבור מי"ט שנה וז' מחזורין קטנים יש בו יש מהם משתים ויש מהם משלש שלש ושתים שלש שלש ושתים (*editio princeps*, Constantinople 1514, fol. 6a; http://www.usc.edu/projects/pre-project/graphics/index-01.html accessed 18 June 2013); note that this passage is also short of one שלש, but there are variants in the textual witnesses.

World the moon did not start to function along with the sun at the beginning of the fourth night; rather, the sun preceded the *molad* by 7-9 and 642; from the start of the fourth night until 4-9-642 is 7-9-642.[83]

We have found in a *baraita* the (following) order of intercalations: "three-three-two-three-three-three-two. R. Eliezer said: three-two-three-three-<three->two-three."[84] Israel follows the Sages, and the Nations of the World follow R. Eliezer, and they intercalate the fifth year and sixteenth year.[85]

It is a confirmed fact that in the intercalation of the eighth and the 11th year

83 This is slightly confusing because the numbers do not mean exactly the same thing: 4 in 4-9-642 means the 4th day of the week, whereas 7 in 7-9-642 means a number of days. The *tequfah* of Nisan in the year of the Creation occurred at the beginning of the 4th night (i.e. Tuesday evening), one week before the *molad* that occurred on the following 4th night (Wednesday early morning) at 9 hours and 642 parts. The interval between them is thus 7-9-642.

84 A similar *baraita* is cited by Isaac Israeli, *Yesod Olam* 4:2: "R. Eliezer says three-two-three-three-three-two-three, the Sages say three-three-two-three-three-two-three, and R. Gamaliel says three-three-two-three-three-three-two" (here the last of these views is attributed to the Sages and corresponds to the cycle of the fixed rabbinic calendar). Even more similar is the *baraita* cited in Berlin, MS Or. oct. 352, fol. 2d: "How does one intercalate? Three-three-two-three-three-three-two, the words of R. Judah; R. Eliezer says three-two-three-three-three-two-three." The text continues: "The Nations of the World reckon like R. Eliezer, and we intercalate like R. Judah." An abbreviated version of this *baraita* appears in *Pirqei de-Rabbi Eliezer,* end of chapter 8 (see note cc to the Hebrew text).

85 This is a reference to the Christian 19-year Easter cycle, which corresponds to R. Eliezer's if the same epoch is assumed for Jews and Christians.

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(ושנת) תשע עשרה תקופת ‹ניסן› קודמת למולד ונופלת באדר השני.

ועוד עתה אורה לך סימנין אחרים לדעת המולד כי על ידי חבי[dd] עי׳ ענייני חשבונות לבא למולד ולתקופה נפתח לב האדם להיות עבורו שגור בפיו וללמד להמתיק לתלמידים ולהעמיד גירסא ולא עתה יבוש ולא פניו יחורו כי ידבר אויבים בשער א׳ש׳ר[ee] אחרי אשר ידעת כי עלו לך השעות והת׳פ׳ה׳ין של ר׳נ׳ז׳ מחזורים ט׳ו׳ י׳ב׳ ת׳מ׳ה׳ ונשאר ה׳ה׳ ת׳ר׳ל׳ה׳ השלך אותם ז׳ז׳ ונשאר א׳י׳ב׳ ת׳מ׳ה׳ חזור וחשוב שנת העולם של ר׳נ׳ז׳ מחזורים יום ורביעי לשנה והשלך הכל ד׳ אלפים ות׳ת׳פ׳ג׳ ז׳ז׳ ונשאר בידך ו׳ ימים וי׳ח׳ שעות הוצא מהם

dd Obscure; perhaps an error for רובי.

ee This word is marked for deletion with primes.

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and the nineteenth year, the *tequfah* of <Nisan> precedes the *molad* and falls in the second Adar.

Now I will instruct you further on other signs for knowing the *molad*, because through numerous types of calculations to arrive at the *molad* and the *tequfah*, man's mind is opened to be fluent in calendar calculation and to learn how to make it easier for students and establish (its) formulation; and henceforth, he will not be ashamed nor will his face grow pale when he speaks to the enemies at the gate.[86]

Once you know that the hours and the 485s of 257 cycles[87] come to 15-12-445, and that the remainder [of the *molad* calculation over the same period] is 5-5-635,[88] cast out the (former) by 7s; the remainder is 1-12-445. Go back and calculate, (for) the year of (the era of) the world of 257 cycles, one and a quarter day per year;[89] cast out 7s from the sum, 4883,[90] and you are left with 6 days and 18

86 A combined paraphrase of Isa. 29:22 and Psalm 127:5 and probably an allusion to debate with Christians about the calendar.

87 I.e., the sum of 1 hour and 485 parts (which is the excess of the solar year at the end of every lunar cycle) for all of the 257 cycles.

88 This clause is out of place: the remainder of the *molad* is not a premise, but rather what we are trying to calculate. Perhaps this is an erroneous gloss; alternatively, the author means that because we have already calculated through another method that the remainder of the *molad* is 5-5-635, the present method will be verified when we arrive at the same result.

89 The rest of the year, 364 days, is automatically cast out as a multiple of 7.

90 Actually, 4883 + 4883/4. Indeed, 4883 is the last year of the 257th cycle; one day and a quarter must be reckoned for each of these years (this step is not mentioned here), hence 4883 + 4883/4, from which all sevens must be cast out, yielding the remainder of 6 and 3/4 days (or 18 hours).

א׳י׳ב׳ ת׳מ׳ה׳ ונשאר ה׳ה׳ ת׳ר׳ל׳ה׳ הוסף לב׳ה׳ר׳ד׳ ותמצא מולד תשרי ואם על לד׳ט׳ ת׳ר׳מ׳ב׳ תוסיפנו תמצא מולד ניסן של אחריו.

אם תרצה לידע כל שנה ושנה שבמחזור מהשנה ראשונה יצא ליתר השנים . צא ולמד מתחילת מחזור ר׳נ׳ח׳ היה מולד תשרי ביום ז׳ י׳ שעות ת׳ת׳ל׳ט׳ חלקים . הותר ד׳ח׳ ת׳ת׳ע׳ו׳ ש׳ שיתר על ז׳ז׳ על ז׳י׳ ת׳ת׳ל׳ט׳ ויבא לך מולד תשרי של שנה שניה יום ד׳ י׳ט׳ שעות ות׳ר׳ל׳ה׳ חלקים. ד׳י׳ט׳ ת׳ר׳ל׳ה׳ סימן. חזור והוסף ד׳ח׳ ת׳ת׳ע׳ו׳ ויבא לך מולד תשרי של שנה שלישית יום ב׳ ד׳ שעות ות׳ל׳א׳ חלקים. חזור והוסף ה׳כ׳א׳ ת׳ק׳פ׳ט׳ שכן מוסיפין לשנה מעוברת מפני שעיברת בתוך שנה שלישית ויש י׳ג׳ חדשים בין תשרי לתשרי ויבא לך יום א׳ בשעה אחת ות׳ת׳ר׳ך׳ חלקים.

ואם מניסן לניסן אתה רוצא להשליך כמו כן תוסיף כסדר זה. ואם מחדש לחדש אתה רוצא להשלי׳ כמו כן תוסיף כסדר זה א׳י׳ב׳ ת׳ש׳צ׳ג׳ מחדש לחדש.

14 י׳ שעות] ו׳ שעות 16 ד׳י׳ט׳] ד׳ר׳ט׳

hours.[91] Subtract 1-12-445 from this and the remainder is 5-5-635.[92] Add this to n2-5-204 and you will find the *molad* of Tishri. And if you add this (instead) to n4-9-642, you will find the *molad* of the following Nisan.

If you want to know (the *molad* of Tishri of) every year in the cycle, the rest of the years can be obtained from the first year.

Go and learn: at [*lit*. from] the beginning the 258th cycle, the *molad* of Tishri was on the 7th day, 10 hours, 839 parts. Add to 7-10-839 the 4-8-876 that remains over 7s,[93] and you will get the *molad* of Tishri of the second year: 4th day, 19 hours, and 635 parts. The sign is 4-19-635.

Go back and add 4-8-876, and you will get the *molad* of Tishri of the third year: 2nd day 4 hours and 431 parts.

Go back and add 5-21-589, which is what one adds for an intercalated year, because you intercalated (a month) within the third year, so there are 13 months between Tishri and Tishri; and you will get the 1st day, one hour, and 1020 parts.

And if you want to (calculate and) cast out from Nisan to Nisan, add (these quantities) in the same order.

And if you want to (calculate and) cast out from month to month, add in the same order 1-12-793 from month to month.

91 This means that after 4883 years, the day of the week of the start of the solar year will be 6 and 3/4 days later than at the beginning of the era. The day of the week of the *molad*, however, will be 1-12-445 earlier than that of the solar year, as we calculated above. This is why the next subtraction needs to be made.

92 See above, n. 88. QED.

93 Something seems to be missing here. The author means that 4-8-876 is the remainder of 12 lunar months after casting out sevens; this amount must be added to the *molad* of Tishri of the first year (7-10-839) to obtain the *molad* of Tishri of the second year.

ואם מניסן לתשרי אתה בא להוסיף אתה
משליך ב'ד'ת'ל'ח.   וכן מתשרי לניסן
ואם יש עיבור בין תשרי לניסן אתה
משליך ג'י'ז' ק'נ'א'

וסימניך
א'י'ב'   ת'ש'צ'ג'

[p. 469]

א'י'ב' ת'ש'צ'ג'   לכל חדש וחדש הוצג.
ב'ד' ת'ל'ח'   בעמק חצי שנה פשוטה שולח.
ג'י'ז'א' ק'נ'א   סודות חצי שנה מעוברת תחזקנה .
ד'ח' ת'ת'ע'ו'   לשנה פשוטה קבעו.
ה'כ'א' ת'ק'פ'ט'   לשנה מעוברת החק ומשפט .
ב'י'ו' ת'ק'צ'ה'   לתכלית מחזור נמצא .

ועכשיו ידעת היאך למצא ולידע מולדות ניסן
ותשרי צא ולמד אימתי נקבע ראש חדש ביום מולדו
ואימתי ידחו.[ff] **ה'ד'ח'י'ו'ת'** הן ארבעה לתשרי וכנגדן ארבעה

ff An error for ידחה.

If you want to add from Nisan to Tishri, you cast out (after adding) 2-4-438. And so from Tishri to Nisan. And if there is an intercalation between Tishri and Nisan, you cast out (after adding) 3-17-151.

And your signs are 1-12-793:[94]

[p. 469]

1-12-793 for every month is set up
2-4-438 in the depth of half a plain year is sent forth[95]
3-17-151 the secrets of half an intercalated year strengthen[96]
4-8-876 for a plain year they fixed
5-21-589 for an intercalated year is the statute and law
2-16-595 to the end of the cycle is found

And now you know how to find and know the *moladot* of Nisan and Tishri.

Go and learn when the first of the month is set on the day of the *molad*, and when it is postponed. **There are four postponements** for Tishri,

94 "1-12-793" functions like a catchword to announce the next page. The signs that follow are set in rhymes, which we have not attempted to imitate in the translation. In this context, the function of the signs and rhymes is certainly mnemonic (see above, n. 28). Note also that the first number of the first five signs form the sequence 1-2-3-4-5, broken only in the sixth and last line.

95 "In the valley is sent forth" is a paraphrase of Judges 5:15; in this context, עמק is better rendered as "depth."

96 Or: "are strengthened."

לניסן והמדקדק יכול לקבוע כמו כן ארבעה לכל חדש וחדש.
ואילו הן הדחיות .
א'ד'ו' י'ח' תשרי פסל[gg] **גטרד שאינו לפני אדר**
העיבור בטו תקפט אחרי אדר העיבור
תשרי פסול פירוש אדו
אם יארע מולד תשרי ביום אחד בשבת או ביום
רביעי בשבת או בשישי בשבת לא תקבע ראש חדש בו ביום אלא
דחהו למחרתו. י'ח'. וכן אם יארע בב'ג'ה'ז' שהם ימים
הראוים ליקבע אם יארע בי'ח' שעות או ביתר על כן לא תקבע
ראש חדש בו ביום אלא דחהו ליום אחר ליום הראוי .
גטרד שאינו לפני אדר העיבור.
אם יארע מולד תשרי
בשלישי בשבת בט' ור'ד' חלקים או ביתר מיכן . תן עיניך[hh]

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אם תתעבר שנה זו כשר וקבעוה ביומו עד י'ח' שעות . ~~ואל~~[ii] ואם
לא תתעבר השנה דחהו ליום חמישי. בט'ו' ת'ק'פ'ט' .

1 י'ח'] ח'

gg Probably an error for פסול.

hh At the bottom of the page, catchword: אם תתעבר.

ii This word looks as if has been struck through by the scribe.

and correspondingly, four for Nisan. One who is precise can similarly set four (postponements) for every single month.

And these are the postponements:

***ADU* [1, 4, 6][97] (and) 18 (in) Tishri are invalid; 3-9-204 which is not before an intercalary Adar, (and) 2-15-589 after an intercalary Adar, (in) Tishri are invalid.**

Explanation:

"*ADU* [1-4-6]:"

If the *molad* of Tishri occurs on the first day of the week or on the fourth day of the week or on the sixth of the week, do not fix the first of the month on that day, but postpone it to the next day.

"'18:"

Likewise, if it occurs on (days of the week) 2-3-5-7, which are permitted days for (the first of the month) to fall, but it (the *molad*) occurs at 18 hours or more, then do not fix the first of the month on that day, but postpone it to another day, the (next) day that is permitted.[98]

"3-9-204 which is not before an intercalary Adar:"

If the *molad* of Tishri falls on the third (day) of the week at 9 (hours) and 204 parts or later, be watchful:

[p. 470]

if this year is going to be intercalated, it is permitted, so set (the first of the month) on that day, until [i.e. unless it falls after] 18 hours. But if the year is not going to be intercalated, postpone (the first of the month) to the fifth day.

97 The letters *ADU* represent these three numbers, which are days of the week (Sunday, Wednesday, Friday).

98 Not simply "to the next day," as in the case of *ADU*, because in the case of 18 (hours), the first of the month must sometimes be postponed by two days (if the next day is one of the *ADU* days and thus not permitted).

אחרי אדר העיבור.   אם יארע מולד תשרי בשיני וט'ו' שעות ת'ק'פ'ט' חלקים.   ואם לא נתעברה שנה שעברה קבעוהו ביומו עד י'ח' שעות.   וכנגדן ארבע דחיות לניסן. וסימן.

בדו י'ג' ו'ת'ר'מ'ב' ניסן פסול אד ותתמו שאינו לפני אדר העיבור זיא וקנא אחרי אדר העיבור ניסן פסול   פירוש.   בדו.

אם יארע מולד ניסן ביום ב' בשבת או בד' בשבת או ביום ו' לא תקבע ראש חדש בו ביום אלא דחהו למחרתו   י'ג' ת'ר'מ'ב'.   וכן אם אירע מולד ניסן בא'ג'ה'ז' שהם ימים הראויים למולד ניסן בי'ג' שעות ות'ר'מ'ב' חלקים או ביתר על כן לא תקבע ראש חדש בו ביום אלא דחהו ליום הראוי.

א'ד' ו'ת'ת'מ'ו' שאינו לפני אדר העיבור .

אם יארע מולד ניסן א' בשבת בד' שעות ות'ת'מ'ו' חלקים או ביתר מיכן תן עיניך אם תתעבר שנה זו כשר וקבעוהו ביומו עד י'ג' ת'ר'מ'ב' ואם לא תתעבר שנה זו דחהו ליום ג'

ז'י'א' ק'נ'א' אחרי אדר העיבור .

אם יארע   מולד ניסן ביום שבת בי'א' שעות וק'נ'א' חלקים תן עיניך אם נתעברה

16 שעות] בשבת   21 נתעברה] נתתעברה

"2-15-589 after an intercalary Adar:"

If the *molad* of Tishri occurs on the second (day of the week), at 15 hours 589 parts, and if the previous year was not intercalated, set (the first of the month) on that day, until 18 hours.[99]

And corresponding to them, there are four postponements for Nisan, and their sign is:

***BaDU* [2, 4, 6] (and) 13-642 (in) Nisan are invalid; 1-4-846 which is not before an intercalary Adar, (and) 7-11-151 after an intercalary Adar, (in) Nisan are invalid.**

Explanation:

"*BaDU* [2-4-6]:"

If the *molad* of Nisan occurs on the second day of the week or on the fourth of the week or on the sixth day, do not set the first of the month on that day, but postpone it to the next day.

"13-642:"

Likewise, if the *molad* of Nisan occurs on (days of the week) 1-3-5-7, which are permitted days for the *molad*[100] of Nisan, at 13 hours and 642 parts or later, do not set the first of the month on that day, but postpone it to the (next) day that is permitted.

"1-4-846 which is not before an intercalary Adar:"

If the *molad* of Nisan falls on the 1st of the week at 4 hours and 846 parts or later, be watchful: if this year is going to be intercalated, it is permitted, so set the first of the month on that day, until [i.e. unless it falls after] 13-642. But if the year is not going to be intercalated, postpone the first of the month to the 3rd day.

"7-11-151 after an intercalary Adar:"

If the *molad* of Nisan occurs on the Sabbath at 11 hours and 151

99 The end of the rule has been omitted, i.e., that if the previous year was intercalated, the first of the month is postponed to the third day.

100 Error for "first day."

שנה שבערה דחהו ליום א׳ ואם לא נתעברה קבעהו ביומו עד י׳ג׳ ת׳ר׳מ׳ב׳. אילו טעמי הדחיות של תשרי. אדו. אחד בשבת למה פסול בתשרי מפני הערבה שאם אתה עושה ראש השנה באחד בשבת יבא לך שביעי של ערבה בשבת. וערבה מנהג נביאי[jj] היא וצריכה חיזוק. ואם תיבטל יום אחד

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מתוך כי אינה כתובה אתי לבטולה לגמרי. ונחלקו רבותינו אם יקבעו הערבה[kk] בשבת אם לאו בר הדיא אמ׳ לא איקל ורבין וכל נחותי ימא[ll] איקלע. והשתא קיימינן[mm] כבר הדיא. ופירש ר׳ חננאל קיבלנו כי אילו שראו שחל שביעי של ערבה בשבת בזמן שלא נקבעו השנים כתיקנן היה כגון ימות השמד .

3 קיימינן] קיימונן 8 ד׳ו׳] ד׳ך׳

jj Probably an abbreviation of נביאים.

kk The first letter is damaged.

ll Not in the talmudic text, and wrong in context; probably a learned mistake for אמ׳ (i.e. אמרי, ‘said’).

mm The manuscript reading is the result of a scribal error and correction.

parts, be watchful: if the previous year was intercalated, postpone the first of the month to the 1st day (of the week); and if it was not intercalated, set it on that day until 13-642.

These are the reasons for the postponements of Tishri:

ADU [1, 4, 6]: Why is the first of the week invalid for Tishri? Because of the willow-branch. For if you make the New Year on the first (day) of the week, the seventh [day of Tabernacles, i.e. the day] of the willow-branch will occur on the Sabbath; and the willow-branch is a custom of the Prophets[101], which needs reinforcement; for if it is cancelled once,[102]

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then, because it [that custom] is not written (in Scripture), it will come to be cancelled completely. And our Sages disputed whether they should set the (day of the) willow-branch on the Sabbath or not; bar Hadaya said: “this has never occurred” and Ravin and all those who went down[103] <said>: “it has occurred.” And now we hold like bar Hadaya. And R. Ḥananel explained:[104] “We have received (as a tradition) that those who saw the ‘seventh day of the willow-branch’ falling on the Sabbath were in a time when the years were not set in the proper manner, as in times of persecution.

101 B *Sukkah* 44a.

102 So as not to desecrate the Sabbath.

103 The *Neḥotai*, i.e., those who emigrated (“went down”) from Palestine to Babylonia, bringing with them Palestinian rabbinic traditions. Our text reads: “those who went down to the sea,” i.e. seafarers, but this is not in the talmudic source (B *Sukkah* 43b) and is evidently an error (see note ll on the Hebrew text).

104 Rabbenu Ḥananel (early 11th century), commentary on B *Sukkah* 44a.

ירושלמי[nn]

ר׳ סימון מפקד לאילן יהבון דעתכון דלא תעבדון ערבתא בשבתא. ד׳ו׳ למה פסולין שאם אתה קובע ראש השנה בהן יבא לך יום הכיפורים בשישי בשבת או באחד בשבת והוו להו תרי שבי גבי הדדי ותרי שבי גבי הדדי לא עבדינן.[oo] וא׳ע׳ג׳ דמשום ירקיא ליתה כדאמרי׳ בראש השנה דאם כן בשאר רגלים נמי ניחוש משום מתיא מיהא איכא חם ושלום שאם ‹מת› לו מת בערב שבת או מערב יום הכיפורים סמוך לחשיכה ולא היה לו שהות להקבר צריך להשהותן עד מוצאי שתי שבתות ונמצא שהמת מסריח וחשו כ׳[pp] חכמים לכבוד המת ואמור דלא עבדינן תרי שבי גבי הדדי . והא דאמור רבנן ביום טוב ראשון יתעסקו בו עממים יום טוב דווקא אמרו ולא התירו לא

nn A citation from J *Sukkah* 4:1 (54b). The prominence given in the manuscript to this heading (very large square letters, on a separate indented line) is not justified, especially given the brevity of the citation, but reflects perhaps the source from which this passage was originally taken, namely, the commentary of Rabbenu Ḥananel, where passages quoted from the Palestinian Talmud may have been displayed prominently.

oo An insertion mark at this point refers to the following text in the right margin (some of its letters have been clipped off): וא׳ע׳ג׳ ‹ומ›שום ירקיא ‹מ›שום מתיא ‹ד›אמור רבנן ‹ד›.

pp Error marked for deletion.

Jerusalem Talmud

R. Simon commanded those:[105] pay heed not to do the willow branch on the Sabbath."

4, 6: why are they invalid? Because if you set the New Year on these (days), Yom Kippur will fall on the sixth of the week or on the first of the week, and there will be two consecutive days of Sabbath [i.e. of rest], and we do not make two consecutive Sabbaths, <as the Sages said, "because of the vegetables and because of the dead."[106] And even though> "because of the vegetables" does not apply, as we say in (tractate) *Rosh ha-Shanah* (20a), because if it did, we should also be concerned about the other festivals, nevertheless "because of the dead" applies: for if Heaven forbid someone's relative died on the eve of the Sabbath or on the eve of Yom Kippur close to nightfall, and there was no time (before night) for him to be buried, he would have to be left until the end of both Sabbaths [the consecutive Saturday and Yom Kippur], and as a result the dead would stink; the Sages were sensitive to the dignity of the dead and said that we should not make two consecutive days of Sabbath. And as for what our Rabbis said (ibid.), "On the first day of a festival, gentiles should take care of it [burial of the dead]," they said specifically regarding festivals, but they did not allow (this on) either the Sabbath or Yom Kippur.

105 This quotation from the Jerusalem Talmud is part of R. Hananel's commentary. The text in J *Sukkah* 4:1 (54b) reads, more intelligibly: "those who calculate" (i.e., the calendar). See discussion above; and, on this passage from the Jerusalem Talmud, Sacha Stern, *Calendar and Community: A History of the Jewish Calendar, 2nd Century BCE–10th Century CE* (Oxford: Oxford University Press, 2001), p. 172.

106 The text in angled brackets is in the margin. The reference is to B *Rosh ha-Shanah* 20a. With regard to the prohibition of labor, Yom Kippur has the status of the Sabbath and thus more restrictions than other festivals, such as a prohibition on cooking. Vegetables cannot be kept fresh for two consecutive days; for a similar reason, burial of the dead cannot be delayed for two days.

שבת ולא יום הכיפורים.   י״ח׳   למה פסול יש שאומרי׳ לפי שאמרו חכמי׳ צריך שיהא לילה ויום מן החדש . ופירשו את הדבר שלא תראה לבנה הישנה ביום שנקבע בו החדש לא ביום ולא בלילה . וכיון דאמור רבנן עשרין וארבעה שעי מיכסי סיהרא לדידהו שית מחדתא ותמני סרי מעתיקא.   ואם נולדה הלבנה אחר י״ח׳ נמצאת שנראת לבנה ישנה בתחילת הלילה אבל אם נולדה קודם י״ח׳ שעות שלא נראתה אמש הישנה חשבינן ליה כאילו לילה ויום מן החדש.   ולא רצו לתלות הטעם

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בהא דאמור רבנן נולדה קודם חצות בידוע שנראת שעה אחת סמוך לשקיעת החמה דהא אמרי עלה דההיא למאי נפק׳ מינה לאכחושי סהדי ואם איתא הכי הוה לן למימר למאי נפקא[qq]

qq The letter פ is written over another undecipherable letter.

18 [i.e. a *molad* after 18 hours]: why is it invalid? Some say because the Sages said: “night and day must be (part) of the new month” (ibid. 20b), and they explain this matter, that the old moon should not be seen on the day that the (new) month is set, either in the day or in the night;[107] and since our Rabbis said (ibid.): “the moon is hidden from them for 24 hours, (of which) six (hours) are of the new (moon) and eighteen of the old,”[108] if (then) the (new) moon is born after 18 (hours of the day), this means that the old moon was visible at the beginning of the night; whereas if it is born before 18 hours, so that the old (moon) was not visible the evening before, we can consider the night and the day to be (part) of the new month. But they did not want the reason

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to depend on what our Rabbis said (ibid.): “If is born before noon, it is known that it is visible one hour close to sunset,”[109] because they said on this (ibid.), “what is the purpose of this (tradition)?” (and they replied,) “to contradict the witnesses”;[110] and if this were so [i.e., that this tradition explains the postponement rule], they [*lit.* “we”] should

107 This explanation is in Rashi on B *Rosh ha-Shanah* 20b.

108 The meaning of this talmudic passage is obscure; but what these commentators go on to suggest, namely, that the old moon can be visible at the beginning of the night, is an astronomical impossibility that our author points out below.

109 Since 18 hours is noon, this passage might have afforded an explanation for the postponement rule, were it not for the author’s refutation of this.

110 I.e., the purpose of this tradition is to enable the rabbinic court to demonstrate that the testimony of the witnesses to the new moon is false if the conjunction is after noon, because then the moon could not have been visible in the evening.

מינה דלא קבעי ביה ירחי. וקשיא לי על זה הטעם אם כן י'ח' יהא כשר אחר י'ח' יהא פסול. ועוד מה שאמרנו למעלה שאם נולדה הלבנה אחר י'ח' נמצא שנראת הלבנה בתחילת הלילה אינו כן כי דבר ברור הוא כי לעולם לא תראה הלבנה הישנה בסוף החדש בתחילת הלילה כי אם בבקר בשחרית. ודבר הנראה לעינים הוא. ונראה כאותן שתולין עצמן על דבר בהא דתניא נולדה קודם חצות בידוע שנראית שעה אחת קודם שקיעת החמה כלומ' חלק אחד וכיון דראויה לראות קרינא ביה כזה ראה וקדש וקבעינן ירחא ואי לא[rr] לא .

7 ברור הוא] ברוק היא

rr The letter א is unclear.

have said, "what is the purpose of this?—not to set the (new) month on that day."[111]

But I have difficulty with this explanation [i.e. the one given above], for if so, (a *molad* of) 18 hours (exactly) should be permitted, and (only) after 18 should it be invalid.[112] Moreover, what we said above, that if the new moon was born after 18 (hours) this means that the (old) moon was visible at the beginning of the night, is incorrect, for it is clear that the old moon will never be seen at the end of the month at the beginning of the night, but only in the morning at dawn, and this is something visible to the eyes.[113] (Therefore), it seems (more plausible to argue) like those who base themselves on that which is taught: "If it is born before noon, it is known that it is visible one hour before sunset," that is, one part;[114] and since it is fit to be seen, we call it "see and sanctify (a moon crescent) like this"[115] and

111 I.e., in the calculated calendar based on the *molad*. The author implicitly assumes that such a calendar already existed in the talmudic period.

112 This is a very fine distinction, which (in our view) the explanation above does not necessarily imply. Furthermore, it is unclear whether the postponement rule of 18 hours includes or excludes 18 hours exactly, although all twelfth-century writers on the Jewish calendar assume as our text does (Abraham Bar Ḥiyya, *Sefer ha-ʿIbbur* 2:7; Zeraḥiah ha-Levi, *Sefer ha-Maʾor*, on *Rosh ha-Shanah* 20b; Abraham Ibn Ezra, *Sefer ha-ʿIbbur* (Lyck, 1874), p. 2a; Maimonides, *Laws of Sanctification of the New Moon*, 7:3).

113 This objection to Rashi is in Tosafot on B *Rosh ha-Shanah* 20b.

114 In rabbinic Hebrew, the term "hour" can refer to any period of time, including, as our author argues here, one part. Note that the text cited here ("one hour before sunset") is slightly different from the text cited above ("one hour close to sunset"); this change may be deliberate, in order to support the present argument. Note also that neither version is attested in any of the text witnesses of B *Rosh ha-Shanah* 20b, which nearly all read simply: "close to sunset."

115 A talmudic quotation, also from B *Rosh ha-Shanah* 20a. The author means that we deem the new moon to have been sighted and sanctified.

והא דאמור רבנן צריך שיהא לילה ויום ‹מן› החדש מן המולד אמרו וסבירא להו שאין קובעין את החדש ביום שנולדה בו הלבנה אלא למחרתו. **ובן פרח**[ss] וא'ע'פי שאין חלוקין עליו בתלמוד אותן חכמים שמסרו לנו סדר העיבור חלוקין עליו. והמסורת עיקר .

גטרד שאינו לפני אדר העיבור למה פסול[tt]

שאם בא לך תשרי בג' ימים וט' שעות ור'ד' חלקים ואתה קובע בו ביום הרי יבא לך מולד תשרי הבא בשבת בי'ח' שעות ואתה צריך לדחותו עד יום שיני בשבת ונמצאת נותן ששה בין קביעות לקביעות ונמצאת השנה יתירה יותר מדאי ותצטרך למלאת מרחשון וכסליו וטבת או אחד משאר חדשים הראוים להיות חסירים והואיל ואיפשר לדחות את ה' הקביעות ליום חמישי ויהיו ארבעה ימים בין קביעות לקביעות וגם מרחשון וכסליו כסדרן יפה לנו לעשות כן ולא נשים לעמי הארץ לשאל לנו על טבת אם מלא אם לאו

14 וסבירא] וחבירא 27 וגם] ויום

ss We are unable to translate or explain these words. An alternative reading might be ובן פדת. See Figure 2.

tt The prominence given to this heading in the manuscript (very large square letters, on a line on its own—see Fig. 2) is out of proportion with its earlier counterparts.

we fix the (new) month (on that day), and if not, then we do not.[116] And what our Rabbis said, "night and day must be (part) of the new month," they said regarding the *molad*, and they are of the opinion that one does not set the (new) month on the day when the moon is born, but on the following day. And even though there are no disagreements about this in the Talmud, those Sages who transmitted the order of the calendar to us disagree.[117] And the tradition [i.e. the latter] prevails.

3-9-204 which is not before an intercalary Adar: why is it invalid?

Because if (the *molad* of) Tishri occurs on the 3rd day at 9 hours and 204 parts, and you set (the first of the month) on that day, then the *molad* of the next Tishri will occur on the Sabbath at 18 hours, and you will have to postpone (the first of the month) to the second day of the week, and as a result you will be putting six (days of the week) between the dates of this year and of the next,[118] and as a result, the year will be too long and you will have to make Marḥeshvan and Kislev and Tevet, or [instead of Tevet] one of the other months that is supposed to be defective, full.[119]. But since it is possible to postpone the date (of the first New Year) to the fifth day, so that there will be four days (of the week) between the dates (of this year and of the next), and also Marḥeshvan and Kislev will be regular, it is better for us to do so, and not to make the common people ask us if Tevet is full or not:

116 On the basis of what the Talmud says, this is a reasonable explanation for the postponement rule of 18 hours, although on astronomical grounds this explanation is equally impossible, as the new moon is never visible as early as 6 hours after conjunction—a fact that demands some astronomical knowledge and of which our author may not have been aware.

117 A similar suggestion is in the Tosafot, loc. cit.

118 Thus the New Year in year 1 will be on the third day (Tuesday) and in year 2 on the second day (Monday), six days of the week later. For this to happen, the year would have to be longer than it is allowed to be.

119 Meaning eight 30-day months in the year, which is not allowed in the Jewish calendar.

וכיון שידעו את מרחשון ‹וכסליו› אם מליאין אם חסירין אם סדורים להם ‹ידעו› כל השנה כולה

בט׳ו׳ ת׳ק׳פ׳ט׳ אחרי אדר העיבור למה פסול

לפי כשאתה משליך ה׳כ׳א׳ ת׳ק׳פ׳ט׳ למפרע אתה מוצא שהיה מולד תשרי של אשתקד ביום ג׳ בי׳ח׳ שעות והוצרכנו לדחותו עד יום חמישי ועכשיו שבא מולד תשרי ביום ב׳ בט׳ו׳ שעות תק׳פ׳ט׳ אם אתה קובע היום ראש השנה נמצא שאין בין קביעות לקביעות אלא ד׳ ימים ואתה צריך לחסר מרחשון וכסליו ושבט או אחר מן החדשים הראוים להיות מליאים וכיון דאיפשר לדחות את הקביעות ליום השלישי יפה לנו לדחותו ויהיה לנו חמשה ימים בין קבעות לקביעות. ונעשה מרחשון וכסליו חסירים ולא נטריח את הנשים לשאל לנו על שבט אם מלא או לאו.

דוגמא לדבר מצינו שחשו לתקנת עמי הארץ ואמרו ‹אדר› הסמוך לניסן לעולם חסר. וטע׳[uu] לפי שהעם מסתכלים בפורים ואומרין מן הפורים ועד הפסח שלישים יום ואילו היינו עושים אותו פעמים מלא פעמים חסר היינו מטריחי׳ את העם לשאול לנו על אדר אם מלא אם חסר בכל שנה ושנה.וזימנין דמשתלו ולא שיילי ואתי למיכל חמץ בפסח.

5 אשתקד] אשקד   13 אם] יום

uu Abbreviation for וטעמו.

and once they know whether Marḥeshvan and Kislev are full, defective, or regular, [they will know] the rest of the year.

2-15-589 after an intercalary Adar: why is it invalid?

Because if, (looking) backwards, you subtract (from this) 5-21-589 [i.e. the remainder, after casting out 7s, of the foregoing intercalated year], you find that the *molad* of Tishri of the previous year was on the 3rd day at 18 hours, and we had to postpone it to the fifth day. And now that the *molad* of Tishri falls on the 2nd day at 15 hours 589 (parts), if you set the New Year on that day, there will only be 4 days (of the week) between the (New Year) dates [of last year and this year, 4 days of the week from Thursday to Monday], and you will need to make Marḥeshvan and Kislev and Shevat, or [instead of Shevat] one of the other months that should be full, defective. But since it is possible to postpone the date (of the first New Year) to the third day, it is better for us to postpone it and have five days between the dates (of last year and this year); and we will make Marḥeshvan and Kislev defective and will not trouble the women to ask us if Shevat is full or not.

We find an example of this[120] in that, out of concern that the common people get it right, they said: “<Adar> adjacent to Nisan is always defective” (B *Rosh ha-Shanah* 19b). The reason (for this) is that the people look at Purim and say ‘there are 30 days from Purim until Passover’; and if we were to make it [the Adar before Nisan] sometimes full and sometimes defective, we would be troubling the people to ask us every year whether Adar is full or defective; and sometimes they could make a mistake and not ask and would come to eat leaven on Passover.

120 I.e., of this concern to prevent common people and women from making mistakes.

הרי פירשתי לך דחיות תשרי וטעמי׳ .

בא ונפרש לך אותן של ניסן. **ב׳ד׳ו׳ למה פסול בניסן.** לפי שאמרו חכמי׳ לעולם פסח ערב עצרת ועצרת ערב ראש השנה. ואי אתה עושה ניסן בב׳ד׳ו׳ יבא לך פסח בב׳ד׳ו׳. ושבועות בג׳ה׳ז׳ וראש השנה בא׳ד׳ו׳.

י׳ג׳ ות׳ר׳מ׳ב׳ פסול לניסן. שאם בא ניסן בי׳ג׳ ת׳ר׳מ׳ב׳ יבא לך תשרי בי׳ח׳ שעות וכיון שדחית את תשרי מי׳ח׳ שלכן הוצרכת אתה צריך כמו כן לדחות את ניסן מי׳ג׳

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ת׳ר׳מ׳ב׳ שאם אין אתה עושה כן צריך למלאת את אייר שלא יהא דילוג יותר משני ימים בין ניסן לתשרי[vv] או אחד משאר חדשי הקיץ החסירים. **א׳ד׳ ות׳ת׳מ׳ו׳ שאינו לפני אדר העיבור למה פסול לניסן.** שאם בא לך מולד ניסן שאינו לפני אדר העיבור בא׳ד׳ ות׳ת׳מ׳ו׳ יבא לך תשרי בג׳ט׳ר׳ד׳ . וכיון שדחית את תשרי מ׳ג׳ט׳ר׳ד׳ אתה צריך לדחות גם את ניסן מא׳ד׳ ות׳ת׳מ׳ו׳ כדי שלא יהא דילוג יותר משני ימים בין ניסן

vv The clause שלא יהא דילוג יותר משני ימים בין ניסן לתשרי belongs to the previous line, after ת׳ר׳מ׳ב׳. Its displacement suggests that it was initially omitted, then reinserted in the wrong place. It is unlikely to be a gloss, as the same clause appears in the next paragraph.

Now I have explained to you the postponements of Tishri and their reasons.

Come we will explain those of Nisan to you.

***BaDU* [2, 4, 6], why are they invalid for Nisan?** Because the Sages said that Passover always (falls on the same day of the week as) the eve of Pentecost, and Pentecost (on the same day of the week as) the eve of the New Year. And if you make Nisan (begin) on 2, 4, 6, Passover will fall on 2, 4, 6, and Pentecost on 3, 5, 7, and the New Year on 1, 4, 6.

13-642 is invalid for Nisan: Because if (the *molad* of) Nisan occurs at 13-642, (the *molad* of Tishri) will be at 18 hours, and since you postponed (the start of) Tishri from 18 hours [i.e, when the *molad* occurs at or after 18 hours], because you had to, you must similarly postpone Nisan [when the *molad* occurs at or after] 13-

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642, so that the difference between (the day of the week of the first) of Nisan and (the first of) Tishri is not more than two days; for if you do not do so, you will have to make Iyyar, or another of the defective summer months, full.[121]

1-4-846 which is not before an intercalary Adar, why is it invalid for Nisan? Because if the *molad* of Nisan which is not before an intercalary Adar occurs at 1-4-846, (the *molad* of) Tishri will occur at 3-9-204. And since you postponed Tishri from 3-9-204 [i.e. since you will postpone[122] the first day of Tishri when the *molad* is at or after 3-9-204], you must also postpone Nisan [when the *molad* occurs

121 The order of the clauses has been rearranged in accordance with our textual conjecture.

122 The past tense, in the text, is perhaps to express that this rule is already known from the discussion above.

לתשרי. ז'י'א' וק'נ'א' אחרי אדר העיבור למה פסול לניסן לפי שיבא לך תשרי ב'ב'ט'ו' ת'ק'פ'ט' וכיון שדחית תשרי ב$^{\text{מ}}$ב'ט'ו'[ww] ת'ק'פ'ט' הוצרכת לדחות ניסן מ'ז'י'א' ק'נ'א' כדי שלא יהא לך דילוג יותר משני ימים בין פסח לראש השנה.

הרי פירשתי לך הדחיות וטעמיהן.

ואם תאמר מפני מה נתנו י'ח' לתשרי י'ג' ת'ר'מ'ב' לניסן היה לנו י'ח' לניסן ונסדר דחיות תשרי על ידי ניסן . זהו טעמיה של דבר כי תשרי ראש לשנים ושנות העולם מתשרי נכ[xx] מנינן ובתשרי נברא העולם. כדאמרי' בראש השנה כמאן מצלינן האידנא זה היום תחילת מעשיך כמאן כר' אליעזר אמטול הכי' נתנו י'ח' לתשרי.

ומפני מה נתנו חכמים עיניהם על מרחשון וכיסליו לעשותם פעמים מליאים ופעמים חסירים פעמים סדורים ולא סדרו להם שני חדשים אחרים זהו טעם הדבר כי על כרחנו צריך אנו למלאות מרחשון למה כשבא תשרי

ww The superscript מ is intended to replace the erroneous prepositional ב.

xx An error, not struck out.

at or after] 1-4-846, so that the difference between (the days of the week of the first) of Nisan and (the first of) Tishri is not more than two days.

7-11-151 after an intercalary Adar, why is it invalid for Nisan? Because (the *molad* of the subsequent) Tishri will occur at 2-15-589, and since you postponed Tishri from 2-15-589 [i.e. since you will postpone the first day of Tishri when the *molad* is at or after 2-15-589], you must postpone Nisan from 7-11-151, so that the difference between (the days of the week of the first day) of Passover and the New Year is not more than two days.

Now I have explained to you the postponements and their reasons.

And if you say, why did they set 18 (hours as the *molad*'s limit) for Tishri and 13-642 for Nisan? Let us set 18 for Nisan, and fix the postponements of Tishri according to Nisan![123]

The reason for this is that Tishri is the head of the years, and the years of the world are counted from Tishri, and the world was created in Tishri, as we say in (tractate) *Rosh ha-Shanah* (27a): "Whose opinion do we follow nowadays when we pray, 'This day is the beginning of your works,' whose opinion? R. Eliezer's." This is why they set 18 (as the limit) for Tishri.

And why did the Sages select Marḥeshvan and Kislev to be sometimes full, sometimes defective, and sometimes regular, and did not do so for some other two months?

This is the reason for this, namely, that we must necessarily make

123 As explained above, the limit of 13-642 for Nisan is only a derivative of Tishri's limit of 18 hours. The author's question is why the limit of 18 hours was applied specifically to the month of Tishri rather than to the month of Nisan (which in some contexts, such as biblical chronology and the cycle of *tequfot*, is treated as the first month of the year) and derive the limit of Tishri from the limit of Nisan.

בפחות מי׳ח׳ וקבענוהו ביומו כגון אם היה מולד תשרי בי׳ז׳ ש׳ שעות ביום ב׳ השלך א׳י׳ב׳ ת׳ש׳צ׳ג׳ יבא לך מולד מרחשון כל[yy] ד׳ בה׳ שעות וני[zz] ות׳ש׳צ׳ג׳ חלקים וקבענוהו ביומו. חזור והשלך א׳י׳ב׳ ת׳ש׳צ׳ג׳ ויבא לך מולד כסליו ביום ה׳ בי׳ח׳ שעות ות׳ק׳ו׳ חלקים וצריך אתה לדחותו ליום ו׳ ויהיה מרחשון של שלשים וכיון שעל כרחינו צריכין אנו לעשות מרחשון פעמים מלא ופעמים חסר צרפו חכמים להם את כסליו הסמוך לו וברוו להם אילו שני החדשים לחסרם ולמלאם כפי

24 בי׳ז׳] בי׳ו׳

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מה שהשנה צריכה ובהם נתקנו כל חדשי השנה שלעולם לא תמצא חדש שיבא מולדו לאחר י׳ח׳ שלא יהא נדחה למחרתו או ליום הראוי לו ואם תאמר בששניהם צריכין לחסר יניחו את כסליו במקומו ויחסרו את תשרי זהו טעמו של דבר לפי ש׳ שפעמים שצריך לחסר שני חדשים וצריך למלאות את תשרי כדי שלא יהא נקבע ראש חדש מרחשון בי׳ח׳ שעות. כגון שאם בא מולד תשרי בליל א׳ בה׳ שעות ור׳פ׳ז׳ חלקים . וצריך לדחותו ביום ב׳ הוסף ד׳ח׳ ת׳ת׳ע׳ו׳ ויבא לך מולד תשרי ליום ה׳ לי׳ד׳ שעות ופ׳ג׳ חלקים

9 לי׳ד׳] לי׳ב׳

yy This word is erroneous, possibly a mistake for בד׳.

zz This error seems to be marked for deletion.

Marḥeshvan full. Why? When (the *molad* of) Tishri occurs before 18 (hours), and we set it (the beginning of the month) on the same day, for example if the *molad* of Tishri was at 17 hours on the 2nd day, add 1-12-793, (and) the *molad* of Marḥeshvan will occur on (the) 4th (day) at 5 hours and 793 parts, and we set (the first of the month) on the same day. Repeat this and add 1-12-793, and the *molad* of Kislev will occur on the 5th day at 18 hours and 506 parts, and you will you have to postpone it to the 6th day, so Marḥeshvan will be 30 (days). And since we must necessarily make Marḥeshvan sometimes full and sometimes defective, the Sages added Kislev, which is adjacent to it, and chose these two months to be made defective or full, according to

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what the year needs; and through them, all the months of the year are set correctly, because you will never find a month whose *molad* occurs after 18 (hours) that is not postponed to the next day or to the day that is appropriate for it.

And if you say, when both need to be defective, let them leave Kislev as it is and make Tishri defective! This is the reason for this (for not doing so), because sometimes it is necessary to make two months defective but to make Tishri full, in order that the first of Marḥeshvan be not set at 18 hours. For example, if the *molad* of Tishri falls on the night of the 1st at 5 hours and 287 parts, and (the New Year) must be postponed to the 2nd day, add 4-8-876 and the *molad* of (the next year's) Tishri will occur on the 5th day, at 14 hours and 83 parts...

Sacha Stern is head of the Department of Hebrew and Jewish Studies at University College London and principal investigator of the ERC Advanced Grant project at UCL on Calendars in late Antiquity and the Middle Ages: Standardization and Fixation. He is the author of *Calendar and Community: A History of the Jewish Calendar, 2nd cent. BCE–10th cent. CE* (Oxford 2001) and of *Calendars in Antiquity: Empires, States, and Societies* (Oxford 2012). Some of his research on ancient and medieval calendars has appeared previously in *Aleph*.
Email: sacha.stern@ucl.ac.uk

Justine Isserles is a scientific collaborator at the University Library in Geneva (BGE). She completed her doctorate in 2012 at the École Pratique des Hautes Etudes (Paris) and the University of Geneva, with a study of the corpus of extant *Maḥzor Vitry* manuscripts. Between 2011 and 2013, she was an associate researcher in the Department of Hebrew and Jewish Studies at University College, London, where she worked on a project, funded by the Leverhulme Trust and led by Prof. Sacha Stern, on Jewish and Christian Calendars from Franco-Germany (12th–15th centuries). Her recently published articles related to this project are: "Some Hygiene and Dietary Calendars in Hebrew Manuscripts from Medieval Ashkenaz," in *Time, Astronomy and Calendars in Jewish Tradition*, edited by Sacha Stern and Charles Burnett (Leiden: Brill, 2014): 273-326; and, with P. Nothaft, "Calendars beyond Borders: Exchange of Calendrical Knowledge Between Jews and Christians in Medieval Western Europe (12th–15th c.)," *Medieval Encounters* 20 (2014): 1–37. Email: jisserles26@gmail.com