

## *The Beginning of the Jewish Calendar*

By: BERNARD DICKMAN

### The Traditional View

The Jewish calendar is a lunisolar calendar consisting of 12 months annually of 29 or 30 days. An extra leap month of 30 days is added every 2 or 3 years (7 leap months in 19 years) for a total of 235 lunar months in 19 years. This 19-year cycle is called the Metonic cycle and results in the 19 Jewish years approximating 19 solar years.<sup>1</sup> In this way, the Jewish holidays are always in the same season and vary by less than a month in the solar calendar. However, the approximation is not exact, and the average Jewish year is 6-7 minutes longer than the average solar year. As a result, the Jewish calendar is one day longer over approximately every 216 years. This causes a calendar drift where the holidays and seasons are gradually coming out later in the solar year.

Historically, Sanhedrin decided when a month started and when a leap year should be added. Sometime after the destruction of the second Temple a fixed calendar was put in place. Rambam in *Kiddush Ha-Chodesh* (K"V) 5:3 dates it to the time of the Babylonian *Amoraim*, Abaye and Rava. However, he provides no evidence for this assertion, and the Babylonian Talmud, which was completed many years after the demise of these *Amoraim*, never overtly mentions anything about such a calendar or its rules. Rambam does not attribute authorship of our fixed calendar to any specific person. R. Avraham bar Chiyya in *Sefer ha-Ibbur* (1123) says that in 992 R. Hai Gaon claimed

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<sup>1</sup> In chronology, a period of 19 years in which there are 235 lunations, or synodic months, after which the moon's phases recur on the same days of the solar year, or year of the seasons. The cycle was discovered by Meton (fl. 432 bc), an Athenian astronomer. Computation from modern data shows that 235 lunations are 6,939 days, 16.5 hours; and 19 solar years, 6,939 days, 14.5 hours. Source: *Encyclopedia Britannica*.

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Bernard Dickman is a professional educator. His works on Biblical and Talmudic topics appear in *Tradition*, *Higayon*, and *Location Sciences*.

that the calendar was created in Eretz Yisrael under the leadership of Hillel II in 358/9. We do not have a copy of the cited R. Hai Gaon's work. The earliest confirmed existence of our calendar dates to the 12<sup>th</sup> century. According to the standard dating of when Abaye and Rava lived, Rambam's dating of the calendar is consistent with R. Avraham bar Chiyya's, but he never mentions a person named Hillel II nor suggests that the calendar was developed in Eretz Yisrael. It is, however, not all that certain that Rambam agrees that Abaye and Rava were 4<sup>th</sup> Century *Amoraim*.

In his introduction to *Mishneh Torah*, Rambam writes:

"18: ... and R. Yochanan wrote the *Talmud Yerushalmi* in Eretz Israel, close to 300 hundred years after the destruction of the Temple. 23: ... Rav Ashi is the one who wrote the *Talmud Bavli* in the land of Shinar, about 100 years after R. Yochanan wrote the *Talmud Yerushalmi*."

This places R. Yochanan 300 years after the destruction of the 2<sup>nd</sup> Temple. The Temple was destroyed in 70 and Abaye and Rava lived about 70 years after R. Yochanan. If Rambam places R. Yochanan 300 years after the Temple, then Abaye and Rava lived towards the middle of the 5<sup>th</sup> century, not 358/359.

Many calendar historians question this dating and some say that the fixed calendar was not finalized until the 800s. A noted expert, Engineer Yaaqov Loewinger,<sup>2</sup> reviews this controversy and argues that astronomical data are consistent with a 358/9 dating of the calendar.<sup>3</sup> Loewinger suggests that a reasonable criterion for the fixed calendar is that at the start of every 19-year cycle, "the true period of spring (according to astronomy) coincided reasonably closely with the time of the appearance of the new moon of Nisan according to the calendar." In 345, when the cycle that includes 358/9 started, there was about a six-hour difference between "the actual spring equinox and the 'mean' appearance of the new moon of Nisan." However, in

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<sup>2</sup> In "Can Astronomy Help Determine When the Hebrew Calendar was Founded?" 1999, available at <<http://www.biu.ac.il/JH/Parasha/veethcha/lev.html>>.

<sup>3</sup> A more thorough history of the fixed calendar can be found in Sacha Stern's 2001 book "Community and Calendar: A History of the Jewish Calendar, Second Century BCE-Tenth Century CE," Oxford University Press 2001.

839 (also the starting year of a 19-year cycle), the actual equinox was two days earlier than the appearance of the new moon, and in 1998 (the start of our current cycle), the equinox was more than seven days earlier. Thus, he concludes that a starting date for the fixed calendar in 359 is more compatible with astronomical data than a ninth-century starting date.<sup>4</sup>

### The Role of *Bais Din*

The dating of the starting time of our fixed calendar is of more than mere historical interest. Ramban is quite explicit (*Hagabos to Sefer Hamitzvos*, *Aseh* 153) that a *Bais Din* of *semuchin*—although not *Bais Din Hagadol*—is necessary to establish Jewish holidays, and therefore he states that Hillel was *mekadesh* all future *Roshei Chadashim* upon realizing that *smicha* would soon be voided. The position of Rambam in this regard is not as clear. Rambam K”H 5:1 puts the authorization of the monthly and yearly calendar established via sighting in the hands of the Sanhedrin in Eretz Yisrael, i.e.:

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<sup>4</sup> Stern (pp. 197–200) reviews and critiques Loewinger. He points out that the “start” of spring (*tekufas* Nisan) is not a clearly defined term, and that Loewinger assumes that it refers to the true vernal equinox (TVE). In this system the four seasons of the year are not of equal length. However, *tekufas* Nisan is also at times used to refer to a mean equinox (MVE) under the assumption that all seasons of the year are of equal length. Rabbi Chaim Kanievsky (*Shekel Hakodesh, Hilchos K”H* 10:7:20) offers a similar explanation of MVE. J. Jean Ajdler (*Tradition*, Winter 2004) “Rav Safra and the Second Festival Day: Lessons About the Evolution of the Jewish Calendar” (pp.16-17) argues that *tekufah* indeed refers to this mean vernal equinox and therefore rejects Loewinger’s argument. Ajdler defines true equinox as “the passage at the vernal or autumnal point of the true sun,” while he defines mean equinox as “the passage at these points of the mean sun.” Stern also points out that the calculation of the equinox was imprecise in those days and a margin of error of one day in the calculations could affect Loewinger’s numbers by over 200 years. He concludes that “any date between the fourth and eighth centuries could equally be considered” as a starting date for the calendar. We will discuss the issue of TVE vs. MVE in great detail later in the paper.

“Whatever we have said about establishing *Rosh Chodesh* by sighting ... is only done by Sanhedrin of Eretz Yisrael or by an ordained Bais Din of Eretz Yisrael who were given permission to do so by the Sanhedrin... but at a time when there is no Sanhedrin in Eretz Yisrael, months and leap years are established only by the calculations that we do today.”

With respect to the fixed calendar, Rambam in *Mishneh Torah* makes no mention of a need for any authoritative body to confirm its general implementation or monthly usage:

**K”H 5:2-5:3**—“And this matter is a *Halacha L’Moshe M’Sinai*—in the time when there is a Sanhedrin, you make the *kviyut* based on observation, and when there is no Sanhedrin, the *kviyut* is determined based on the calculations we currently use. And when did all Israel begin to use this method of calculation? From the end of the period of the Talmudic sages when Eretz Israel was destroyed and there did not remain a fixed *Bais Din*; but in the times of the Mishnah sages and also in the times of the Talmudic sages until the days of Abaye and Rava—the people relied on the *kviyut* of Eretz Israel.”

However, in *Sefer Hamitzvos, Mitzvah* 153, Rambam offers the following:

“... when we today in the Diaspora do the calendar calculations and say that this day is *Rosh Chodesh* and this day is *Yom Tov*, the fact that it is *Yom Tov* is not based on our calculations at all but only because (the Great) *Bais Din* in Eretz Yisrael has (already) established that it is *Yom Tov* or *Rosh Chodesh* {this is so} whether their decision is based on calculations or sighting...<sup>5</sup>

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<sup>5</sup> The words “Great” and “already” appear in some texts, and are omitted by Rav Kappach in his version. See R. Chaim Heller’s *Sefer Hamitzvos, Mitzvah* 153 n. 13. Rabbi Heller includes them although in Ramban’s text of *Sefer Hamitzvos* both of these words are lacking. Some (e.g. שו”ת אבני נזר או”ח סימן שי-שיא) suggest that since according to R. Heller’s reading, *smicha* is necessary for the sanctification of the moon, Rambam’s position is that the whole world today grants a temporary *smicha* to a regular Bais Din in Eretz Yisrael for the sole purpose of sanctifying the month. Such an agreement to confer a full-fledged *smicha* can be found in Rambam *Sanhedrin* 4:11-12.

Thus while some texts imply that Rambam requires *Bais Din Hagadol* for establishing the fixed calendar, the most authoritative texts do not. Rambam in *Sefer Hamitzvos* also seems to say that for the fixed calendar to continue to be implemented, there must be a contemporary *Bais Din* in Eretz Yisrael, although it need not be one of Great *Bais Din* status.

Since *smicha* ostensibly ended after Hillel's days, it would seem that according to Ramban the original implementation of a fixed calendar would apparently have had to occur no later than the 4<sup>th</sup> century. Whether Rambam is bound by the same criterion depends on the proper text of the *Sefer Hamitzvos*.

Although Rambam's language in K" H 5:2 seems to say that the fixed calendar we use today is *Halacha L'Moshe M'Sinai*,<sup>6</sup> Chazon Ish<sup>7</sup> says this was not Rambam's intention:

“On the basics of our calendar that Rambam said was *Halacha L'Moshe M'Sinai*, he does not mean that the details were transmitted, but rather it was transmitted so that the *Chachamim* are permitted to do a fixed calculation according to which the years will be ordered so that the solar years and lunar years are paired, and according to this Hillel and his *Bais Din* instituted our calculations. But it does not prevent the institution of another calculation according to which will be established the solar and lunar years. And as Shmuel said in Rosh Hashanah 20b, ‘I can fix it a calendar for the entire Diaspora,’ and if Hillel's calculations were accepted from Sinai why do we need Shmuel for this?”

According to Chazon Ish, Rambam holds that any “reasonable” fixed calendar would satisfy the *Halacha L'Moshe M'Sinai* and we are not necessarily restricted to the one in use today.

## Calendar History

The tradition that the fixed rabbinic calendar was fully established by the Sanhedrin in 358/9 has often been challenged. Stern<sup>8</sup> offers many

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<sup>6</sup> הלכות קידוש החודש ה:ב ודבר זה הלכה למשה מסיני הוא--שבזמן שיש סנהדרין, קובעין על הראייה; ובזמן שאין שם סנהדרין, קובעין על חשבון זה שאנו מחשבין בו היום. ואין נזקקין לראייה...

<sup>7</sup> *Hilchos Rosh Hashanah*, at the end of *siman* 140.

<sup>8</sup> Stern, p. 176. See also pp. 277–283.

reasons why the tradition was questioned. With the exception of R. Hai's reference, Hillel b. R. Yehuda is unknown in early rabbinic writings. Also, in the Babylonian Talmud (which was completed around 500), there is no reference to the fixed calendar, with the possible exception of a comment in *Betzah* 4b.<sup>9</sup> More important, there are a number of documents and tombstones that reference dates that would have not been possible if our current fixed calendar was in place. The most famous of these documents is the 835/836 letter of a Babylonian exilarch that was found in the Cairo Genizah. His letter discusses the day of the week for the start of Pesach in 836.<sup>10</sup> Pesach was due to start on Tuesday, so that the following Rosh Hashanah would be on Thursday, even though the *molad* of Tishrei was Thursday afternoon, and based on the "*Molad Zaqen*" rule (see Rambam K"V 7:2) would have been deferred to Shabbos.<sup>11</sup>

Some suggest that while the calendar may have been introduced in 358, it may have been finalized later.<sup>12</sup> Stern<sup>13</sup> claims that R. Hai himself, in speaking of Hillel II, is discussing only the basic 19-year cycle of intercalations, and that only later (in the 12<sup>th</sup> century) was the entire fixed calendar credited to Hillel. In his article (n. 4), Ajdler provides evidence of a gradual movement towards a fixed calendar in the years preceding Hillel, especially in the 300s, and suggests that 359 "could represent the date of the official and irreversible institution of the fixed calendar" (Ajdler, *ibid.* p. 19) that was finalized around 839.

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<sup>9</sup> "But now (that we know the fixing of the new moon), for what reason do we (in the Diaspora) observe two (festival) days?" Stern, p. 170, n. 63.

<sup>10</sup> See Stern, pp. 277–283, for a copy of this letter and a translation.

<sup>11</sup> Possible answers offered to resolve these contradictions include: The fixed calendar was not universally accepted; *Molad Zaqen* rule was not observed (see Stern p. 196); the calculation of the *molad* (on which the entire calendar is based) may have been different (see Stern fn. 159 and p. 206, and Ajdler endnote 106).

<sup>12</sup> Stern (chapter 4) and Loewinger present additional issues in this debate.

<sup>13</sup> Stern, p. 176.

## Intercalations – Equinox Relationship

In Bavli *Rosh Hashbanah* 21a, R. Huna b. Avin tells Rava, “When you see that the winter season is prolonging itself until the 16<sup>th</sup> of Nisan, intercalate that year.” Rambam (ibid. 4:2) states that a leap month should be added when the vernal equinox occurs on Nisan 16 or later.<sup>14</sup> In explaining the timing of the start of the spring season according to our fixed calendar,<sup>15</sup> Rambam offers the following timing of the start of spring season and Molad Nisan in year 1 of creation (Tohu):

**K”H 10:1:** The solar year, according to those who say it is less than {365 and} a quarter days, say it is 365 days 5 hours, 997 *chelakim* and 48 *regas*—a *rega* is 1/16 of a *chelek*— ... **K”H 10:3:** According to this calculation, the *tekufah* of Nisan of the first year of Creation was 9 hours and 642 *chelakim* prior to the molad of Nisan ... And so it will always be, in the first year of each 19-year cycle, 9 hours and 642 *chelakim* prior to the *molad* of Nisan...**K”H 10:6:** The calculations of both *tekufahs* which we have explained, are all approximations, based on the average motion of the sun and not on its true position. But according to the true position of the sun, the *tekufah* of Nisan in these times is about two days prior to the time of the *tekufah* resulting from either one of the two *tekufahs* that are a result of this calculation, whether the calculation is according to one who thinks a complete quarter of a day {over 365 days} or according to the one thinks less than a quarter of the day.

The two types of *tekufahs* Nisan mentioned by Rambam in 10:6 are the True Vernal Equinox (TVE) and the Mean Vernal Equinox (MVE). These equinoxes represent different approaches as to how to identify the start of spring (i.e. Tekufas Nisan),<sup>16</sup> and Rambam is say-

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<sup>14</sup> Tosafot (TB, R”H 21a), Rabbi Abraham b. Chiyya (*Sefer ha-Ibbur*, 3:5) and Rabbenu Chananel (TB, R”H 21a) say we add a month only if the equinox occurs after Nisan 16.

<sup>15</sup> This is generally referred to as Rav Adda’s model. Rambam never mentions his name.

<sup>16</sup> See footnote 4 for a discussion of what TVE and MVE represent. The question of which better represents the start of spring was a matter of discussion as early as 45 BCE when the Julian calendar was introduced. See also *Hakirah* vol. 6, “Bircas HaChamah and Calendar Mathematics: Precision, Simplicity and Conflict.”

ing that for the fixed calendar MVE is used, and that in his time TVE preceded MVE by approximately two days. Thus, at Creation, spring (MVE) began Tuesday 6 pm and Molad Nisan (MN) was Wednesday 3:35:40 am (9 hours and 642 *chelakim*, 4 days later). Rambam's assertion that the difference between the start of spring and MN is the same for year 1 in every 19-year cycle is based on the fixed-calendar-model assumption that the length of 19 solar years exactly equals the length of 19 lunar years. Although Rambam does not mention it, corresponding years in all 19 cycles also have the same divergence between Molad Nisan and the Mean Vernal Equinox (see Table 1). In reality, because the fixed-calendar-model assumption slightly overstates the length of a solar year, Molad Nisan is actually moving later in the year relative to MVE. Thus, Rambam's reference of all first years of 19-year cycles having the same MVE/MN relationship is a "halachic" statement rather than a factual observation.<sup>17</sup>

Rambam's position in K" H 4:2 that Tekufas Nisan (TN) must precede the 16th of Nisan seems to be at odds with the fixed-calendar model he described in chapter 10. MN in the 16th year of the cycle precedes TN by 15.14 days (see Table 1). If Nisan in the 16th year of a cycle starts on the day of the *molad*, TN is on the 16th of Nisan and in violation of K" H 4:2. Assuming that the fixed calendar was introduced in 358/359, based on the rules of our fixed calendar, this problem would have arisen on the 2nd year of its implementation (i.e., 360 CE is the 16th year of a 19-year cycle that began in 345) and 9 more times in the twenty-seven 19-year cycles that began in 364 CE and ended in 857 CE, i.e., 379, 493, 512, 607, 626, 664, 740, 759, 854. For this reason Yessod Olam<sup>18</sup> and others maintain that while Rambam states that the empirical calendar used the end of Nisan 15 as the cutoff date, the fixed calendar uses the end of Nisan 16. If this is correct, why does Rambam not clearly state this difference between the two calendars?<sup>19</sup> Also, why didn't the *Chachamim* just make year 16—the only year in the 19-year cycle that can possibly have an equi-

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<sup>17</sup> Similar to Rambam's calculation of when the seasons begin according to Shmuel, which is based on a year being 365 and  $\frac{1}{4}$  days, which Rambam admits is incorrect.

<sup>18</sup> *Maamar* IV, chap. 2, p. 4. See also Jaffe in *Korot Heshbon ha-Ibbur*, p 112.

<sup>19</sup> Loewinger in *Al ha-Sheminit*, p. 25 interprets Rambam as making this point.

nox on Nisan 16—a leap year instead of year 17, so no date switch would be necessary? An alternative solution to the problem of year 16 is that Rambam refers in 4:2 to the TVE, not MVE. Since TVE precedes MVE by 2 days, the latest TVE that could be in year 16 is Nisan 14 (Table 1) and everything would be consistent. A difficulty with this approach is, why does Rambam concentrate on MVE in chapters 9 and 10 when the key parameter to follow is TVE?

**Table 1**

	<u>Length in Days</u>	<u>Solar – Lunar</u>
Solar Year →	365.2468222	
Lunar Year Regular ( R ) →	354.3671296	10.87969258 days
Lunar Year Leap ( L ) →	383.8977238	-18.65090156 days

  

<u>Year- Type</u>	<u>MVE- MN Differential</u>	<u>TVE-MN Differential</u>
1- R	-0.40	-2.40
2- R	10.48	8.48
3- L	-8.17	-10.17
4- R	2.71	0.71
5- R	13.59	11.59
6- L	-5.06	-7.06
7- R	5.82	3.82
8- L	-12.83	-14.83
9- R	-1.95	-3.95
10- R	8.93	6.93
11- L	-9.73	-11.73
12- R	1.15	-0.85
13- R	12.03	10.03
14- L	-6.62	-8.62
15- R	4.26	2.26
16- R	15.14	← 13.14
17- L	-3.51	-5.51
18- R	7.37	5.37
19- L	-11.28	-13.28

## The Start of the Fixed Calendar and Calendar Drift

The solar year is 365 days, 5 hours, 48 minutes and 46 seconds. The Jewish solar year assumes a solar year of 365 days, 5 hours, 55 minutes and 25 seconds. Thus, on average, every Jewish year is longer than the actual solar year by 6 minutes and 39 seconds, which is equivalent to adding about one day every 216 years. Because of this, the Jewish holidays are gradually moving later, as are the halachic *tekufohs*. This amount is called the calendar drift. For example, when the calendar was fixed, assume that according to the Jewish calendar the true vernal equinox occurred on March 20, and that Rambam's MVE (*tekufoh*) was two days later on March 22. If 216 years later, the true vernal equinox was again on March 20, then according to the Jewish calendar, the true vernal equinox would be on March 21 and the mean vernal equinox would be on March 23. According to Yessod Olam, as explained in the previous section, this means that according to Rambam MVE would always have to precede Nisan 17.

If we want to know how much the calendar has drifted between any two years, we calculate the number of years between them and divide by 216. For example, if the fixed calendar was instituted in 358/9, then the calendar drift until now should be approximately 7.6 days [(2008-358)/216]. Thus, in our days, Nisan 17 should always be at least 7.6 days after the mean vernal equinox. We will now use this to determine, according to Yessod Olam, the earliest year the fixed calendar could have been established. In 2013, the true vernal equinox occurs at 1:24 PM Jerusalem Mean Time on March 20, the mean vernal equinox at 6:26 AM JMT on March 22 (one day and 17 hours later), and Pesach starts Monday night March 25. This is the earliest start for Pesach since the same date in 1899. Therefore, the calendar drift as measured from the mean vernal equinox until the end of Nisan 16 on March 27 at 6 PM (the latest time that the *tekufoh* could be) is less than five days and twelve hours or about 5.48 days. This tells us that from the time the fixed calendar was finalized until 2013, the calendar will have drifted by at most 5.48 days.<sup>20</sup> Multiplying 5.48 by

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<sup>20</sup> If we did similar calculations for the other 18 years in this cycle, we would get a larger upper bound for each year, since 2013 is the sixteenth year in the cycle, which is the year in the cycle when Pesach comes earliest, i.e., it comes closest to the mean vernal equinox. Thus,

216 yields 1183.68, and the calendar could not have been finalized until at least the year 829 (2013-1184). According to Chazon Ish's interpretation of Rambam, it is of course possible that a fixed calendar was sanctioned and introduced by a Bais Din of *smuchim* in 358/359 but the rules were slightly different from the ones we have, and that in 829 or later a regular *Bais Din* in Eretz Yisrael modified it so that it is what we have today.

Note, however, that if the TVE is required to occur before the end of Nisan 16, then the drift is 7.2 days and  $2013 - (7.2 \times 216)$  gives us the year 458. Interestingly, this would place the starting date of the fixed calendar close to where Rambam placed the close of the Sanhedrin and the establishment of the fixed calendar.

## 7 in 19

A key component of the Jewish calendar is the *molad*, or average conjunction, of each new month. The timing of the *molad* of Tishrei determines when Rosh Hashanah occurs. The *molad* is calculated by taking the *molad* of the Tishrei at creation V'YAD (Friday morning 8AM) and adding the average time between months (29 days, 12 hours, 44 minutes and 3.33 seconds) for every month until we get to the desired month. This requires one to know how many years and months have passed since creation. The number of years we know based on our Jewish calendar. However, we do not know which years had a leap month. A basic assumption of the Jewish calendar is that it has averaged 7 leap months every 19 years. While there may have been 19-year periods with six or eight leap months, over the entire time span since creation, the Jewish calendar assumes that there have been exactly 7 leap months for every 19 years.

However, if that was true, based on our work above, then by 359 (= 4119 Anno Mundi), the calendar drift would have been 4119/216 or 19 days and by our day, 5769/216 or 26.7 days. Clearly, prior to the institution of the fixed calendar, the *Chachamim* did not follow a pattern of 7 leap months every 19 years, but used a calendar based on

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for this 19-year cycle, the least upper bound is 5.48 days and the calendar drift is 5.48 days or less. As each 19-year cycle goes by, the difference between Pesach and the mean vernal equinox grows by about 126 minutes (19x 6 minutes and 39 seconds).

a number of rules for instituting a leap month as described in Bavli Sanhedrin. These rules allowed Sanhedrin to avoid any calendar drift. There is no mention of the 19-year cycle until the eighth century, although it may be implicit in the seventh-century liturgical works (*piyyutim*) of R. Eleazar ha-Qallir (Stern, p. 197).

W. M. Feldman in his classical 1931 work “Rabbinical Mathematics and Astronomy” (pp. 207-208) demonstrates, through the mathematical technique called continued fractions, that a 334-year cycle would result in a calendar that differs from the actual solar year by only about 39 minutes per 334 years (less than half a day since creation). This cycle would consist of 17 of our current 19-year cycles followed by a truncated cycle of 11 years. Each 334 year cycle would have 123 ( $17 \times 7 + 4$ ) leap years. Thus, in 6346 years ( $19 \times 334$ ), the 334 year cycle would have 2337 ( $19 \times 123$ ) leap months while our current calendar would have 2338 ( $7 \times 334$ ) leap months. This one extra leap month corresponds to the 29.38 days that our current calendar would have drifted in the 6346 years.

## The Fixing of the Calendar

According to Ramban, the fixing of the calendar is dependent on *smicha* and there is no way for us to tamper with the calendar that was set up for all time, which he believes was done in the year 359. It is difficult to reconcile this position with the calculations we have presented in this paper, unless we were to assume that *Chazal* had erred in their original calculations.<sup>21</sup>

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<sup>21</sup> All of our above calculations are based on the assumption that the *Chachamim* who initially introduced the fixed calendar agree with our calculation of the true vernal equinox of their time. However, Stern in his review of Loewinger’s article points out that the calculation of the equinox was imprecise in those days and a margin of error of one day in the calculations could affect Loewinger’s numbers (and similarly ours) by over 200 years. Stern concludes that based on this possible imprecision, “any date between the fourth and eighth centuries could equally be considered” as a starting date for the calendar. Based on Stern’s statement, it is possible that the VE was calculated inaccurately, thereby resulting in Pesach occurring too early in winter. However, the Traditional belief is that the *Chachamim* had secret calculations—*Sod Ha’Tbbur*—and they knew when a leap month was necessary.

However, the Chazon Ish's reading of Rambam, coupled with the most authoritative texts of the *Sefer Hamitzvos*—which do not require *Bais Din Hagodol* for setting the fixed calendar—suggests another approach. The *Halacha L'Moshe M'Sinai* merely dictates that accurate calculations be used to conform to rules that ensure that *Pesach* falls in spring. It seems likely that these rules can be and have been emended over the years, and could theoretically be emended again. ❧

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