Examining the Impact of the Book of Enoch, Sefer Yetzirah, and Greek Civilization on the Jewish Calendar System: An Islamic Astronomical Law Perspective

Meneliti Dampak Kitab Enoch, Sefer Yetzirah, dan Peradaban Yunani terhadap Sistem Kalender Yahudi: Perspektif Hukum Astronomi Islam

Youla Afifah Azkarrula[*]
Universitas Islam Negeri Walisongo Semarang, Indonesia
youlaafifahrvvl@gmail.com

Susanne M. Hoffmann
Independent Scholar, Jena, Germany
service@urania-uhura.de

Ahmad Izzuddin
Universitas Islam Negeri Walisongo Semarang, Indonesia
izzuddin@walisongo.ac.id

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[*] *Corresponding Author*

Abstract: This article analyzes changes in the reference system of the Jewish Calendar. Initially, the Jewish Calendar was based on the movement of the Sun. However, the calendar system used by the Jewish community worldwide now refers to two celestial bodies, the Sun and Moon. This study is literature research with a qualitative approach and uses the Book of Enoch and Sefer Yetzirah as primary sources. The authors found that the first reference system of the Jewish Calendar, which was based on the movement of the Sun (Solar calendar), follows the description in the Book of Enoch and Sefer Yetzirah. These two books explain the calendar system used by Prophet Enoch to Prophet Moses. The Solar calendar reference system was later replaced with the Lunar calendar in the second century BCE. Six centuries later, the Jewish calendar returned to using a Solar calendar combined with the Lunar calendar, known as the Lunisolar calendar. The latest reference system is a mathematical calendar with the Metonic cycle that refers to the movement of the Sun and Moon. The authors argue that the influence of Greek civilization and adjustments to the difference between the Lunar and Solar years caused the changes in the reference system of the Jewish Calendar.

Keywords: Jewish Calendar, Book of Enoch, Greek Civilization, Sefer Yetzirah, Meton Cycle.

Abstrak: Artikel ini menganalisis perubahan-perubahan acuan dalam sistem penanggalan Kalender Yahudi. Pada awalnya, penanggalan Kalender Yahudi mengacu pada gerakan Matahari. Namun, sistem kalender yang digunakan oleh komunitas Yahudi saat ini telah berubah dan mengacu pada dua benda langit, Matahari dan Bulan. Studi ini merupakan penelitian kepustakaan dengan pendekatan kualitatif dan menjadikan Kitab Enoch dan Sefer Yetzirah sebagai sumber primer. Para penulis menemukan bahwa sistem penanggalan pertama Kalender Yahudi yang mengacu pada gerakan Matahari (Solar) sesuai dengan keterangan dalam Kitab Enoch dan Sefer Yetzirah, dua kitab yang menjelaskan tentang sistem kalender yang dipakai dari Nabi Idris hingga Nabi Musa. Sistem penanggalan yang menggunakan Kalender Solar tersebut kemudian diganti dengan Kalender Lunar pada abad kedua sebelum Masehi. Enam abad setelahnya, Kalender Yahudi kembali menggunakan Kalender Solar yang digabungkan dengan Kalender Lunar, disebut Lunisolar. Acuan penanggalan kalender terakhir merupakan kalender matematis dengan siklus Meton yang mengacu pada pergerakan Matahari dan Bulan. Para penulis berargumentasi bahwa perubahan-perubahan acuan dalam sistem penanggalan Kalender Yahudi disebabkan oleh pengaruh peradaban Yunani dan penyesuaian perbedaan antara tahun Lunar dan tahun Solar.

Kata Kunci: Kitab Enoch, Sefer Yetzirah, Peradaban Yunani, Kalender Yahudi, Siklus Meton.

A. Introduction

The Jewish Calendar System is one of the most complex calendar systems in the world because it refers to two celestial bodies as its reference, the Sun and the Moon.[1] The calendar is based on the principles in the Yahudi scriptures, such as Sefer Yetzirah and Torah.[2] The calendar consists of cyclical years and consists of 12 months. Each month consists of 29 or 30 days, and the year of the cycle consists of 365 days.[3] Years consisting of 366 days are called leap years.[4] The system is based on the revolution of the Earth around the Sun, 365 days.[5] In addition, the Jewish

[1] Slamet Hambali, *Almanak Sepanjang Masa Sejarah Sistem Penanggalan Masehi, Hijriyah dan Jawa*, ed. Abu Rokhmadi, Pertama (Semarang: Program Pascasarjana IAIN Walisongo Semarang, 2011), 21.

[2] Zeller David, *The Soul of the Story: Meetings with Remarkabke People* (Jewish Lights Publishing, 2006), 45-60.

[3] Joseph Katz and Ben Abrahamson, *The Islamic Jewish Calendar: How the Pilgrimage of the 9th of Av Became the Hajj of the 9th of Dhu'al-Hijjah*, ed. Rebecca Abrahamson, *Studies in History and Jurisprudence* (New York: AlSadiqin Press, 2007), 5.

[4] Sharon Cohen Anisfeld, *The Jewish Calendar: A Closer Look* (Tennesse: Jewish Lights Publishing, 2010), 15

[5] Katz and Abrahamson, *The Islamic Jewish Calendar*: 5. In reality, this revolution is 365.25 days, so the Roman calendar that we are still using today (in a slightly reworked version to correct even more digits of the fraction) inserts a leap day every fourth year.

calendar system also follows the principles of special days set out in other Jewish scriptures, such as the Torah and Talmud.[6]

In the history of Islamic astronomy, the Jewish Calendar was used by the Prophet Moses, who was sent to the Israelites to worship their God YHVH.[7] Based on the Torah and Zabur, the calendar dating system refers to *ṣuḥuf*[8] of the previous Prophet and the Apostle. Following this belief, the Book of Enoch is a *ṣuḥuf* derived from the words of the Prophet Enoch,[9] while Sefer Yetzirah is *a ṣuḥuf* derived from the word Prophet Abraham.[10] Some churches teach that ancient ancestors and earlier prophets used the Book of Enoch: Prophet Noah, Prophet Ibrahim, and Prophet Jacob.[11] This calendar is believed to have been re-taught by the Angel to the Prophet Moses as a guide in performing worship. Prophet Moses and Prophet Abraham also referred to this calendar to be taught to their people to determine the performance of worship to God.[12] In fact, the calendar used by Jews today has a different dating system than the Book of Enoch[13] and Sefer Yetzirah. Although it has undergone several changes over the centuries, this system is still maintained today and continues to be used by Jewish communities worldwide.[14]

Based on some previous research, this Jewish Calendar has undergone several changes. The earliest reference to this Jewish Calendar is the Book of Enoch,

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[6] Nathan Bushwick, *Understanding the Jewish Calendar* (New York: Moznaim, 1989), 8.

[7] Abdul Syukur Al-Azizi, *Kitab Peninggalan-Peninggalan Bersejarah Para Nabi* (Yogyakarta: Saufa, 2014), 161.

[8] *Ṣuḥuf* is a word that refers to the sheets given by Allah SWT to His Prophets. Allah sent down *ṣuḥuf* to Adam, Enoch, Seth, and Abraham. See: Mehmet ALTUNTAŞ, "Kur'an'da Peygamberlere Gönderilen 'Suhuflar/Kitaplar' Üzerine Bir Değerlendirme," *Journal of Turkish Studies* 11, no. 12 (2016): 2-3.

[9] See: Tessa Sitorini, *Kitab Nabi Idris: The Book of Enoch*, ed. Zaenal Muttaqin and Zamzam A J Tanuwijaya, I (Bandung: Pustaka Prajabati, 2017); Novi Arizatul Mufidoh, "Nabi Idris dalam Perspektif Kitab-Kitab Suci Agama dan Ketokohannya dalam Kajian Ilmu Falak," *Islamic Review: Jurnal Riset dan Kajian Keislaman* 9, no. 1 (2020).

[10] Aryeh Kaplan, *Sefer Yetzirah: The Book of Creation*, Revised (Boston: WeiserBooks, 1997). xii.

[11] "Enoch Calendar - The Book of Enoch Reveals the Enoch Calendar," accessed November 12, 2022, https://enochcalendars.webs.com/.

[12] "Enoch Calendar - The Book of Enoch Reveals the Enoch Calendar."

[13] The Book of Enoch is not canonically included in neither the Jewish nor the Christian holy books. Fragments are preserved in many languages including Greek and Aramaic but it is only fully preserved in the ancient Ethiopian language, suggesting that it might belong to a different tradition than the other books of Jewish prophets.

[14] Anisfeld, *The Jewish Calendar*, 17.

typically dated to the 4th century BCE.[15] In addition, Sefer Yetzirah is also one that explains the relationship between days, months, and celestial bodies but does not discuss the Jewish Calendar system.[16] With several reference sources from the Jewish Calendar, various scholars began to explain and detail the Jewish Calendar. Unfortunately, the authors have found only a few studies describing the relationship between the Jewish Calendar and the Book of Enoch. Meanwhile, research linking the Jewish Calendar to Sefer Yetzirah does not exist.[17] Therefore, the study linking the Jewish Calendar to the Book of Enoch and Sefer Yetzirah is urgent to research and is the focus of this article.

This article uses a type of *library research* and the presentation of data using qualitative methods. The authors' primary sources are Sefer Yetzirah and the Book of Enoch. The authors also used secondary data sources referring to journals and books on the Sefer Yetzirah, the Book of Enoch, and the Jewish Calendar to strengthen the data. In addition to documentation, this article also uses data collection techniques in the form of interviews as a secondary source. The informant in this article is Asherit, an adherent of the Book of Enoch. The data analysis technique that the authors use is content analysis. First, the authors studied and examined the time system and calendar described in each book to find formulas or algorithms in the calendar derived from Sefer Yetzirah and the Book of Enoch. The two algorithms were combined to get the right algorithm in the Jewish Calendar. It started because there was a difference in the number of days described in the Book of Enoch and Sefer Yetzirah.

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[15] See: Jeanette C. Fincke, Wayne Horowitz, and Eshbal Ratzon, "BM 76829: A Small Astronomical Fragment with Important Implications for the Late Babylonian Astronomy and the Astronomical Book of Enoch," *Archive for History of Exact Sciences* 75, no. 3 (2021); Eshbal Ratson, "4Q208: A New Reconstruction and Its Implications on the Evolution of the Astronomical Book," *Revue de Qumran* 31, no. 1 (2019).

[16] See: Tzahi Weiss, "'The Book of Formation of the World': Sefer Yetzirah and Hilkhot Yetzirah," *Journal of Jewish Thought and Philosophy* 27, no. 2 (2019): 168–79; Malek Abdul Qader, "Harfler ve Varlık Sefer Yetzirah ve İbn-i Arabi Arasında Karşılaştırmalı Bir Çalışma," *Journal of Divinity Faculty of Hitit University* 36, no. 2 (2019): 497–522.

[17] See: Nadia Vidro, "Non-Rabbanite Jewish Calendars in the Works of Jacob al-Qirqisānī and Saadia Gaon," *Aleph* 21, no. 1 (2021): 149–87; Basil Lourié, "An Archaic Jewish-Christian Liturgical Calendar in Abba Giyorgis of Sägla," *Scrinium* 12, no. 1 (2016): 73–83; Siam Bhayro, "Time, Astronomy, and Calendars in the Jewish Tradition," *Journal of Jewish Studies* 66, no. 1 (2015): 210–12.

B. Calendar System in the Book of Enoch

The third wisdom[18] in the Book of Enoch explains the circulation of celestial bodies.[19] One of the contents discusses the calculation of the Lunisolar calendar[20] used by the Jews in performing worship. This calculation is described in chapter 74, verses 10 until 17.[21] The provisions regarding the number of days in a month are in different chapters and are still in the third wisdom book. This calendar is used in the Torah and handed down to the Prophet Moses. This calendar described to the Prophet Moses became the official Hebrew calendar until the 2nd century BCE. As this calendar refers to the motion of the Sun only, it is called the Solar calendar.[22] However, some Jewish religious practices even today are determined by the stars.[23] It is exceptional because the normal Jewish calendar is a Lunar calendar.

Chapter 74, verse 10 in the Book of Enoch, explains that a year consists of 364 days. The number of days in each month has been described in chapter 72, from verse 6 until verse 32, and reaffirmed in chapter 72, verse 32, that the time of year is 364 days. When studied, the order of the number of days in consecutive months is 30, 30, 31, 30, 30, 31, 30, 30, 31, 30, 30, and 31. So, the schema is 4* (2* 30, 1* 31) days: four blocks with three months each, and each block has two months with 30 days and one with 31. It is striking that there are four blocks, as there are also four seasons in the northern Mediterranean area.

In contrast, Egypt has three seasons (ancient names: Akhet, Peret, Shemu)[24] , and Mesopotamia has only two (a rainy and a dry one).[25] Hence, the four parts of the year in the Book of Enoch do not reflect the real climate in Mesopotamia, North

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[18] The Book of the Prophet Idris, *Enoch*, consists of five parts. Each section is referred to as *wisdom*. See: Sitorini, *Kitab Nabi Idris: The Book of Enoch*, xi.

[19] George W. E. Nickelsburg and Otto Neugebauer, "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72-82)," *Journal of Biblical Literature* 103, no. 3 (1984), 457.

[20] Lunisolar is a designation that refers to a calendar system that refers to the Sun (Solar) and the Moon (Lunar) as determinants of time. See: Constantine Nomikos Vaporis, "Lunisolar Calendar," in *Voices of Early Modern Japan* (United Kingdom: Routledge, 2020).

[21] Sitorini, *Kitab Nabi Idris: The Book of Enoch*, 92-93.

[22] "Enoch Calendar - The Book of Enoch Reveals the Enoch Calendar."

[23] E.g. Most Jewish festivals start at the evening of the day and last until the next evening. This is the traditional Babylonian concept of the day, counting from Sunset to Sunset (in contrast to the Greek style, counting days from Sunrise to Sunrise). Consequently, the end of each Sabbath is also when the first stars are seen on Saturday evening. The Solar and sidereal calendar are equal.

[24] Climate in Egypt is ruled by the trade winds in the south while the north is determined by the Azore High in summer and by the wind cells of the northern temperate zone in winter.

[25] Mesopotamia is at the edge of the range of the Asian monsoon zone.

Africa, or the Mediterranean coast in Israel. Still, Mesopotamian astronomers had divided their "ideal" year[26] into four equal sections, preserved in the Babylonian astronomical compendium MUL.APIN[27] (dating before 1000 BCE).[28] Therefore, the four blocks in the Book of Enoch might suggest an influence of Mesopotamian mathematical astronomy (and calendar makers). It is compatible with the suggestion by Sitorini 93-94 that the Enoch calendar system does not only refer to the Sun but also to the stars.[29] Then this calendar system refers not only to the Sun but also to the Constellations.[30]

Chapter 75, verse 1 supports this view explicitly stating: "…… *and the leaders of the heads of the thousands, who are placed over the whole creation and over all the stars, also have to do with the four intercalary days, being inseparable from their office, according to the reckoning of the year, and these render service on the four days which are not reckoned in the reckoning of the year*." Chapter 75, verse 1, explains that a year consists of four days of intercalation into which the day is inserted in certain months. By looking at this sequence, the authors ensure that the number of days each month is always fixed and regular. It amounted to 30 days in two initial months, followed by 31 days the following month. Thus, there are eight months with 30 days,

[26] More information on the "ideal year" of mathematical Babylonian astronomy and how to find this in MUL.APIN, see: Mathieu Ossendrijver, *Babylonian Mathematical Astronomy: Procedure Texts*, Sources and Studies in the History of Mathematics and Physical Sciences (New York: Springer, 2012); Susanne M. Hoffmann, *Hipparchs Himmelsglobus: Ein Bindeglied in Der Babylonisch-Griechischen Astrometrie?*, Research (Wiesbaden: Springer Spektrum, 2017); Susanne M. Hoffmann, "Das Babylonische Kompendium MUL.APIN: Messung von Zeit Und Raum," in *Zeit Ist Macht. Wer Macht Zeit? 13. Mitteldeutscher Archäologentag = Time Is Power. Who Makes Time?: 13th Archaeological Conference of Central Germany*, ed. Harald Meller, Alfred Reichenberger, and Roberto Risch, Tagungen Des Landesmuseums Für Vorgeschichte Halle 24 (Mitteldeutscher Archäologentag, Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte, 2021), 251–75.

[27] Hermann Hunger and John Steele Gordon, *The Babylonian Astronomical Compendium MUL.APIN*, (London: Routledge, 2020).

[28] It should be remarked that the written form of the Book of Enoch is typically dated to the 4th century BCE which is the time when the Macedonian king Alexander the Great conquered Syria and the area that is now called Israel as well as Babylon, and a new Greekness was invented as a common culture in this huge empire (Doumanis 2010)—of course by merging local cultures. See: Nicholas Doumanis, *A History of Greece*, Palgrave Essential Histories (Basingstoke: Palgrave Macmillan, 2010). An exchange of astronomical knowledge is certainly attested in this time (cf. Simplicius, In Cael. II 12).

[29] The Solar and the stellar year have the same length but as the change of the points of rising and settings of the Sun from day to day is hard to observe, astronomers in Egypt and Mesopotamia also used the heliacal risings of stars to determine the (Solar) calendar. This is attested at least since the Egyptian diagonal star clocks the late 3rd millennium.

[30] Sitorini, *Kitab Nabi Idris: The Book of Enoch*, 93-94.

four months with 31 days, and one year consisting of 12 months.[31] As for adding one day, each month of multiples of three has its rationale. This insertion is called intercalation to create a calendar or time system following the phases of the season or lunations.[32] The 31-day duration of the month is the inclusion of one-day intercalation for the sake of the laying of the Sabbath[33] and the aftermath of the seasons. Sabbath is important to take care of[34] because, in essence, one-year experiences four seasons. To separate these seasons, one day is inserted as intercalation.

Chapter 75, verse 2 explains that "…… *and owing to them men go wrong therein, for those luminaries truly render service on the world-stations, one in the first portal, one in the third portal of the heaven, one in the fourth portal, and one in the sixth portal, and the exactness of the year is accomplished through its separate 364 stations*." It makes it clear that the four days of intercalation are considered at four different places or gates, marking the transition from one season to the other. If you do not intercalate, then the calculation will be wrong.[35]

The third book of wisdom also describes the number of days a year in the sidereal year, the Solar year, and the Lunar year. In addition, it also explains the difference in days between each year which refers to the motion of the Sun, the stars, and the Moon. It is expressed in Chapter 74, verses 10 until 17 in the Book of Enoch, as depicted in Table 1. It describes the attempt to synchronize three (or maybe even four) calendar systems that refer to the stars, the Sun, and the Moon. Based on verse 10, the number of days in a year based on the Sun is 364 days, and verse 12 states that the Solar year and the stellar year are perfectly equivalent,[36] i.e., of the same

[31] Sitorini, *Kitab Nabi Idris: The Book of Enoch*, 86-89.

[32] William Adler, "Calendar and Community: A History of the Jewish Calendar, 2nd Century B.C.E.-10th Century C.E. (Review)," *Jewish Quarterly Review* 95, no. 4 (2005), 710.

[33] Sabbath comes from the Hebrew, sabbath, meaning rest. Chapter 5 verse 14 of Deuteronomy explains that sabbath is the seventh day of rest for YHWH (Lord Israel/God). On this day, people are not allowed to work other than to be used to worship YHWH. See: American Revision Committee, *The American Standard Bible of the Holy Bible: Printed in the United States of America* (New York: Messrs Thomas Nelson & Sons, 1901).

[34] Asher Cohen and Bernard Susser, "The 'Sabbatical' Year in Israeli Politics: An Intra-Religious and Religious-Secular Conflict from the Nineteenth through the Twentry-First Centuries," *Journal of Church and State* 52, no. 3 (2010): 454.

[35] Sitorini, *Kitab Nabi Idris: The Book of Enoch*, 93.

[36] This is logical from the modern knowledge because the apparent motion of the Sun (due to the revolution of the Earth around it) causes the apparent motion of the stars.

length. However, the Solar and the stellar year fall behind 6 days per year (stated in verse 11) that agglomerate to 30 days, a full month, in 5 years (stated in verses 10 and 11).[37] Verse 12 explains that the Sun and the stars are the exact benchmarks in precision in all years. The usage of both as a reference is because the celestial bodies never moved faster or slower, based on the explanation in the Book of Enoch. Verse 13 states the totals of days after some years: 364 days of the year times 3 gives 1092 days in 3 years, times 5 shows 1820 days in 5 years, times 8 gives 2912 days in eight years.

Table 1

Chapter 74, Verses 10 until 17 in the Book of Enoch[38]

No.	Verse	Content
1.	10	And if five years are added together, the Sun has an overplus of thirty days, and all the days accrued to it for one of those five years, when the full, amount to 364 days.
2.	11	And the overplus of the Sun and the stars amounts to six days: in 5 years 6 days every year come to 30 days: and the Moon falls behind the Sun and leads to the number of 30 days.
3.	12	And the Sun and the stars bring in all the years exactly so that they do not advance or delay their position by a single day unto eternity but complete the years with perfect justice in 364 days.
4.	13	In 3 years, there are 1092 days, and in 5 years, 1820 days, so in 8 years, there are 2912 days.
5.	14	For the Moon alone, the days amount in 3 years to 1062 days, and in 5 years, she falls 50 days behind.
6.	15	And in 5 years, there are 1770 days, so for the Moon, the days in 8 years amount to 2832 days.
7.	16	all the days she falls behind in 8 years are 80.
8.	17	And the year is accurately completed in conformity with their world stations and the stations of the Sun, which rise from the portals through which it (the Sun) rises and sets 30 days.

Source: (Tessa Sitorini, 2017).

The movement of the Moon is described in Chapter 74, verses 14 to 17. Verse 14 mentions the total of days in 3 Lunar years (1062, 30 days less than 3 Solar years) and claims that the Moon is 50 days behind the Sun after five years. Thus, the difference between the Lunar and Solar years is 10 days yearly. Verses 15 and 16

[37] Prior to this section, the positions of the moon rise at the eastern and western horizons are described over the course of one lunar month. It concludes in verse 7 with the Sun rising from the fourth gate, which is exact east (equinox position, new year position).

[38] Sitorini, *Kitab Nabi Idris: The Book of Enoch*, 92-93.

exemplify this statement with more numbers. Table 2 gives an overview of these statements by sorting them in a modern way:

Table 2

Difference between the Lunar and the Solar Year

No.	Solar Calendar (Verses 10,13)	Lunar Year	Difference
1.	1 year = 364 days	-	-
2.	3 years = 3*364 = 1092 days	1062 days (verse 14)	30 days
3.	5 years = 5*364 = 1820 days	1770 days (verse 15)	50 days (verse 14)
4.	8 years = 8*364 = 2912 days	2832 days (verse 15)	80 days (verse 16)

This table shows that the writer of the Book of Enoch calculated that the difference between the Lunar and the Solar year is ten days per year (which is wrong in our modern knowledge because the difference is 11 days). The contrast of 30 days in 3 years is a computation from the given number of days. The 30 days difference between the Solar year and something else within 5 years mentioned in verse 10 seems to not refer to the Moon. Together with the fact that there is no comparison given in verse 10 (behind what the Sun falls back 6 days per year), this seems to be a corrupted calendar text. It suggests that there had been yet another calendar system with 370 days (364+6) criticized here with astronomical means.

Interestingly, it is also what multiples of years are given: 3, 5, and 8. After 3 years, a full month has to be intercalated between the Solar and the Lunar calendar (as, e.g., the Babylonians did in the 1st millennium)[39] , but why did they choose the other numbers? Five might be a practical number in the decimal number system (the Egyptians used), but 50 days is no particular cycle: neither one nor two months. It is not mentioned in the text of the Book of Enoch. Still, the cycle of 8 years is interesting because it is the cycle of the bright planet Venus: Venus is visible sometimes as an evening star and sometimes as the morning star but the months in which Venus is seen either in the evening or in the morning change from year to year. The position of Venus at dusk or dawn next to a specific star pattern (e.g., "Venus in the Pleiades

[39] See: Hermann Hunger, "Celestial Regularity as a Basis of Time-Reckoning," in *Harmony and Symmetry: Celestial Regularities Shaping Human Culture: Proceedings of the SEAC 2018 Conference in Graz*, ed. Sonja Draxler, Max E. Lippitsch, and Gudrun Wolfschmidt, SEAC Publications/European Society for Astronomy in Culture, Vol. 1 (Hamburg: Tredition, 2020), 172–78; Hoffmann, "Das Babylonische Kompendium MUL.APIN: Messung von Zeit Und Raum."

in modern month April") only repeats every 8 years. Perhaps, verses 10 to 16 of Chapter 74 show the attempt to synchronize the Solar year with the rhythms of the Moon and Venus.[40]

Verse 17 concludes the paragraph by stating a full cycle of the year. It contains no further astronomical information. Based on the explanation from Table 1, the order of the year system from the day with a larger number to the smaller number of days is the Solar time system and the Moon time system, which respectively amount to 364 days and 354 days within a year. In the Jewish calendar, the number of days in a week on each time system of the three celestial bodies is the same, seven days, according to the Book Genesis. If each time system is divided by one week of seven days, successive results will be obtained, namely 52 weeks and 50 weeks 4 days. It is the Jewish week with its seven days that explains the unusual number of days per year: The book of Enoch gives a Solar year with 364 days which is neither observable in the sky nor fits any of the other concepts of years (the Egyptian and Babylonian "ideal year" has 360 days because 360 = 30 * 12 and the observable number of sunrises in this time is 365, causing the Egyptians to count 360 days in 12 months of their Solar year and 5 extra days as a "new years celebration"). 360 is a multiple of 5, 10, 12, and 60, the basic numbers in ancient mathematics. 364 does not fit any of them but is a multiple of 7.

C. Calendar System in Sefer Yetzirah

Chapter IV and Chapter V of Sefer Yetzirah describe the time system relating to the calendar. The explanation of this book is slightly different from the Book of Enoch, where Sefer Yetzirah also explains the names of days and months. Chapter IV describes the number of days in a week, the terms of the days, and the number of Sabbaths and Jubilees. The contents of Chapter IV can be seen in Table 3.

[40] It should be remarked that Venus as the third brightest object in the sky (after Sun and Moon) is considered the third power in the sky. It is represented at many ancient documents, e.g. seals of many cultures and Babylonian *kudurru* stones. See: Susanne Paulus, "The Babylonian Kudurru Inscriptions and Their Legal and Sociohistorical Implications," in *Untersuchungen Zur Assyriologie Und Vorderasiatischen Archäologie 11/1*, ed. Alexa Bartelmus and Katja Sternitzke (De Gruyter, 2017), 229–44. Some of the earliest observations from all over the world are Venus observations, e.g. the Venus tablets of Babylonian king Ammisaduqa dating around mid-17th century BCE. See: Hermann Hunger and David Pingree, *Astral Sciences in Mesopotamia* (Leiden: Brill, 1999).

Table 3

Chapter 4:6 to 4:15 in Sefer Yetzirah[41]

No.	Chapter	Content
1.	4:6	Seven days in the Year.
2.	4:7	Seven days in the year. The seven days a week.
3.	4:8	Yom Rishon (Sundays) in the Year.
4.	4:9	Yom Sheni (Monday) in the Year.
5.	4:10	Yom Shlishi (Tuesday) in the Year.
6.	4:11	Yom Revi'i (Wednesday) in the Year.
7.	4:12	Yom Chamishi (Thursday) in the Year.
8.	4:13	Yom Shishi (Friday) in the Year.
9.	4:14	Yom Sabbath in the Year.
10.	4:15	Seven days, seven weeks, seven years, seven sabbaticals, seven jubilees.

Source: (Aryeh Kaplan, 1997).

Table 3 explains that a week consists of seven days, nonday, Tuesday, Wednesday, Thursday, Friday, and Sabbath. Based on the version of Sefer Yetzirah edited by Aryeh Kaplan, there are seven days in one week, seven days of the great celebration of Passover[42] and Tabernacle.[43] After it was discovered that one week consisted of seven days, the authors found that there was a "seven weeks" statement. According to Aryeh Kaplan, this statement is that there are seven weeks between Passover and Shavuot. It is explained in the Torah, (Leviticus [23]: 15), "…… *and ye shall count unto you from the morrow after the sabbat... seven sabbaths shall there be complete.*" The statement "seven years" is based on seven years in the *sabbatical* cycle. The Torah also explains that on the seventh day, the ground should be left vacant and not be worked on. It is listed in Leviticus [25]: 3-4, "*Six years thou shalt sow thy field …..,. but in the seventh year shall be a sabbath of solemn rest for the land, a sabbath unto Jehovah….*"[44]

[41] Kaplan, *Sefer Yetzirah,* 167-176.

[42]Passover (Pesach) is a feast day that falls on the Jewish month called Nissan to celebrate the anniversary of the Israelites' exit from Egyptian slavery. See: Rasid Rachman, *Hari Raya Liturgi: Sejarah dan Pesan Pastoral Gereja* (Jakarta: PT BPK Gunung Mulia, 2009), 56.

[43] The Tabernacle in the Bible is a sacred place of tents like the portable temples of the Hebrews during their wanderings in the desert. In the Book of Numbers, the Tabernacle is referred to as the Tabernacle of Meeting when it serves as the site of Divine revelation to Moses. See: Richard Elliott Friedman, "Tabernacle," in *The Anchor Yale Bible Dictionary*, 2021, 292.

[44] Committee, *The American Standard Bible of the Holy Bible*.

The statement "seven sabbaticals" explains that the year of Jubilee will be celebrated at the end of the cycle of seven *sabbaticals*. All enslaved people will be freed, and real property will be returned to their hereditary owners. Leviticus [25]: 8 and 10 explain, "…… *and thou shalt number seven sabbaths of years unto thee, seven times seven years; and there shall be unto thee the days of seven sabbaths of years, even forty and nine years. And ye shall hallow the fiftieth year, and proclaim liberty throughout the land unto all inhabitants: it shall be a jubilee unto you.*"[45] The statement "seven Jubilees" is expressed by multiplying 49 or 50 years together with the consecrated year by seven. Thus, it will yield 343 years or 350 years.

Chapter V describes the number of months in a year and their names, and what constellations are in those months. The contents of Chapter V can be seen in Table 4.

Table 4

Chapter 5:3 until 5:10 in Sefer Yetzirah[46]

No.	Chapter	Content
1.	5:3	Twelve constellations in the Universe. Twelve months in the Year.
2.	5:4	Twelve constellations in the Universe: Aries (T'leh, the Ram), Taurus (Shor, the Bull), Gemini (Teumim, the Twins), Cancer (Sartan, the Crab), Leo (Ari, the Lion), Virgo (Betulah, the Virgin), Libra (Maznayim, the Scales), Scorpio (Akrav, the Scorpion), Sagittarius (Keshet, the Archer), Capricorn (Gedi, the Kid), Aquarius (Deli, the Water Drawer), and Pisces (Dagin, the Fish).
3.	5:5	Twelve months in the year: Nissan, Iyar, Sivan, Tamuz, Av, Elul, Tishri, Cheshvan, Kislev, Tevet, Shevat, and Adar
4.	5:7	Aries in the Universe, Nissan in the Year. Taurus in the Universe, Iyar in the Year. Gemini in the Universe, Sivan in the Year.
5.	5:8	Cancer in the Universe, Tamuz in the Year. Leo in the Universe, Av in the Year. Virgo in the Universe, Elul in the Year.
6.	5:9	Libra in the Universe, Tishrei in the Year. Scorpio in the Universe, Cheshvan in the Year. Sagittarius in the Universe, Kislev in the Year.
7.	5:10	Capricorn in the Universe, Tevet in the Year. Aquarius in the Universe, Shevat in the Year. Pisces in the Universe, Adar in the Year.

Sumber: (Aryeh Kaplan, 1997).

[45] Committee, *The American Standard Bible of the Holy Bible*.
[46] Kaplan, *Sefer Yetzirah*, 209-218.

Table 5

Difference between the Lunar and the Solar Year

Month Names		Constellation(s) MUL.APIN (before 1000 BCE) in [...] the Modern Constellations	Greco-Babylonian Zodiacal Signs (from 400 BCE on)
Hebrew	**Babylonian**		
Nissan	Nisannu	Hired Man [Aries], the Stars [Pleiades], and Old Man [Perseus].	Aries
Iyar	Ajjaru	Bull of Heaven [Taurus], True Shepherd of Anu [Orion], and Crook [Auriga].	Taurus
Sivan	Simanu	Great Twins [parts of Gemini] parts of Crab [Cnc].	Gemini
Tamuz	Du'uzu	Crab [Cancer] and parts of Urgulu [Leo].	Cancer
Av	Abu	Urgulu Demon [Leo, Sextant]	Leo
Elul	Ululu	Furrow with Ear of Grain [part of Virgo].	Virgo
Tishri	Teshritu	Balance [Libra, Virgo] and parts of The Scorpion [Sco].	Libra
Cheshvan	Arahsammu	The Scorpion [Scorpius] and parts of the constellation "God Zababa" [Ophiuchus] and constellation God Pabilsag (a god depicted with bow and arrow) [Sagittarius].	Scorpius
Kislev	Kislimu	Part of God Pabilsag [Sgr] Goat-Fish Demon [Capricornus].	Sagittarius
Tevet	Tebetu	Goat-Fish (part of) [Cap]. The Great One (the allegoric name for God Ea, Greek named The One with Water) [Aquarius].	Capricornus
Shevat	Shabatu	The Great One [Aquarius] and parts of The Great Swallow.	Aquarius
Adar	Addaru	The Great Swallow [covering modern constellations of Pisces and Cetus, possibly including a star from Andromeda].	Pisces

Table 4 explains that in one year, there are twelve months with Hebrew month names (which are the Babylonian month names taken over by the Jews in the exile under Nebuchadnezzar in the 6th century BCE, see Table 5) associated with the Greco-Babylonian zodiacal signs (taken over from Babylon in the 4th century BCE because the zodiac was invented there and the constellations depict Babylonian

deities[47]). The association of specific constellations with specific months originates from the observations of the path of the Moon in the sky in ancient Babylon.[48] The Lunar phases determine the Sun's position among the stars, e.g., the full Moon is always in the constellation opposite the constellation of the Sun, and the thin waning and waxing crescents are observable in the constellations neighboring the constellation of the Sun. Based on Table 4, the first month of the year is Nissan which coincides with the constellation Aries (those days: Aries rising heliacally, i.e., is seen at dawn) at the vernal equinox. Thus, the beginning of the month of the year begins with Nissan and ends with Adar. The order of the months in succession is Nissan, Iyar, Sivan, Tamuz, Av, Elul, Tishrei, Cheshvan, Kislev, Tevet, Shevat, and Adar.

As the Jewish culture had taken over knowledge from the Egyptians (before they were guided to their own country by Moses) and from the Babylonians (in exile under *Nebchadnezzar*), it is pretty obvious that the Jewish month names are based on the Babylonian ones. Before 1000 BCE, the Babylonian month names referred to 17 Babylonian constellations (see Table 5), which were the root of developing the 12 zodiac signs in the middle of the 1st millennium.[49] This zodiac (a division of the ecliptic in twelve exactly equal parts) was taken over by Greek astronomers almost immediately, i.e., around 400 BCE.[50] Still, as the constellation names from the Babylonian religion were not understandable by the Greeks, they renamed many of them.[51]

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[47] See: Felix Gössmann, *Planetarium Babylonicum* (Rome: Päpstliches Bibelinstitut, 1950); Susanne M. Hoffmann and Kay Elzner, *Wie der Löwe an den Himmel kam: Auf den Spuren der Sternbilder*, Mit Kosmos mehr entdecken (Stuttgart: Kosmos, 2021); Gennadij E. Kurtik and G. E. Kurtik, *Zvezdnoe nebo Drevnej Mesopotamii: šumero-akkadskie nazvanija sozvesdij i drugich svetil* (Sankt-Peterburg: Aletejja, 2007).

[48] Tablet I, List 6 "Constellations in the Path of the Moon." See: Hermann Hunger and John Steele Gordon, *The Babylonian Astronomical Compendium MUL.APIN*, (London: Routledge, 2020).

[49] Britton argues that was exactly in 410 BCE. John P. Britton, "Studies in Babylonian Lunar Theory: Part III. The Introduction of the Uniform Zodiac," *Archive for History of Exact Sciences* 64, no. 6 (November 2010): 617–63.

[50] Susanne M. Hoffmann, *Hipparchs Himmelsglobus: Ein Bindeglied in Der Babylonisch-Griechischen Astrometrie?*, (Wiesbaden: Springer Spektrum, 2017).

[51] See: Gudrun Wolfschmidt and Susanne M. Hoffmann, eds., "History of Constellations as Popularization of Uranometry," in *Popularisierung der Astronomie: Proceedings der Tagung des Arbeitskreises Astronomiegeschichte in der Astronomischen Gesellschaft in Bochum 2016*, Nuncius Hamburgensis, Band 41 (Popularisierung der Astronomie, Hamburg: Tredition, 2017), 135–58; Asterios Kechagias and Susanne M. Hoffmann, "Intercultural Misunderstandings as Possible Source of Ancient Constellations," in *Astronomy in Culture-Cultures of Astronomy*, ed. Susanne M. Hoffmann and Gudrun Wolfschmidt, Nuncius Hamburgensis--Beiträge Zur Geschichte Der Naturwissenschaften (Ahrensburg: Tredition, 2022), 205–35.

D. Algorithms in the Jewish Calendar System

Jews use the Jewish calendar worldwide to determine the time of worship and as the official calendar used by Israel. This calendar is a calendar system that is based on of movements of the Sun and Moon and is referred to as Lunisolar. This calendar uses an insert-month system to adjust to the current season.[52] The determination of the beginning of the month in the Jewish calendar is the same as the Hijri calendar, which refers to the circulation of the Moon. The beginning of the month in the Jewish Calendar is marked by the appearance of the Crescent Moon (*ḥilāl*).

At first, Jews determined the beginning of the month using *Molad*[53] observations. Anyone who sees *Molad* at Sunset on the 29th will be reported to the *Sanhedrin.*[54] If the report is rejected, the month will be fulfilled to 30 days.[55] One year has twelve months. One inserted month is only valid in leap years, not common years. The twelve months' names are Tishri, Heshvan, Kislev, Tevet, Shevat, Adar I, Adar II (month of insertion), Nisan, Iyar, Sivan, Tamuz, Av, and Elul.[56] The months in the Jewish Calendar have a different arrangement. If based on the religious (Ecclesiastical Jewish) calendar, it begins with the Month of Nisan and ends with the Month of Adar. If based on the civil calendar, it starts in the Month of Tishri and ends in the Month of Elul.[57] A year in the Jewish Calendar consists of three categories: regular years, full years, and following years. Thus, the number of days in each class differs in the common year and the leap year.

The system used in determining the annual period of the Jewish Calendar refers to four provisions. If *Molad* at the beginning of the year appeared during the

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[52] Hambali, *Almanak Sepanjang Masa Sejarah Sistem Penanggalan Masehi, Hijriyah dan Jawa*, 22-23.

[53] *Molad* is the singular form of the new Moon of astronomy in Hebrew. The plural is referred to as *Moladot. Molad* can be likened to *ḥilāl* in Islam. Thus, *Molad* is not a dead Moon. See: Sacha Stern, "A Primitive Rabbinic Calendar Text from the Cairo Genizah," *Journal of Jewish Studies* 67, no. 1 (2016): 69.

[54] *The Sanhedrin* was the highest council in the Jewish religion that had authority in the religious and political spheres. The council consists of priests and consists of 71 members. At the time of Roman rule, his authority was limited to religious purposes only.

[55] Steven Lemke, "The Sanhedrin: Their History and Function," *Biblical Illustrator 34*, (April 2008): 16.

[56] Ahmad Izzuddin, *Sistem Penanggalan* (Semarang: CV. Karya Abadi Jaya, 2015), 22.

[57] Richard E. G, *Maping Time: The Calendar and Its History* (Oxford: Oxford University Press, 1999), 222.

day, then the new year is postponed by one day (*dehiyyat molad zaken*). If *Molad* starts on Sunday, Wednesday, and Friday before noon, then the beginning of the new year is postponed by one day (*dehiyyat lo 1-4-6*).[58] However, if two years with a total of 356 days occur in a row, then the beginning of the year is postponed for two days. Finally, if two years with a total of 382 days occur sequentially, then the beginning of the year for the second year is postponed for one day.[59] If you look at these provisions, it can be seen that the number of days is different for different categories of years and various types of years.[60]

Table 6 explains that for 19 years, there are three categories of years, namely regular year, following year, and complete (leap) year. Leap Years consist of 3, 6, 8, 11, 14, 17, and 19. A regular year consists of years 2, 5, 10, 13, and 16. The following year consists of years 1, 4, 7, 9, 12, 15, and 18.[61] This provision is obtained from the difference between one Solar year and one Lunar year. If the resulting difference is more than 16 days, it is included in a leap year. Suppose the difference shown is more than eight days and less than equal to 16 days, then including a regular year. If the difference is less than eight days until it reaches a negative result,[62] then included in the following year.[63]

[58] The third avoidance of this day is intended to avoid a few days: *Yom Kippur* or the day of redemption/repentance that falls on Friday or Sunday and *Hoshana Rabbah* or the day of great supplication on every 21 Tishri (the seventh day on the feast of Sukkot/Tabernacles) that falls on Saturday.

[59] Ahmad Adib Rofiuddin, *Kalender Islam Global (Studi Penentuan Awal Bulan Hijriah di Indonesia, Turki, dan Maroko)*, ed. Alfian Qodri Azizi and Supangat, Pertama (Semarang: CV Rafi Sarana Perkasa, 2021), 56.

[60] Under this rule, *Rosh Ha-Shanah* will always fall on Monday, Tuesday, Thursday, or Saturday. If in that year the number of days is 353 days, then *Rosh Ha-Shanah* will fall on Monday or Saturday. If the number of a year is 354 days, then *Rosh Ha-Shanah* will fall on Tuesday or Thursday. If one year is 355 days old, then *Rosh Ha-Shanah* will fall on Monday, Thursday or Saturday. These three provisions apply in a common year. Based on leap years, if a year is 383 days old, then *Rosh Ha-Shanah* will fall on Monday, Thursday or Saturday. If a year is 384 days old, then *Rosh Ha-Shanah* will fall on Tuesday. If one year is 385 days old, then *Rosh Ha-Shanah* will fall on Monday, Thursday or Saturday.

[61] Rofiuddin, *Kalender Islam Global,* 56-57.

[62] Negative results are obtained if one year of Solar falls before the Lunar year of that year.

[63] Bushwick, *Understanding the Jewish Calendar*, 8.

Table 6

Number of Days in Each Month by Year Type in Jewish Calendar Arrangement[64]

Name of Month	Common Year			Leap Year			Gregorian Month
	Regular	Following	Complete	Regular	Following	Complete	
Tishri	30	30	30	30	30	30	Sep-Oct
Heshvan	29	29	30	29	29	30	Oct-Nov
Kislev	30	29	30	30	29	30	Nov-Dec
Tevet	29	29	29	29	29	29	Dec-Jan
Shevat	30	30	30	30	30	30	Jan-Feb
Adar I	29	29	29	30	30	30	Feb-Mar
Adar II	-	-	-	29	29	29	Mar-Apr
Nissan	30	30	30	30	30	30	Mar-Apr
Iyar	29	29	29	29	29	29	Apr-May
Sivan	30	30	30	30	30	30	May-Jun
Tammuz	29	29	29	29	29	29	Jun-Jul
Av	30	30	30	30	30	30	Jul-Aug
Elul	29	29	29	29	29	29	Aug-Sep
Total	354	353	355	384	383	385	-

Source: (Joseph Katz and Ben Abrahamson, 2007).

The name used as the end of a number in a year in the Jewish calendar is *Anno Mundi* (AM), meaning in years in the world. Epoch[65] in the Hebrew Calendar begins on October 7, 3761 BCE, or 1 Tishri, the year 1 Hebrew, considered the year of Adam's creation.[66] The calculation of the Jewish Calendar today is much different from before. Previously, the Jewish Calendar adhered to the Lunar system described in the *Tanakh,* and based on the Book of Enoch, the calendar used is based on the Solar system. Such changes occurred during the reign of Greece.[67]

E. Changes in the Jewish Calendar: The Influence of the Greek Civilization

The newly invented "Greek culture" in Alexander's empire influenced the reference system used in the Jewish Calendar. Initially, the system used in the calendar was the Solar system, as found in Sefer Yetzirah and the Book of Enoch. The

[64] Katz and Abrahamson, *The Islamic Jewish Calendar*: 5. Note that the Jewish month names as well as the system of intercalation of a second Adar are taken over from the Babylonians.

[65] *Epoch* is a specific time set to be used as the reference point of the time scale, such as B1950.0 or J2000.0. See: Jean Meeus, *Astronomical Algorithm* (Virginia: Willmann-Bell Inc., 1991), 320.

[66] Kaplan, *Sefer Yetzirah,* 186.

[67] Asherit, "Interview," 2021.

system was transformed into a Lunar system during the reign of King Antiochus IV Epiphanes (early 2nd century BCE) through Daniel's Antichrist Prototype Movement. From the 4th century CE until now, the Jewish Calendar system uses a Lunisolar frame of reference. This latest reference change is due to the correction of the difference between the Lunar year and the Solar year, which are different.

In Sefer Yetzirah, the first year in the Jewish calendar begins at the time when the Prophet Adam was created.[68] It is reinforced by the statement of the years described in the biblical genealogy that the year dates back to Adam was created. It is believed (e.g., confirmed from Al-Biruni, 11th century CE) Adam is reported to have been made 3448 years before the Seleucid era,[69] starting 312 BCE.[70] When added together, Adam was created in 3760 BCE. According to the rabbis[71], the beginning of the Hebrew year was not based on the creation of Adam but existed before Adam's creation, namely in the month of Tishri. The Book of Seder Olam Rabbah[72] explains that Adam was created on Monday, 25 Elul in the year 1 Hebrew, September 22, 3670 BCE.[73] Based on the explanation of the last book, conversions in Jewish years are always supplemented by 3761. When referring to this year, the Jewish Calendar system originally used a Solar system. A similar description is also found in the Book of Enoch.

The use of the Solar system in the Jewish Calendar ended in the second century BCE. At that time, King Antiochus IV Epiphanes changed Solar-based systems to Lunar-based. The goal might have been to Hellenize the Hebrews. Antiochus IV was the Hellenistic King of Greece who opposed the time system with

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[68] Kaplan, *Sefer Yetzirah*, 186.

[69] The Seleucid era was a year numbering system used during the Seleucid Empire and surrounding other countries in the ancient Hellenistic civilization. This era existed during the time of King Seleucus I Nicator in Babylonia. See: Denis C. Feeney, *Caesar's Calendar* (Berkeley: University of California Press, 2007), 139.

[70] Andi Pangerang, "Mengenal Kalender Ibrani," Pusat Sains Antariksa LAPAN, 2021, https://edusainsa.brin.go.id/artikel/mengenal-kalender-ibrani/426.

[71] *Rabi* is a spiritual leader or religious leader or religious teacher in Jews. In Islam, rabbi can be equated with kyai or ulama.

[72] Seder Olam Rabbah is one of the chronologies of the second century that tells the details of the dates of biblical events from the creation to the conquest of Alexander the Great of Persia. See: Midrash, "Seder Olam Rabbah," accessed January 21, 2023, https://www.sefaria.org/Seder_Olam_Rabbah?tab=contents.

[73] B. Ratner, "Ratner's 'Seder Olam Rabbah,'" *The Jewish Quarterly Review* 9, no. 4 (1897): 740.

a Solar frame of reference. The replacement of this system was rejected by Onias III, the last descendant of Aaron, who was legally appointed a priest in Israel. Because of this refusal, King Antiochus IV Epiphanes ordered the Sanhedrin to kill Onias III together with all the descendants of Aaron.[74] According to Asherit, the change in the Jewish Calendar from the Solar to the Lunar system caused Daniel's antichrist movement prototype, which changed the time and law of YHVH. This movement goes against the law of YHVH by claiming to be the Christ described in the book of Daniel. King Antiochus IV deprived the Hebrews of freedom in worshipping YHVH and forced them to honor Zeus (the highest Greek God) and Bacchus (son of Zeus, who was the God of wine, pleasure, and feast).[75]

After the death of King Antiochus IV (164 BCE), some Hebrew clergy tried to restore the Jewish Calendar system to the Solar calendar. However, the influence of the Lunar calendar among Jews was so strong[76] that the system's return was immutable and could not be widely accepted by the people. The older Babylonian calendar (and the zodiac) upon which the Jewish Solar calendar is based had also originated from the attempt to build a calendar with both the Sun and the Moon. In 359 CE, Rabbi Hillel II, the fifth-generation Rabbi in Israel, re-propagated the teachings of the Solar calendar and combined it with the Lunar year already known to the public.[77]

As a result of the use of the Lunar system, the determination of the beginning of the month in the Calendar is marked by the emergence of *Ḥilāl* or *Molad* through observation. This system of determining the beginning of the month through observation was only valid from 70 to 1178 CE. Because it was too complicated, the observation-based calendar was gradually replaced with a mathematically calculated calendar. Finally, in 1178 CE, a mathematically based calendar with the

[74] Asherit, "Interview."
[75] Asherit, "Interview."
[76] We should admit that the synodic lunar month is the base for the fundamental number 7 in the Jewish system (as shown above). The number 7 is an exact quarter of 28 days (while the synodic month has 29.5 days) and therefore the time between one of the half Moons and the neighbouring syzygy (full moon or modern new moon). This way it is introduced in the Book of Enoch, Chapter 74 verses 1 to 9. So, there is a natural observable base for the lunar calendar.
[77] "Enoch Calendar - The Book of Enoch Reveals the Enoch Calendar."

Metonic cycle[78] used and lasted for nineteen years. The Church uses the Metonic cycle to determine the fall of Easter, which is based on the Jewish festival of Passover.[79] The formulation of this formula does not necessarily exist but through various studies. Moses codifies this Metonic cycle ben Mainom,[80] known as Maimonides, in the twelfth century CE. This cycle is found in the Mishneh Torah or Book of Deuteronomy, not the Old Testament Deuteronomy. The arrangement of this calendar is based on Talmud[81], Mishneh Torah[82] , and Sulchan Arusch.[83]

Since the 4th century CE until now, the Jewish Calendar system combines two references to celestial bodies referring to the Lunar and Solar systems, referred to as Lunisolar. This last reference change is due to the correction of the difference between the Lunar year and the difference in the Solar year. The change resulted in the disruption of the Sabbath's laying. At the time of the Solar calendar, the laying of the Sabbath followed the provisions given by the Prophet Moses. Since the change of the Jewish calendar in the Lunar system, the laying of the Sabbath has been disrupted. In addition, the merger of Solar and Lunar systems also requires the right algorithm so that the laying of the Sabbath can be placed correctly again.[84]

This change in the Jewish Calendar using the Lunisolar system differs from the explanations in Sefer Yetzirah and the Book of Enoch. The calculation system

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[78] Metonic cycle or *enneadecaeteris* (from Ancient Greek: ἐννεακαιδεκαετηρίς, from ἐννεακαίδεκα, "nineteen") is a period of almost exactly 19 Solar years, equaling 235 synodic months. After that, the phases of the Moon repeat at the same time of the year. See: Georges Declercq, *Anno Domini: The Origins of the Christian Era* (Turnhout, 2000), 65-66.

[79] There are many algorithms to compute the date of Easter. This development of these algorithms was one of the main issues of mathematical astronomy in Late Antiquity and the Middle Ages. Even today, the office of the catholic pope in Rome uses a so-called "computus" that differs from the Greek orthodox, from the Coptic, and from the Russian orthodox Church. Subsequently, not all Christian celebrate the highest fest of Christianity, Easter, simultaneously.

[80] His real name is Moses ben Maimon and is also referred to as Rambam. The Arabic name is Abū ʿImran Mūsā ibn Maymūn ibn ʿUbayd Allāh. He born on 30 March 1135 in Córdoba, Spain, and died on 13 December 1204 in Egypt. He was a Jewish philosopher, jurist, physician, and prominent intellectual figure of medieval Judaism. See: B. Zion Bokser, "Moses Maimonides," Encyclopedia Britannica, 2023, https://www.britannica.com/biography/Moses-Maimonides.

[81] Talmud is a rabbinic account (rabbinic discussion) of Jewish law (*halaka*) and Jewish theology. See: Adin Steinsaltz, *What Is the Talmud? The Essential Talmud*, 30th anniv (Basic Book, 2009).

[82] *Mishneh Torah* is a code of rabbinic Jewish religious law (*halakha*) written by Maimonides. See: Omer Michaelis, "Crisis Discourse and Framework Transition in Maimonides' Mishneh Torah," *Open Philosophy* 3, no. 1 (2020): 664–80.

[83] Sulchan Arusch is a code of Jewish law. See: Joseph Davis, "The Reception of the Shulhan ʻArukh and the Formation of Ashkenazic Jewish Identity," *AJS Review* 26, no. 2 (2002): 252-253.

[84] Bushwick, *Understanding the Jewish Calendar*, 8.

and the intercalation in the Book of Enoch also differ from the current Jewish Calendar. The Book of Enoch only commands to intercalate one day each of the four seasons. However, the Jewish Calendar currently intercalates by inserting one month in certain years, which brings the number of months in the year to thirteen months instead of the 12 months as they are in the Books of Enoch and Sefer Yetzirah. In addition, the months in the religious and Jewish civil calendars have different beginnings. Every turn of the year, the beginning of the month used as a reference is the month of Tishri, which is based on the civil calendar. This provision differs from Sefer Yetzirah, which is based on the religious calendar. To find out the Hebrew year number, the year can be converted from CE to Hebrew by adding 3761 years as Epoch from the Hebrew year. If it has passed or is on the 1st of Tishri,[85] then they rely on Tishri, not Nissan. For example, if we wanted the Hebrew year to be in 2022, then the Hebrew year is 3761 + 2022 = 5783 AM.

F. Conclusion

The reference system used in the Jewish Calendar originally referred to the movement of the Sun (Solar calendar) as outlined in the Books of Enoch and Sefer Yetzirah. After being influenced by Greek civilization, King Antiochus IV changed the calendar system to the Lunar calendar in the second century BCE. The goal is considered to Hellenize the Hebrews. In 359 CE, Hillel II reintroduced the Solar calendar and combined it with the Lunar calendar to a Lunisolar one. The consolidation of this calendar system has been running for quite a long time in the community and is still valid. The merger resulted in the algorithm of the fluctuating Jewish Calendar, which originally referred to the Solar calendar with 364 days, to the Lunisolar calendar, which had a different number of days each year following the cycles of the Sun and Moon.

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[85] Pangerang, "Mengenal Kalender Ibrani."

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