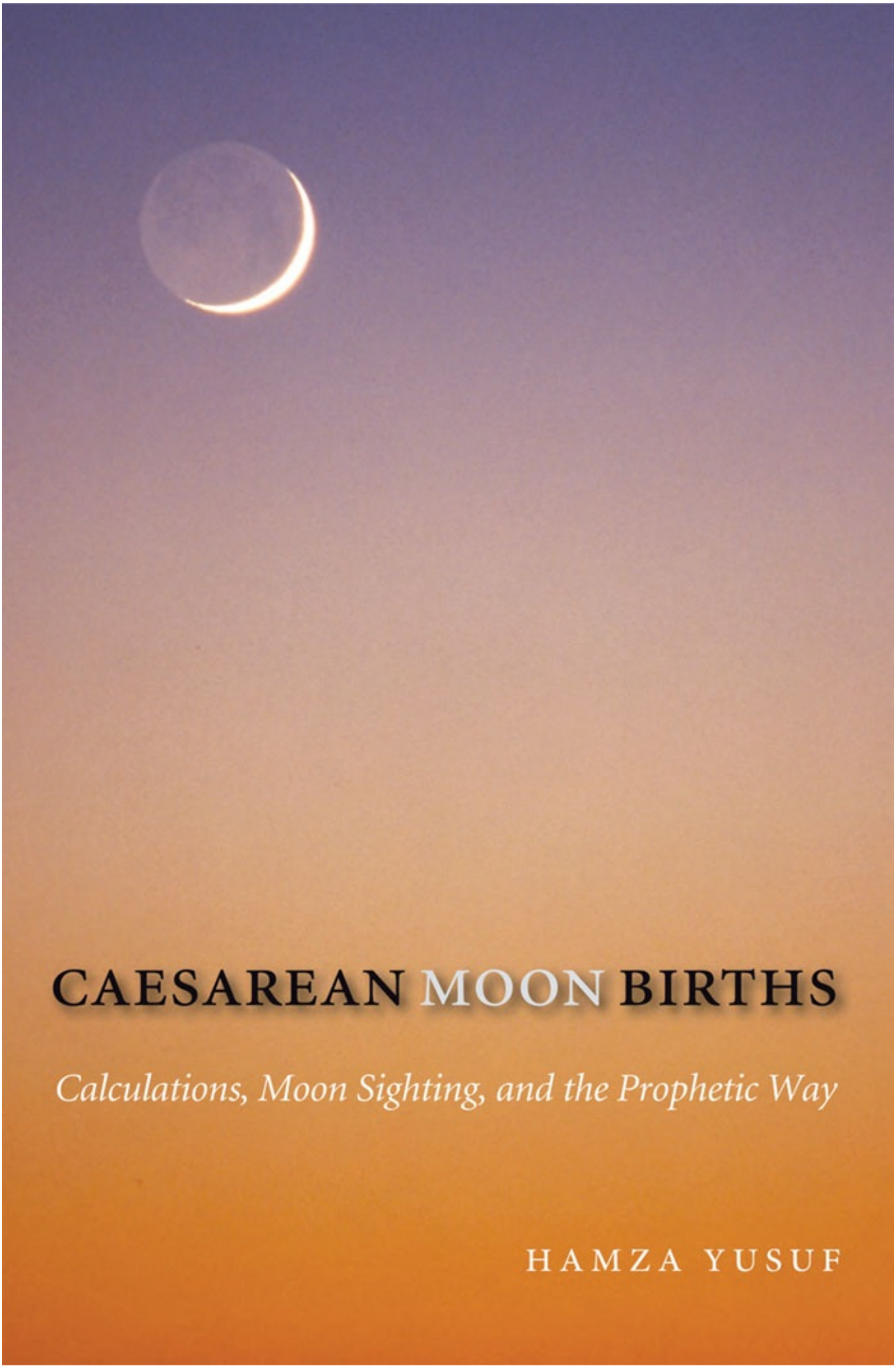
CAESAREAN MOON BIRTHS
Calculations, Moon Sighting, and the Prophetic Way
HAMZA YUSUF

Caesarean Moon Births

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INTRODUCTION

ALL OF THE acts of ritualized worship incumbent upon Muslims are related to time, and thus the measurement and the detailing of time's passage is a religious duty. According to ʿAbd al-Ḥayy al-Kattānī, maintaining time is a religious position to which the Prophet ﷺ himself appointed certain people in Medina. Islamic law considers sacred timekeeping (*tawqīt*) a communal obligation, so once someone in a community fulfills this duty, the rest of the community is relieved of it.[1] Not only is it a religious duty to monitor the sun and the moon's courses for prayer times and for the other acts of worship contingent upon certain months, but, according to the Prophet ﷺ, it is one of the most pleasing and beloved acts to God. The Prophet ﷺ said, "The most beloved of God's servants to God are those who monitor the sun and moon, engendering love of God in God's servants and love of God's servants in God." And in a sound narration related by al-Ḥākim, the Prophet ﷺ said, "The best of God's servants are those who watch the sun, moon, stars, and shadows in order to remember God."[2]

* The title "Caesarean Moon Births" was chosen for two reasons. Like a caesarean birth, the early announcements of the lunar months that have historically accompanied a calculated new moon are primarily the result of conforming to the scheduling requirements of modern bureaucratic societies. Also, it was the edict of Caesar that was instrumental in forcing the Jews to abandon their lunar calendar based on actual sighting and resorting to one based on calculations.

In another hadith, the Prophet ﷺ said to Muʿādh before sending him to Yemen to act as a judge, "What will you base your judgments on?"

Muʿādh replied, "The Book of God."

The Prophet ﷺ then asked, "And should it not be in the Book of God?"

"Then the Sunnah of the Prophet," replied Muʿādh.

"And should you not find it in the Sunnah?" asked the Prophet ﷺ.

“Then I will exert my efforts completely and not falter.”

To this, the Prophet ﷺ responded, “Praise is due to God, who has given the messenger of the Messenger of God success.”

This hadith elucidates the methodology to be followed by any scholar attempting to understand an issue involving a legal ruling in the sacred law of Islam. There are four agreed upon sources of legislation:

1) The Qur’an, first and foremost, 2) the Sunnah, which comprises the words, deeds, and acknowledgments of the Prophet Muḥammad ﷺ,as transmitted through reliable sources, 3) the consensus of the Muslim scholars (*ijmaʿ*), and, finally, 4) analogical reasoning (*qiyās*) that is used as a last resort in the absence of definitive proofs. However, of these four, the two sources agreed upon for use as single sources are the Book of God and the Sunnah of the Prophet ﷺ. The Prophet ﷺ stated, “I have left you two things; as long as you hold to them, you will never stray: the Book of God and my Sunnah.”

So the scholars first look to the Qur’an, then to the Sunnah, and then to the consensus of the previous scholars, and then, finally, resort to independent reasoning (*ijtihād*). However, *ijtihād* is permissible only when there is no decisive and unequivocal text (*naṣṣ*) found in the Qur’an or the Sunnah; this is based upon the juristic principle, “There can be no *ijtihād* in light of an explicit text.”

Another important axiom is that both the Qur’an and the Sunnah were revealed in Arabic, and any interpretation must be in accordance with the accepted linguistic meaning of those texts during the period of revelation, between 610 and 632 CE. It is proscribed to interpret the Qur’an in the Arabic of any other period. One may refer to authentic pre-Islamic poetry to determine the meanings of words because linguistic usages of that period were accepted at the time of the Qur’anic revelation. Immense human effort has been exerted in order to preserve the meanings of the Arabic language of the Prophet’s time. No other religious community on earth has the level of certainty about their sacred scriptures’ historical authenticity and lexical signification as Muslims do. This is due first to God’s promise of scriptural preservation, and then to efforts of those scholars who codified the Qur’an and preserved the Arabic language in the voluminous lexicons of the first centuries of Islam.

THE PROBLEM

The lunar Islamic calendar follows the phases of the moon, beginning with the

crescent moon and ending with the conjunction of the moon and the sun in their respective perceived movements around the earth. The time of one lunation or complete cycle of the moon is approximately 29.5 days. This must be averaged because the moon does not travel at a constant speed nor does it travel in a perfect circle but in an elliptical orbit around the earth. The moon's monthly cycle around the earth varies between 29.2 days and 29.8 days, which means that throughout the year there will be approximately six months in which there are twenty-nine days, and six months in which there are thirty days. The total number of days in a lunar year is approximately 354, which is eleven days shorter than the average solar year. In order to make the lunar years consistent with the solar, many pre-Islamic societies intercalated or added days to the lunar months. This enabled them to follow a lunar calendar without having it depart from the fixed seasons of the solar calendar. This was and remains the practice of the Jewish community, which intercalates a thirteenth month every three years in order to align the lunar and solar calendars. Interestingly, however, the Jews originally practiced a purely lunar calendar and introduced intercalation later. The pre-Islamic Arabs used a lunar calendar but both calculated and intercalated their calendars when suitable for their needs. Their general practice however was to rely on a physical sighting of the crescent moon.

The Islamic lunar calendar is not to be tampered with, as the Prophet ﷺ prohibited intercalation in his farewell address to his community during the final pilgrimage. Islam condemns intercalation, regarding it as a rejection of the natural order inherent in the perfection of the lunar calendar that God has provided humanity for measuring time. For this reason, in a number of hadith that have the status of infallible (*mutawātir*) and are thus on par with the legislative authority of any verse in the Qur'an, the Prophet ﷺ commanded Muslims to base their month on the physical sighting of the new moon and stipulated that if not seen on the twenty-ninth completed day of the previous month on a clear evening, or if clouds or other atmospheric barriers hinder visibility, then to complete thirty days and begin the new month on the following sunset, which would be on the thirty-first day following the previous sighting.

In the modern world, however, exact times are far more significant than they were in the premodern world because of the importance placed on mechanical clocks, trains, planes, and deadlines. For this reason, Saudi Arabian officials, who use the lunar calendar for all governmental activities, decided at a certain point to rely on calculation as a basis for their calendar in order to ensure that people use the same dates and that the dates can be predetermined to facilitate scheduling and other time concerns of a modern society. The criterion they use for calculation is the conjunction of an astronomical new moon occurring before

sunset of the first day of their lunar calendar. Although convenient, this system can be as much as two days off an actual new crescent sighting. Errors, due to this fact, have occurred in the past.

Muslims in North America use a lunar calendar only for devotional purposes and have had recourse to various methods of determining the lunar months. The most prominent methods include local sighting, sighting anywhere in North America, a physical sighting anywhere globally, and calculated sighting. There is also the option of simply following Saudi Arabia, and some assert that since anyone wishing to make the pilgrimage must follow Saudi Arabia for the hajj determination, it logically follows to include Ramadan as well, especially since Saudi Arabia is the only country in the world that still uses a lunar calendar for its day-to-day scheduling. Another popular method is following family members who reside in Muslim countries, as the option of simply calling mom, dad, grandma, or grandpa overseas and going along with the dates of their calendar in Damascus, Cairo, Karachi, or elsewhere is emotionally comforting for some, especially when calling to wish "Eid mubārak" to family back home when they themselves are just getting up to finish the last day of fasting (since the family is in a time zone that is several hours ahead).

The essential problem, therefore, is that there are indeed various ways to start Ramadan in North America and each group puts forward its reasoning for a preferred method. Who then should we follow?

THE QUR'AN AND THE MOON

The Qur'an declares: *Surely the months with God are twelve in the book of God since the day He created the heavens and the earth; four of them are sacred* (9:36). Imam ʿAbd Allāh b. Ahmad al-Nasafī, the noted theologian and exegete, explains the meaning of this verse: "This verse is to clarify that the legal rulings in shariah are to be determined by lunar months that are calculated by the crescent moons irrespective of the solar calendar."[3] Thus, the Qur'an commands Muslims to use the lunar month for their devotional matters, but not necessarily their worldly affairs. Qadi Abū Bakr b. al-ʿArabī cites the verse, *They ask you about the crescent moons; say they are a means to measure your specific times* (mawāqīt) *and are also for the commencement of the hajj* (2:189) and explains it thus:

> The wisdom in this is that God has made the sun and moon two of His signs, and it is related in some sources that He assigned to each an angel and decreed for them two points of rising. He moves them between the two [throughout the year] for two benefits: one worldly, which is the solar calendar, and the other religious, which is based upon the lunar.[4]

Since two major obligatory acts of devotion and many minor recommended ones have designated times throughout the year, the lunar months have been given to specify those times. The word used for "specific times" is *mawāqīt* and is derived from the Arabic word *waqt*, which means "time." The difference between the word *waqt* and the other Arabic word for time, *zamān*, is that "*zamān* is absolute time and [refers to] the movements of the celestial orbs that indicate it from their starting point to their finishing point. So *zamān* is the division of time into past, present, and future, whereas *waqt* is *zamān* when it specifies a point that is for some specific affair."[5] Thus, the crescent moons were designated for determining specific times within the flow of time.

An intriguing aspect of the verse mentioned above is that it was revealed in response to those who asked the Prophet ﷺ about the crescents, and they were seeking to understand the actual mechanism, that is, the *science* of the crescent. They wanted to know how the moon did what it was doing. However, the Qur'anic response enlightened them that more important than their question of how, is why. This is the essential difference between science and religion, and is summed up in this one momentous verse of the Qur'an. The verse immediately following God's reply to their question is, *Do not enter houses through their back doors*. Some commentators understood that to mean, "Ask the right question: why, not how."

Our English word "month" is derived from "moon." In fact, the earliest human calendars were lunar, and it was lunar calendars and the human need to determine time's progression, especially the passage of the year itself, that led to the development of mathematics. This purpose is clearly stated in the verse, *It is God who made the sun shine and the moon glow, and determined the lunar phases that you may know the number of years and calculation* (10:5). According to Ibn ʿAbbās and others, "That you may know the number of years and calculation (*ḥisab*)," was interpreted to mean that the 28 divisions or mansions (*manāzil*) of the moon allowed man to calculate which phase of the month he was in, thus enabling him to measure his days, given that there are twenty-eight phases of the month determined by the lunar mansions and on the twenty-ninth the moon disappears for a day or two only to re-emerge as a newborn crescent. However, it also implies that the challenge of measuring time gave man an impetus to learn and develop mathematics, and by extension, science. Hence, the sun and the moon following clear courses enabled humanity to track them and in so doing, increase our knowledge of science.

In his book on the calendar, David Duncan writes, "A case can be made that science itself was first sparked by a human compulsion to comprehend the passing of time, to wrestle down the forward motion of life and impose on it

some sense of order."[6] The Muslim contribution to mathematics is immense and is largely a result of Muslim scientists attempting to forecast the appearance of new moons, find the precise qibla, and determine inheritance portions accurately. Muslims further developed Greek plane trigonometry as well as spherical trigonometry; interestingly, they considered spherical trigonometry as a separate science from plane trigonometry, as they used it to solve astronomical and geographical problems. This enabled them to make highly sophisticated astronomical predictions that resulted in a greater and more accurate reckoning than previous civilizations, which nonetheless, had highly complex systems of measuring time and the movements of celestial phenomena.

To summarize, a consensus exists among all Muslims that the basis of our religious calendar is lunar, that it is determined by the crescent moons in compliance with the Qur'anic verse, and that intercalation to maintain consistent years is prohibited.

CALENDARS IN PRE-ISLAMIC ARABIA

The calendar used by pre-Islamic Arabs was an intercalated lunar calendar, which enabled them to plan certain solar festivals and manipulate the beginning and end of the sacred months for fighting purposes. In an earlier period, the Arab calendar was intercalated lunisolar, which is why some of the names of the lunar months reflect the seasons to which they correspond. However, at the advent of the Prophet's message, the sacred months, which were initially from the Abrahamic teaching, had lost their specific assignment within revelation's specified time as a result of the intercalation by the Arabs. For this reason, in his farewell address, the Prophet ﷺ prohibited the insertion of days into the lunar calendar.

In his intriguing book of seasons and sky signs, the seventh-century Islamic astronomer and scholar, Abū Isḥāq al-Ajdābī, notes that astronomers tended to determine the Arab months based upon the estimated time of separation after the conjunction of the sun and moon (*mufāraqah*). He states that the first month was Muḥarram, to which the astronomers assigned a duration of thirty days, and the next month, Ṣafar, had twenty-nine; they continued to alternate in that order through the remaining ten months, with the last month, Dhū al-Ḥijjah, having twenty-nine days. Every leap year, a thirtieth day was added to Dhū al-Ḥijjah in order to make up for the fraction of a day, which is approximately three-tenths of a day per month. Abū Isḥāq al-Ajdābī continues:

> This is what astronomers have noted with respect to computing the periods of the Arabian months. This is based on the method of calculating the point

> of separation after conjunction (*ḥisāb al-mufāraqah*).[7] However, Arabs did not adopt this method. They always depended in their civil life on the crescent moons. Whenever they sighted a new moon, with it, they placed the commencement of the month. They commenced the month from the first night in which the new moon had appeared. They called this night the "the month's forelock" (*ghurrat al-shahr*), on account of the new moon appearing in the beginning like a *ghurrah*, which is a blaze or white spot on the horse's face. According to the Arabs, the month does not come to an end till the new moon is visible a second time, and from then on, they place the commencement of a second month…. When Islam arrived, it affirmed this practice.[8]

The every-other-month method is primitive and was rejected as unscientific by the polymath and astronomer, Abū al-Rayḥān al-Bayrūnī, who both refuted and mocked it. It was, nonetheless, an easy way to determine the months and is also a self-correcting system. The pre-Islamic Arabs, who were aware of the lunation or synodic month, did not implement it as the basis for their calendars; rather, unlike the later Jewish practice of calculation, they chose to sight the crescent moon. While modernists might look askance at these early calendars, the truth is that observational astronomy, for all intents and purposes, has advanced little in the last few thousand years. In fact, more than two thousand years ago, the Greek astronomer and mathematician Hipparchus of Nicaea (d. 125 BC) determined the length of the average lunar month to be within one second of today's accepted value and gave accurate calculations of the inclination of the ecliptic and of the changes of the equinoxes.[9]

Moreover, many ancient cultures accurately predicted the conjunction of the sun and moon in the ecliptic nodes, which enabled them to accurately foretell eclipses. What many people today do not understand is that creating a calendar, whether lunar, solar, or lunisolar, requires a thorough knowledge of the motions of the stars and many cumulative, learned adjustments. The noted American scientist, Stephen Jay Gould (d. 2002), in conversation with the Italian philosopher and novelist Umberto Eco, had this to say:

> Why have calendars at all? In order to predict the regular patterns of nature. In an agricultural society you need a solar calendar to know when best to sow your crops. In a society that lives by fishing you need a lunar calendar to know the tides. *Yet it is impossible to establish a simple arithmetical relationship between the two that would bring them into harmony*.[10]

Thus, the Arabs, who used calculating, sighting, and intercalation with their calendar, required a level of computation that had some relative complexity, and the ability to do so existed among those pre-Islamic individuals who were

directly responsible for keeping time, which, as Gould points out, is a function of any organized society. Indeed, "The calendar is thus a synthesis that draws on scientific knowledge, religious belief, and political will. It reveals the way that power, religion and science interact."[11]

THE JEWISH CALENDAR

The Jewish community is the most similar to the Muslim community in both theology and devotional practice, as indicated by the sound hadith, "You are most like the Children of Israel." It is, therefore, not surprising that the Jews also follow a lunar calendar for their religious holidays, which was originally a uniquely lunar calendar, as indicated by the Hebrew word, *ḥodesh*, which means "month," or "new moon." At a certain point in their religious history, however, they began to intercalate in order to align the transitionary lunar year with the stationary solar year. Each month is still based upon a lunation or synodic month, in which the Jews add a given number of days a year, and an extra month every few years in order to maintain the lunisolar congruence.

How, then, did the Jews originally determine their lunar month? They had eyewitnesses sight the new moon and convey the information to the Sanhedrin (assembly of Jewish judges), according to the *Catholic Encyclopedia*, which explains further:

> The Hebrew months have always been lunar, and extended from one new moon to another. The beginning of the month with the appearance of the new moon was—as it is still—of great practical importance among the Hebrews, inasmuch as the first of every month was to be observed as New Moon's Day, and certain feasts were affixed to the 10th, 14th, or other days of the month. The earliest appearance of the new moon was long ascertained by direct observation, and authoritatively settled by a commission of the Sanhedrin, and the intelligence then made known to the Jews at large, first by means of fire-signals, and later on through special messengers. In the present day, and for many centuries, this very primitive manner of fixing the beginning of the month has given way to a systematic calculation of the latter's duration, and the Jewish calendar is now constructed on the basis of a mean lunation of 29 days, 12 hours, 44 minutes, and 3.5 seconds.[12]

For more than a thousand years, Jews followed a calendar based upon naked-eye observation of new moons. However, during the reign of the Roman Emperor Constantius II (337–361 CE), persecution of the colonized Jews intensified, preventing them from communicating news of a sighted moon to one another. It

was Rabbi Hillel II (330–365 CE) who first introduced to Judaism a new calendar based upon calculation and not actual physical sighting of the moon, in order to facilitate the observance of holidays for the oppressed Jews. The calendar was introduced in 358. "Its computations were designed to simulate the practical constraints of the observed calendar (including postponements and intercalations) as closely as possible," according to the Active Bible Church of God,[13] which also contains the following statement:

> Suggestions have been made that the computations should be changed, or that observation should again be used. It is clear that adjustments need to be made to the computed calendar in order to keep it synchronized with the sun and moon. But there is no consensus as to how this should be done, and, in the modern world, this needs to be done years in advance. *Returning to observation is idyllic, but totally impractical. The modern world requires plans for religious observances to be made months, or even years, in advance*. Only a computed calendar permits this. It is clear that just as "the Sabbath was made for man," so also "the Calendar was made for man." It is a tool to help us worship God. And an essential feature of a tool is that it must be useful and practical.[14]

One can see from this the compromises the rabbis made. Arguably, the Jews' initial abandonment of eyewitness sighting was because of undue hardship at a specific period in their history; and the result of one of their great rabbis' own human efforts to serve his community. Having said that, according to the principles of Islamic law, when the hardship that allowed the facilitating dispensation (*rukhṣah*) in the first place is no longer present, the license is no longer valid, and the original ruling must be restored. The Jews never returned to their original tradition of following a purely lunar calendar determined by eyewitnesses; instead, they continue to determine the new moon by calculation. Our Prophet ﷺ clearly warned us not to follow the Jews and the Christians in their abandonment of their own prophetic practices, and to be especially vigilant about this. Lamentably, he also informed us that many Muslims would not heed this advice. Predetermining our lunar months through calculation is a fulfillment of his prediction.

The Prophet ﷺ said, "You will follow the [erroneous] ways of those before you handspan by handspan, arm's breadth by arm's breadth, to such a degree that if they went down a lizard's hole, you would also go down the hole."

His companions exclaimed in response, "The Jews and the Christians, O Messenger of God?"

"If not them, then who?" he replied.[15]

Going from sighting to calculation is essentially to follow the Jewish abandonment of their original tradition. The Prophet ﷺ also said, according to a sound hadith narrated by Imam al-Tirmidhī, "What happened to the Children of Israel will also happen to my community, step-by-step…."[16] No disrespect is intended toward the Jewish or Christian communities, but this matter of strict adherence to our respective prophetic practices is a crucial point of divergence in our three Abrahamic traditions. The Prophet ﷺ saw himself as a restorer of the true Abrahamic practices that had fallen into dereliction among the Jews and Christians of his time. Among these practices is following a purely lunar calendar for devotional purposes and the determination of its months by the physical appearance and sighting of the moon.

CALENDARS AFTER THE ADVENT OF ISLAM

The Prophet ﷺ commanded the Muslims to keep track of the crescent moons and to inform him of the sightings. If a new moon was sighted for the devotional months of Ramadan or Dhū al-Ḥijjah (the month in which hajj is performed), the news was announced to all. According to Imam al-Tirmidhī, upon seeing the crescent moon, the Prophet ﷺ would recite the prayer: "O God, cause this new moon to come upon us in safety and sound faith, security and submission." Then, addressing the moon, he would say, "My Lord and your Lord is Allah."

According to Abū Dāwūd, the Prophet ﷺ would also say to the new moon, "A crescent of goodness and guidance, a crescent of goodness and guidance, a crescent of goodness and guidance. I believe in the One who created you; I believe in the One who created you; I believe in the One who created you." Then he would say, "Praise be to the One who caused the previous month to depart and brought us this month."[17]

In 637 CE, sixteen years after the Hijrah of the Prophet ﷺ, the Caliph ʿUmar رضي الله عنه instituted the new Islamic year based upon the first of Muḥarram in the year that the Prophet ﷺ had migrated from Mecca to Medina. The first of Muḥarram 622 CE, which coincided with the sixteenth of July 622 CE, began year one of the Muslim era. We are now in the 1428th year since that momentous event occurred.

Ever since then, Muslim astronomers and mathematicians have maintained rigorous and effective calendars for their respective eras, developed accurate ephemeredes that detailed the phases of the moon, and even provided crescent

visibility tables for different climes. The Seljuq minister, Nīzam al-Mulk (d. 1092 CE), desirous of instituting a more accurate working calendar, commissioned the notable polymath ʿUmar Khayyām (d. 1131 CE), known in the West for his *Rubaiyat*, to develop a calendar based on the solar year. Khayyām was able to calculate the duration of the solar year to within decimals of that established by contemporary calculations. The calendar that he produced has an astronomical basis that is "more accurate than the Gregorian calendar with a discrepancy, it is said, of only one day in 3770 years." Unfortunately, his calendar was never adopted to replace the less effective solar calendars still in use.[18] Clearly, Muslims in premodern times possessed the intricate and detailed knowledge necessary to construct both lunar and solar calendars in order to organize their worldly and religious affairs.

Until very recently, the most widely used solar calendar in the Muslim world was the Coptic calendar. In the eighteenth century, the Ottomans adopted the Julian calendar as their solar calendar while continuing to use the lunar calendar for their devotional practices, basing it upon physical sighting of the new moons.[19] Shortly after the collapse of the Ottoman Empire, non-Muslim colonialists ran the administrations of much of the Muslim world; this led to the Muslim adoption of the current Gregorian calendar. Despite the almost universal hegemony of the Western calendar, Morocco, the United Arab Emirates, Egypt, Turkey, and Saudi Arabia still produce qualified sacred timekeepers who have studied the traditional science of horology and are capable of maintaining lunar calendars based upon both separation (*mufāraqah*), as is currently practiced in Saudi Arabia, and moon sighting, as is practiced in Morocco. My teacher and friend, Shaykh ʿAbd al-Ḥayy al-ʿUmrāwī, who inherited the position of timekeeper from his father and who still holds the key to the timekeeper's tower in the Jāmiʿ al-Andalus in Fes, took me up into the tower and showed me the holes that had been precisely positioned to enable the timekeeper to simply look through them at the approximate outset of the corresponding points throughout the year where the new crescent would appear, if it were visible.

THE MEANING OF "CRESCENT" IN ARABIC

In determining the crescent moon, an important question arises: What exactly does "crescent" (*hilāl*) mean in the classical Arabic language? Furthermore, does our modern understanding of this word differ from the Arab understanding of the seventh century? The earliest and one of the most authoritative lexicons in the Islamic tradition is that of the linguist, al-Khalīl b. Aḥmad of Oman. His book, *al-ʿAyn*, is the first scientific lexicon in human history. In it, he defines "crescent" as, "The first light of the moon, when people actually see the crescent at the