

# THE IMPACT OF LUNAR SIGHTING DISCREPANCIES ON THE BEGINNING AND END OF RAMADAN FASTING: A COMPARATIVE FIQH ANALYSIS AND THE ROLE OF AI IN RESOLVING DIFFERENCES

**Manswab Mahsen Abdulrahman\***

\*Department of Shariah, Faculty of Islamic Studies and  
Arabic Language, Islamic University in Uganda,  
Kumi Road, P.O. BOX 2555 Mbale.

\*(Corresponding author) e-mail: manswab@iuiu.ac.ug

DOI: <https://doi.org/10.22452/syariah.vol33no2.5>

## ABSTRACT

*The beginning and end of Ramadan have traditionally been determined by physically sighting the crescent moon. Despite this long-established practice, differences in lunar visibility across regions frequently result in varying start and end dates for fasting. These variations often create confusion among Muslim communities, sometimes leading to disagreement among scholars and worshippers regarding the correct time to observe Ramadan. This study adopts a comparative fiqh approach, analysing the perspective of classical and contemporary jurists on moon-sighting methodologies. It also explores how modern artificial intelligence (AI) technologies*

*could contribute to minimizing these differences. Using a qualitative and comparative methodology, the research draws upon primary and secondary fiqh sources, juristic opinions, and recent studies on astronomical calculation. The findings of this research highlight three legitimate methods for confirming the commencement of Ramadan; sighting the crescent moon (ru'yah al-hilāl), completing thirty days of Sha'ban (ikmāl Sha'ban), and estimating the crescent moon in cloudy conditions (ḥisāb). Furthermore, the determination of Ramadan's start and end dates has been a persistent source of debate among Muslim communities worldwide due to inconsistencies in moon sighting (ikhtilāf al-maṭāli'), particularly between proponents of global sighting (ru'yah al-'alam) and local sighting (ru'yah al-maḥallī). Each region follows its own sighting. In response to these challenges, AI-equipped drones have been introduced to enhance the detection of the Ramadan crescent moon by providing accurate predictions and identifying optimal locations for moon sighting.*

**Keywords:** *Lunar sighting, Ramadan, hilal, fiqh analysis, artificial intelligence*

## INTRODUCTION

The month of Ramadan is the ninth month of the Islamic calendar, and it is a great and blessed month for Muslims. It is the month in which the Qur'an was revealed, and it also contains the Night of power (*Lailah al-qadr*). Furthermore, fasting during Ramadan is one of the pillars of Islam. During the month of Ramadan Muslims abstain from eating and drinking, among other acts that nullify their *sawm* (fasting) from dawn until sunset.<sup>1</sup> The month of Ramadan also has deep spiritual significance, as it is considered a month of repentance, recitation of the Qur'an, and increased acts of worship (*'ibādah*). During this month Muslims gather together and share the meal at the time of breaking the fast, known as *ifṭār*.

The month of Ramadan begins with the sighting of the new crescent moon (*hilāl*). If the crescent is sighted on the 29th night of the month of the preceding month (Sha'ban), the following day is the first Ramadan. If the crescent is not sighted, Muslims are required to complete thirty days of

---

<sup>1</sup> Muḥammad ibn Ibrāhīm 'Abd Allāh al-Tuwayjirī, *Mukhtaṣar al-Fiqh al-Islāmī fī Ḍaw' al-Qur'ān wa al-Sunnah*, (11th ed., al-Sa'ūdiyyah: Dār Aṣḍā' al-Mujtama', 2010), 623.

Sha'ban, after which Ramadan begins. Like all lunar months, Ramadan consists of 29 or 30 days, and it ends with the sighting of the crescent moon that signals the beginning of Shawwal, marked by the celebration of '*Aid al-Fitr*'.<sup>2</sup> Ramadan holds a special place in Islamic history and heritage, particularly due to the event of the initial revelation of the Qur'an, believed to have occurred during one of the last ten nights of the month, *Lailah al-Qadr*. This night is described in Surah al-Qadr:

لَيْلَةُ الْقَدْرِ خَيْرٌ مِّنْ أَلْفِ شَهْرٍ ﴿٣﴾

“*Lailah al-Qadr is better than a thousand months (emphasizing its spiritual magnitude).*”<sup>3</sup>

(Surah al-Qadr, 97: 3)

The month of Ramadan is also associated with many religious rituals, such as *tarāwīḥ* prayers and seclusion during the last ten days (*i'tikāf*). It is also marked by numerous customs and traditions, including inviting others to break the fast, organizing communal *iftār* meals, and giving alms to the needy. Many traditional features connected with this month become widespread, such as lanterns, decorations, and the Ramadan cannon. Cultural figures such as *Musharātī*<sup>4</sup> and the storyteller,<sup>5</sup> along with specific foods and sweets traditionally eaten after *iftār*, also return to the forefront.

Allah SWT has connected legal rulings that are time-bound to the sighting of the crescent moons. As He, the Most High, says:

---

<sup>2</sup> Abū Ja'far Aḥmad al-Ṭaḥāwī, *Mukhtaṣar Ikhtilāf al-'Ulamā'*, vol. 2 (2nd ed., Bayrūt: Dār al-Bashā'ir al-Islāmiyyah, 1417 AH), 35.

<sup>3</sup> Surah al-Qadr: 3.

<sup>4</sup> The *Musharātī* is the person who takes it upon himself to wake up Muslims during the nights of the month of Ramadan so that they may eat the suhoor meal. What is well known about al-Musaharati is that he carries a drum or flute, which he beats or plays to awaken people before the dawn (fajr) prayer. He is usually accompanied by religious chants. However, with the passage of time and development, this profession declined. As a result, the Musaharati has disappeared from most neighborhoods, after having been widely known and actively practiced in many Islamic countries/cities.

<sup>5</sup> The storyteller, or narrator, is a traditional figure rooted in folk culture. He is someone who made a profession out of narrating stories in homes, shops, cafes and public streets. In the past, people would gather eagerly around him to listen. The storyteller did more than simply recount events; he actively engaged with his audience, bringing tales to life through dramatic gestures, expressive movement, and varied vocal tones. His passion often led him to embody the characters within his stories, turning each performance into a vivid and immersive experience.

يَسْأَلُونَكَ عَنِ الْأَهْلِ قُلْ هِيَ مَوَاقِيتُ لِلنَّاسِ وَالْحَجِّ ﴿189﴾

“They ask you about the new moons. Say, ‘They are measurements of time for the people and for Hajj’.”<sup>6</sup>

(Surah al-Baqarah, 2: 189)

Among the rulings that depend on the appearance of the new moon is the determination of the beginning of fasting in Ramadan and the celebration of ‘Aid al-Fitr, which marks the end of fasting and the start of the month of Shawwal. The commencement of Ramadan is contingent upon the sighting of its crescent moon, while the end of the fast and the onset of Shawwal likewise depend on the sighting of its crescent. Each year, as Ramadan approaches, noticeable differences arise among Muslim countries in announcing the beginning of the month. Some nations commence in announcing the beginning of the month. Some nations commence fasting based on reports of an early crescent sighting, while others begin in a day or two later. Those who start earlier maintain that the crescent was visible within their region, whereas others delay due to the absence of confirmed sightings, often attributed to geographical location or atmospheric conditions. Such recurring discrepancies continue to challenge the sense of unity within the Muslim ummah in matters of collective worship.<sup>7</sup>

It was well established, both through observation and scientific evidence, that the moon’s rising times differ from one region to another. In some areas, the crescent may be visible shortly after sunset, while in others it may not appear until the following day. This natural variation explains why certain countries are able to sight the crescent earlier than others. The renowned Hanafi jurist Ibn ‘Ābidīn remarks in his treatise “*Tanbīh al-Ghāfil wa al-Nā’im bi Ahkām Hilāl Ramaḍān*” affirms this reality by stating that the moon’s rising differs from place to place and that such variation is beyond dispute. His observation underscores the juristic acknowledgment that geographical differences play a significant role in the diversity of moon-sighting reports.<sup>8</sup>

The determination of Ramadan’s beginning and end holds profound spiritual significance in Islam. Yet, the diversity of moon-sighting practices

<sup>6</sup> Surah al-Baqarah:189.

<sup>7</sup> Muḥammad ‘Uqaylah, *Ahkām al-Ṣiyām*, (1st ed., ‘Amān: Maktabat al-Risālah al-Ḥadīthah, 1982),16.

<sup>8</sup> Muḥammad Amīn ibn ‘Umar, *Majmū‘ Rasā’il al-‘Ābidīn*, vol. 1 (1st ed., Bayrūt: Dār Ihyā’ al-Turāth al-‘Arabī, 1405 AH), 250.

shaped by both astronomical realities and differing juristic interpretations often leads to disagreement that affects communal harmony. These differences are rooted not only in scientific considerations but also in the varied methodological approaches by scholars across legal schools and historical periods. Although a number of studies have addressed the issue of lunar sighting, they largely focus on classical discussions of differences in moonrise (*ikhtilāf al-maṭāli'*) and their legal implications. For instance, the study titled "*Ikhtilāf al-Maṭāli' wa Atharuhu 'alā Ikhtilāf al-Ahillah*" examines how variations in moonrise times influence the determination of lunar months. However, existing literature has not sufficiently explored the potential role of artificial intelligence in supporting or enhancing moon-sighting processes. This paper therefore seeks to move beyond the traditional fiqh discourse by introducing an AI-informed perspective, aiming to address gaps in previous scholarship and contribute to a more informed and harmonized approach to determining the lunar calendar.

This study examines the long-standing juristic disagreement among Muslim scholars regarding the sighting of the crescent moon, particularly the debate between local and global sighting and the permissibility of relying on astronomical calculations. It seeks to clarify the principle legal positions adopted by the classical scholars of Islamic law and explore how these differences continue to shape contemporary determinations of Ramadan. In addition, the study investigates the emerging role of Artificial Intelligence (AI)<sup>9</sup> in producing highly accurate lunar prediction data and considers whether such technology can help reduce disagreement (*ikhtilāf*) and promote greater unity within the Muslim community.

Finally, this article is structured into four sections. The first section offers an overview of Ramadan. The second section delineates the methodology employed in the study. The third section presents a finding and discussion on the legitimate methods for confirming the commencement of Ramadan, a topic of ongoing debate among Muslim communities worldwide due to discrepancies in moon sighting (*ikhtilāf al-maṭāli'*), along with an examination of juristic perspectives on the use of artificial intelligence.

---

<sup>9</sup> Artificial intelligence (AI) is revolutionizing the organization of the Islamic lunar calendar, particularly in determining the crescent moon sightings that mark the beginning and end of Ramadan. By integrating with astronomical tracking systems, AI leverages data from satellites, observatories, and historical lunar models to enhance the precision of crescent visibility predictions.

Finally, the fourth section concludes the article by summarizing key findings and providing recommendations.

## LITERATURE REVIEW

Many Muslim scholars have examined lunar sightings from an Islamic Shariah perspective by analysing how varying moon sightings, whether global or local, affect the determination of lunar months. For example, Mohammad Mahmoud Twalaha's research addressed the impact of differing lunar sightings on the beginning and end of fasting, presenting a comparative jurisprudential study. He concluded the following opinions: First, they believe that differing lunar sightings should not be considered at all. Second, they believe that differing lunar sightings should be considered. Third, they offered a more nuanced view, arguing that differing lunar sightings should not be considered if the distance between the two countries is close but should be considered if the distance is far apart, although scholars differed in defining the criterion for the relevant distance. Based on this comparative jurisprudential study of the aforementioned opinions, the researcher concludes that differing lunar sightings are irrelevant in countries that share even a small portion of the night of the new moon sighting.<sup>10</sup>

Similarly, Ali Albayrak discussed the verification of the crescent and highlighted the dispute between moon sighting and astronomical calculation. Furthermore, he outlines the major challenge that lies in harmonising legal text that orders reliance on naked-eye sighting with the use of advanced astronomical instruments to determine the commencement of Ramadan.<sup>11</sup> Likewise, Jamila Nasser al-Qahtani examined the use of astronomical calculations in determining the beginning of lunar months, focusing on the permissibility of using astronomical calculations and observatories for sighting the new moon. She concluded that fasting is established by the sighting of the new moon according to Islamic law, not solely based on astronomical calculations. However, it is permissible to utilize accurate astronomical calculations alongside visual sighting when determining the beginning of the month. If the calculations indicate the possibility of sighting the new moon, but the moon is not actually observed due to obstructions such as clouds, visual sighting remains the decisive factor, and the month must be completed as thirty days, in accordance with authentic texts. Conversely,

---

<sup>10</sup> Mohammad Mahmoud Talafa, "Athar Ikhtilaf al-Matali' fi Bad Saum wa al-Iftar," *Majallat al-Sharī'ah wa Dirāsāt al-Islāmīyah*, vol. 22/71 (2007): 261-294.

<sup>11</sup> Albayrak, Ali, "Ithbāt al-Hilāl bayna al-Ru'yah bi al-'Ayn wa al-Ḥisāb al-Falakī," *Firat Üniversitesi İlahiyat Fakültesi Dergisi*, vol. 30/1 (2025): 137-149.

astronomical calculations must be considered in cases of negation: If they indicate the impossibility of sighting the new moon, any testimony claiming sighting is rejected, as one of the conditions for valid testimony is that it must not contradict established reality. Furthermore, the use of observatories, telescopes, and astronomical instruments is permissible, since sighting remains the primary method for determining the beginning of lunar months, and observing the new moon through these instruments constitutes a valid sighting, even if it is not visible to the naked eye.<sup>12</sup>

In contrast, Muna Salem Mohammed discussed the observation of the new moon within the context of the developments in astronomy and space sciences, presenting a jurisprudential study. She addressed the meaning of observation, the new moon, jurisprudence, and the meaning of astronomy and provided a brief historical overview of the origins and importance of astronomy. She then presented examples of scientists' contributions to the development and manufacture of astronomical instruments used for observing the new moon. Finally, she briefly discussed climatic changes and explained the criteria for sighting the new moon. She also examined differences in lunar sightings and their impact on unifying the beginnings of lunar months. In addition, she addressed the ruling on moon sighting by men and women and explained the ruling on using modern methods for sighting the new moon. She noted that the world today is experiencing rapid climate change, which may affect the possibility and confirmation of moon sightings through the methods prescribed by Islamic law. Accordingly, she explained the ruling on moon sighting based on astronomical calculations, as well as the sighting through telescopes, airplanes and Islamic satellites. She concluded that fasting is a purely devotional act, and visual sighting is a means of establishing its time. Visual sighting, in itself, is not a devotional act in its particularity, but rather a general means of establishing the beginning of the month. What is required for fasting is confirmation of the entry of the month of Ramadan; therefore, whether this is established through legally prescribed sighting or telescope-assisted sighting, the ruling remains the same. Astronomical calculation, however, is not permissible to rely upon independently unless it accords with actual sighting.<sup>13</sup>

---

<sup>12</sup> Jamīlah Nāṣir al-Qaḥṭānī, 'al-Isti'ānah bi al-Ḥisāb al-Falakī wa al-Marāṣid fī Ithbāt Ahlīlat al-Shuhūr: Dirāsah Shar'īyyah, vol. 35, no. 123 (2020) 277-316.

<sup>13</sup> Munā Sālīm Muḥammad, 'Raṣd al-Ahīllah fī Zīll Taṭawwūr 'Ilm al-Falak wa-l-Faḍā': Dirāsah Fiqhīyyah, 'Majallat al-Sharī'ah wa-l-Qānūn, vol. 42, no. 1 (2023) 639-731.

Others, like Frangky Suleman, examined in his research “*The Role of Modern Observation in Understanding the Beginning of the Hijri Month.*” He found that the ministry of religious affairs of the Republic of Indonesia conducted observations based on criteria established in 1970, which include a minimum new moon altitude of 2°, a lunar-solar elongation of at least 3°, and a minimum age of the moon of 8 hours after *ittima*. The finding indicates that under certain conditions, particularly due to light pollution, the new moon cannot be observed when its altitude is below 2°. This is because the crescent appears only as a very thin and faint line, making detection extremely difficult. Consequently, observations of the moon at an altitude of less than 2°. Therefore, scientific methods are essential for understanding both the theoretical framework and practical application of determining the beginning of the Hijri month.<sup>14</sup>

The existing body of literature on *ikhtilāf al-maṭāli*<sup>15</sup> demonstrates a well-established juristic debate grounded in classical legal theory and interpretive diversity. However, much of the scholarship remains repetitive in its treatment of evidentiary proofs and juristic positions, with limited critical engagement with contemporary applications and institutional challenges. This indicates a need for further analytical studies that move beyond descriptive exposition toward a more integrative framework capable

---

<sup>14</sup> Suleman, Frangky and Djamila Usup. “The Role of Modern Observation in Understanding the Beginning of the Hijri Month.” *Jurnal Ilmiah Al-Syir'ah*, 19(1), (2021): 106-121.

<sup>15</sup> The visibility of the crescent moon varies according to longitude, latitude and altitude. Consequently, no two regions share identical conditions crescent sighting, even within the same country. This geographical diversity gives rise to an important jurisprudential question: Is the sighting of the crescent moon in a single region sufficient to establish the beginning of an Islamic month for the entire world? It should be noted that reliance on a single sighting would require eastern regions to wait until very late-sometimes even until after dawn-to determine whether the crescent moon had been sighted in the far western part of the Muslim world. In this context, some argue that Saudi Arabia should be followed in determining the beginning of Ramadan of Islamic months on the basis of the principle of a single sighting. However, in practice, Saudi Arabia itself not adhere to this principle. A clear example of this can be seen in the determination of the beginning of Ramadan in 1420 AH (2009 CE). Yemen announced the sighting of the crescent moon on December 7, 1999 CE, thereby declaring December 8, 1999, as the first day of Ramadan. The official Yemeni announcement included the names and positions of those who testified to the sighting, including mosques imams. Nevertheless, Saudi Arabia did not accept Yemen’s confirmed sighting and instead began fasting on December 9, 1999. A similar situation in 1424 AH (2003 CE). Yemen, Jordan, Palestine, and Egypt all announced the sighting of the crescent moon on October 25, 2003, and accordingly began fasting on that day. Saudi Arabia, however, disregarded these official announcement and commenced fasting on October on 27/10/2003.

of reconciling juristic tradition with contemporary contexts. On the other hand, seminars and conferences were held to explore possible resolutions for lunar visibility. Among them was a conference held in Istanbul in 1398 AH, which focused on determining the beginnings of the lunar months. According to its recommendation, a unified Hijri Calendar Committee was formed, which would hold annual meetings to discuss the beginning of the lunar months, relying on astronomical calculations and organizing schedules. However, the agreement was not implemented after it was signed by the member countries. Furthermore, the Islamic Jurisprudence Academy Conference addressed the issue of unifying the beginnings of lunar months, discussing a range of research papers presented by scholars and researchers in two consecutive sessions in 1985 and 1986. During these conferences, some scholars argued for the necessity of relying on visual sighting, as this is what the Prophetic traditions explicitly state, and such issues are considered acts of worship with established texts, thus precluding independent reasoning. At the same time, others argued that there was no objection to relying on astronomical calculations, given the advancements in astronomy and the absence of explicit texts prohibiting it.<sup>16</sup>

Islamic countries have made significant contributions to the issuance of fatwas, and Egypt is a prime example. The Egyptian Fatwa House issued several rulings regarding the determination of the lunar months. It affirmed that definitive astronomical calculations do not contradict a valid sighting of the new moon; rather, they function as a guiding reference alongside an authentic visual sighting. Such calculations may negate a claimed sighting but cannot independently confirm one. If astronomical data negate the possibility of the moon's appearance, no consideration is given to any claim sighting; however, if they do not negate it, reliance is placed on the visual sighting. The Fatwa house also clarified that the month of Ramadan is either twenty-nine or thirty days and that the people of each region are required to follow the imam in determining the sighting of the new moon, provided that astronomical calculations indicate the possibility of sighting. The methodology of the Egyptian Fatwa House is based on conducting lunar observations for all months in order to ensure the most accurate determination of the beginnings of the three months of particular importance in Muslim worship. The process is carried out by joint scientific and religious committees that include both religious scholars and astronomy specialists,

---

<sup>16</sup> Mājīd Abū Rakhiyyah, "Ithbāt al-Ahillah," *Majallat al-Sharī'ah wa al-Dirāsāt al-Islāmiyyah*, vol. 6, no. 13 (1989): 376.

and it relies on a combination of visual sighting and precise astronomical calculations.<sup>17</sup>

Based on precedent, to determine the beginning of a new month, we first perform the astronomical calculations for the crescent moon on the twenty-ninth day of the current Hijri month and determine the time of the moon conjunction (*al-mahāq* or the birth of the moon). If the moon sets before sunset on that day, it is definitively concluded that the crescent cannot be sighted after sunset. Consequently, the following day will complete the Hijri month, and the new Hijri month will begin on the day after that. However, if the conjunction occurs before sunset and the moon sets after sunset, then we refer to one of the established crescent-sighting criteria, such as that of the South African Astronomical Observatory. In this case, we calculate the altitude difference between the sun and the moon at sunset, as well as the height of the moon above the horizon at the moment. For example, if the altitude difference between the sun and the moon is 10 degrees and the moon's height above the horizon is 4 degrees, the minimum height required for crescent visibility is 4.9 degrees. Since the crescent's height in this example is only four degrees, it is concluded that sighting the crescent is not possible on that day. However, if the crescent's height were nine degrees, for instance, it would be expected to be visible, and the following day would be the first day of the new Hijri month. As for determining the times of sunset and moonset, as well as the altitudes of the sun and the moon and the moon's height above the horizon, these values can be obtained using astronomical computer programs, which may be accessed by consulting local astronomical authorities.<sup>18</sup>

Astronomical calculations are now capable of determining the visibility of the crescent moon for hundreds or even thousands of years into the future or in the past.<sup>19</sup> It is now possible to know when the crescent moon will be visible, for example, after 100 years in a specific region.<sup>20</sup> There are

---

<sup>17</sup> Shawqī Ibrāhīm 'Allām, *al-Qawā'id wa-l-Ijrā'āt al-Muttaba'a li-Ru'yat al-Hilāl fī Miṣr*, Accessed from <https://www.dar-alifta.org/ar/fatwa/details/12825> -القواعد-والإجراءات-المتبعة-لرؤية-الحلال-في-مصر.

<sup>18</sup> International Astronomical Centre, accessed from <https://astronomycenter.net/accut.html>.

<sup>19</sup> For example, on the day of the eclipse on September 2025, astronomical calculations indicated that the eclipse would begin from Sun, 7 Sep 2025, 18:28 and Sun, 7 Sep 2025, 23:55 and end at 4:01:21 PM. The timing of the eclipse's beginning and end was then verified, and both occurred at the exact second predicted by the astronomical calculations. In fact, several citizens witnessed the timing of the eclipse's end. This demonstrates the extreme accuracy of astronomical calculations.

<sup>20</sup> International Astronomical Centre, accessed from <https://astronomycenter.net/accut.html>.

many criteria used to calculate the visibility of the crescent moon, such as the Yallop criterion,<sup>21</sup> and Danjon's Limit,<sup>22</sup> among others. These astronomical models help predict the conditions for sighting the crescent moon and are essential for determining the beginning of the lunar months in Islam, especially whether the crescent moon will be visible on the night of observation (the 29th night of the Islamic month). In this context, recent research has explored the application of artificial intelligence in Islamic astronomy. A study entitled “*The utilization of artificial intelligence in determining the beginning of the Islamic calendar in Indonesia.*”<sup>23</sup> According to its findings, the researcher concluded that AI cannot be used as the primary instrument for determining the beginning of the Hijri month. Rather, AI serves only as a complementary tool for processing new moon images, while astronomical data must be provided independently.

## METHODOLOGY

This research employs a fiqh-based analysis to examine the ongoing challenges related to lunar timings in determining the beginning and end of Ramadan. It aims to identify the legal foundations and differing interpretations among major Islamic schools of thought, while also investigating how artificial intelligence (AI) might help to resolve these issues. Using a comparative methodology, the research analyses the approaches of four Sunni scholars toward moon sighting, including the criteria for accepting testimony and the extent to which astronomical

---

<sup>21</sup> These criteria are among the most reliable, as they integrate multiple factors to assess crescent moon visibility. The primary factors include: the age of the crescent moon, its duration above the horizon after sunset, its altitude above the horizon, and its elongation angle. According to Odeh, crescent visibility can be classified as follows: (i) Impossible: Not visible. (ii) Visible only with a telescope. (iii) Visible with a telescope first, and then with the naked eye. (iv) Easily visible to the naked eye. These classifications are grounded in an extensive archive of historical observations, which have established the minimum possible values for each factor—for instant the youngest crescent moon ever observed with the naked eye was 15 hours and 33 minutes old.

<sup>22</sup> The French astronomer André d'Angon proposed a principle stating that the crescent moon cannot be seen with the naked eye if its elongation angle—the angular distance between the sun and the moon—is less than approximately 7 or 8 degrees, even if the crescent is visible through a telescope. This threshold is widely accepted near-universal standard, underscoring the difficulty of observing the crescent when it is very close to the sun.

<sup>23</sup> Rofuiddin, Ahmad Adib, and Moelki Fahmi Ardliansyah, “The Utilization of Artificial Intelligence in Determining the Beginning of Islamic Calendar in Indonesia,” *Al-Marshad: Jurnal Astronomi Islam dan Ilmu-Ilmu Berkaitan*, 10, no. 2 (2024): 82-94.

calculations may be relied upon. The study is primarily library-based and grounded in a close textual reading of foundational fiqh works alongside relevant Qur’anic verses and prophetic traditions related to fasting and lunar observation. To connect classical jurisprudence with present-day realities, the research also reviews contemporary fatawa, resolutions of international fiqh councils, and scholarly discussions that address the challenges faced by Muslims in a globalized and technologically advanced world. Particular attention is given to practical differences between Muslim-majority countries and Muslim minority communities in the West, especially where the variations in Ramadan observance occur across national boundaries.

Beyond legal analysis, the study evaluates developments in astronomy and AI, focusing on how machine learning and predictive technologies enhance lunar visibility calculations. While the research does not design new AI systems, it critically assesses existing technologies and examines whether their outputs align with recognized Islamic legal standards. AI-generated findings were not accepted uncritically; rather, all data were verified against primary juristic sources, established astronomical tables, and contemporary legal opinions. The evaluation was further guided by key jurisprudential principles, such as the authority of recognized custom (*al-‘urf mu‘tabar*) the priority of clear textual evidence (*al-dalil al-sābiq*), and the requirement that valid *ijtihad* reflect sound scholarly reasoning rather than mere algorithmic approximation. To ensure Shariah compliance, qualified jurists reviewed AI-filtered materials before they were incorporated into analysis.

## FINDINGS AND DISCUSSION

The Islamic legal tradition prescribes three primary methods for confirming the commencement of Ramadan: (i) Sighting the crescent moon: according to the majority of scholars, the sighting of the Ramadan crescent moon can be established by the testimony of a single upright witness. This ruling prioritizes caution in worship, as fasting an extra day in Sha’ban is less severe than missing a day of obligatory fasting in Ramadan. This method is supported by several hadiths, including the narration from Ibn ‘Umar RA, who reported:

عَنْ ابْنِ عُمَرَ قَالَ: تَرَاءَى النَّاسُ الْهَلَالَ فَأَخْبَرَتْ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ إِنِّي رَأَيْتُهُ  
فَصَامَ وَأَمَرَ النَّاسَ بِصِيَامِهِ.

*“The people attempted to sight the crescent, and I informed the Messenger of Allah SAW that I had seen it. Consequently, he fasted and commanded the people to observe the fast.”<sup>24</sup>*

Another hadith states:

جَاءَ أُعْرَابِيٌّ إِلَى النَّبِيِّ ﷺ فَقَالَ أَبْصَرْتُ الْهِلَالَ اللَّيْلَةَ . فَقَالَ: " أَنْشَهُدُ أَنْ لَا إِلَهَ إِلَّا اللَّهُ وَأَنَّ مُحَمَّدًا رَسُولُ اللَّهِ " . قَالَ نَعَمْ . قَالَ: "فَمَ يَا بِلَالُ فَأَذِّنْ فِي النَّاسِ أَنْ يَصُومُوا عَدَا" .  
*“A Bedouin came to the Prophet SAW and said, ‘I have sighted the new moon (of Ramadan).’ The Prophet SAW asked, ‘Do you testify that there is no god but Allah and that Muhammad is His Messenger?’ The man affirmed, and the Prophet SAW instructed Bilal RA, ‘Announce to the people that they should fast tomorrow.’”<sup>25</sup>*

Muslims are required to look for the crescent moon on the 29th of Sha'ban after sunset. Since fulfilling this obligation is necessary for determining Ramadan, the effort to sight the moon is considered a collective obligation (*fard kifāyah*).<sup>26</sup> (ii) Completing thirty days of Sha'ban if the crescent is not sighted. If the crescent moon is not sighted on the 29th of Sha'ban due to clear or cloudy conditions, Muslims must complete thirty days of Sha'ban before commencing Ramadan. The Prophet SAW said:

صُومُوا لِرُؤْيَيْهِ وَأَفْطِرُوا لِرُؤْيَيْهِ فَإِنْ غَمَّ عَلَيْكُمْ فَأَكْمِلُوا عِدَّةَ شَعْبَانَ ثَلَاثِينَ .  
*“Fast when you see the crescent and break your fast when you see it. If the sky is overcast, then complete thirty days of Sha'ban.”<sup>27</sup>*

Since Islamic months alternate between 29 and 30 days, and Ramadan cannot be less than 29 or more than 30 days, it is essential to accurately

<sup>24</sup> ‘Abd Allāh ibn ‘Abd al-Raḥmān al-Dārimī, *Sunan al-Dārimī*, vol. 2 (1st ed., Saudi: Dār al-Mughnī, 2000), ḥadīth no. 1733, 1052.

<sup>25</sup> Muḥammad ibn Yazīd al-Qazwīnī, *Sunan Ibn Mājah* (1st ed., Lebanon: Dār al-Risālah al-‘Ālamīyah, 2009), ḥadīth no. 1652, 565.

<sup>26</sup> Jamīlah Nāṣir al-Qaḥṭānī, “al-Isti‘ānah bi al-Ḥisāb al-Falakī wa al-Marāṣid fī Ithbāt Ahillat al-Shuhūr,” *Majallat al-Sharī‘ah wa Dirāsāt al-Islāmīyah*, vol. 123, no. 35 (2020):10.

<sup>27</sup> Muḥammad ibn Khaṭīb al-Tibrīzī, *Mishkāt al-Maṣābīh*, vol. 1 (3rd ed., Bayrūt: Maktab al-Islāmī, 1985), ḥadīth no. 1970, 615.

determine the beginning of Sha'ban to properly observe its 30th night for moon sighting. (iii) Estimating the crescent moon in cloudy conditions. In cases where the sky is overcast, the Prophet SAW instructed:

قَالَ عَمَّ عَلَيْكُمْ فَأَقْدِرُوا لَهُ

“If the sky is cloudy, then estimate it (*faqdurū lahu*).”<sup>28</sup>

Scholars have differed in interpreting this estimation (*taqdīr*), with three main opinions: (a) Majority view: The phrase means completing thirty days of Sha'ban, as this is the default method in uncertainty.<sup>29</sup> (b) Imam Ahmad's opinion: The estimation refers to making an effort to sight the moon despite obscurity, implying confinement under cloud cover.<sup>30</sup> (c) Imam Shafi'i's opinion: The estimation should be based on astronomical calculations (*hisāb al-manāzil*) to determine the moon's position.<sup>31</sup> This difference in interpretation reflects the juristic diversity in applying textual directives to practical scenarios.

The research problem is the start and end dates of Ramadan have been a persistent source of debate among Muslim communities globally because of inconsistencies in moon sighting (*ikhtilāf al-maṭāli*). These disagreements have led to differences in fasting schedules, even between nearby areas and nations. The root of the problem stems from varying juristic (*fiqhī*) opinions on moon sighting standards, including whether to recognize worldwide sightings or only local ones.<sup>32</sup> Another root of the problem is

<sup>28</sup> ‘Abd al-Ḥaqq ‘Abd al-Raḥmān al-Ishbīlī, *al-Jam‘ bayna al-Ṣaḥīḥayn*, vol. 2 (1st ed., Riyāḍ: Dār al-Muḥaqqiq, 1999), ḥadīth no. 1640, 124.

<sup>29</sup> Ibn Ḥajar al-‘Asqalānī, *Fath al-Bārī Sharḥ Ṣaḥīḥ al-Bukhārī*, vol. 6 (1st ed., Egypt: Maṭba‘at al-Khayrīyah, 1329), 23.

<sup>30</sup> Mansūr al-Bahūtī, *Sharḥ al-Muntahā al-Irādāt*, vol. 3 (1st ed., Saudi: Dār ‘Ālam al-Kutub, 1996), 302.

<sup>31</sup> ‘Abd Allāh al-Qurṭubī, *al-Jāmi‘ li-Aḥkām al-Qur‘ān*, vol. 2 (1st ed., Lebanon: Dār al-Kitāb al-‘Arabī, 1422), 293.

<sup>32</sup> Scientific conferences and seminars on the sighting of the crescent of Ramadan crescent and the unification of the Hijri calendar continued over successive decades in the context of scientists' efforts to address the problem of the different beginnings of the lunar months. In 1978, Istanbul witnessed the National Unification Conference held, as one of the first international conference to bring together jurists and astronomers. This was followed by a symposium on the crescent moon and the Hijri calendar in Kuwait in 1989 AD, which focused on clarifying the relationship between Shariah-compliant sighting and astronomical calculation. In 1991 AD, the World Hijri Calendar Conference was held in Kuala Lumpur, where the idea of a unified calendar was presented in a more structured manner. As the scientific debate developed, a symposium on validating crescent sightings in the context of Sharia and astronomy was held in Rabat in 2008 AD to address the

political influence by Muslim majority states such as Saudi Arabia, Türkiye, and Oman, among others. When state authority aligns interest with religious determinations, it can affect the consistency of Ramadan commencement across the Muslim world. Additionally, disagreement among Islamic institutions undermines the ideal of communal unity (*wahdah al-ummah*). These disagreements arise from variations in jurisprudential interpretation, methodological inconsistencies, and differing epistemological commitments regarding science and testimony.<sup>33</sup>

In relation to this contention, Muslim jurists hold three differing opinions. First, the majority view.<sup>34</sup> The majority of Muslim jurists maintain that differences in moon sightings are irrelevant. They argue that if the crescent moon is sighted in any Islamic country, fasting becomes obligatory for all Muslim-majority regions. This position is supported by the Qur'anic verse: "Whoever among you witnesses the month, let him fast."<sup>35</sup> According to these scholars, the verse establishes that fasting is obligatory once the month is confirmed, regardless of geographical variations in sighting. Imam al-Jaṣṣāṣ explains that the verse mandates fasting for all Muslims upon the moon's confirmation from any location, as the ruling is tied to the general affirmation of the month, not its sighting in a specific place.<sup>36</sup>

Additionally, they cite the following hadith as evidence: "Fast when you see it (the crescent), and break your fast when you see it. If the weather

---

practical problems arising from differences in sighting. This was followed by the International Hijri calendar conference in Mecca in 2012 AD, sponsored by Islamic scientific institutions, to emphasize the importance of collective ijtihad. These efforts culminated when the International Conference for the Unification of the Hijri Calendar was held in Istanbul in 2016 AD, representing a turning point in advocating the adoption of disciplined astronomical standards within the framework of Sharia guidelines. In addition to these conferences, jurisprudence councils have discussed the issue of crescent sighting over successive sessions since the late twentieth century, reflecting a continuing scientific interest in this issue that has a directly impacting Muslim unity.

<sup>33</sup> Personal interview with Sheikh Abdulatif Ibrahim Abdallah, Shariah scholar, Mombasa, Kenya.

<sup>34</sup> This is what the Hanafi jurists said in the apparent view of their school, and it is the well-known view among the Malikis. Ibn Abd al-Barr, in his book *al-Istidhkār*, attributed this opinion to Imam Malik, as narrated by Ibn al-Qasim and the Egyptians. Ibn Abd al-Barr also reported that this is the opinion of al-Layth, an opinion in the school of Imam al-Shafi'i, the view of the Kufans and of Ahmad and of school of the position of the Hanbalis.

<sup>35</sup> Surah al-Baqarah, 2:185.

<sup>36</sup> Ahmad ibn 'Alī Abū Bakr al-Rāzī al-Jaṣṣāṣ, *Aḥkām al-Qur'ān*, vol. 1 (1st ed., Beirut: Dār al-Kutub al-'Ilmiyyah, 1994), 224.

is cloudy, complete thirty days of Sha'ban.”<sup>37</sup> The command to fast is universal and contingent upon the moon's sighting. Once a reliable group witnesses it, the obligation applies to all Muslims, rendering regional differences in sightings insignificant. Furthermore, scholars bolster this opinion through *ijmā'* (consensus). Ibn Qudāmah states in *al-Mughnī*: “Muslims unanimously agree on the obligation of fasting Ramadan. If trustworthy witnesses confirm the sighting, that day becomes part of Ramadan, and fasting becomes obligatory for all Muslims.”<sup>38</sup> Thus, according to this view, a verified sighting in any region obligates fasting for the entire Muslim world.

Second, the regional sighting opinion.<sup>39</sup> Differences in the moon's visibility (due to geographical and astronomical variations) are taken into account, meaning the obligation to fast is tied to local sighting. According to this view, held by the Shafi'i, Hanafi, and some Maliki schools, as well as attributed to Ibn 'Abbās by Ibn 'Abd al-Barr, people are only obliged to fast if the crescent moon is sighted within their own region. This position is supported by several Qur'anic evidences. Allah SWT says, “Whoever among you witnesses the month, let him fast.”<sup>40</sup> The term “witnesses” (شَهِدَ) implies direct observation. Thus, fasting is obligatory only for those who actually see the crescent, not for others. The verse conditions the obligation on personal or communal sighting, making it specific rather than universal. In addition, the Prophet SAW said, “Do not fast until you see the crescent, and do not break your fast until you see it. But if the sky is overcast, then estimate it (by completing thirty days).”<sup>41</sup> This hadith explicitly links fasting to visual confirmation, reinforcing that the obligation applies only where the moon is sighted.

Furthermore, Kurayb reported that while in Syria, he and the people there sighted the Ramadan crescent on Friday night. Later, upon returning to Medina, Ibn 'Abbas RA questioned him about the sighting. When Kurayb confirmed it, Ibn 'Abbas replied, “But we saw it on Saturday night, so we will continue fasting until we complete thirty days or sight the moon.” When Kurayb asked if Mu'awiyah's sighting was not sufficient for them, Ibn

---

<sup>37</sup> Muḥammad ibn Khaṭīb al-Tibrīzī, 615.

<sup>38</sup> Muwaffaq al-Dīn Ibn Qudāmah, *al-Mughnī*, vol. 4 (1st ed., Egypt: Dār Hajr, 1992), 328.

<sup>39</sup> This opinion was attributed by Abd al-Barr to Ibn Abbas and also to the Malikis. Al-Mawardi narrated it as a view of the Shafi'is, and al-Zayla'i selected it from the Hanafis.

<sup>40</sup> Surah al-Baqarah: 185.

<sup>41</sup> Yūsuf ibn 'Abd Allāh ibn 'Abd al-Barr, *al-Istidhkār*, vol. 3 (1st ed., Beirut: Dār al-Kutub al-'Ilmiyyah, 2000), ḥadīth no. 591, 275.

‘Abbas responded, “No, this is how the Messenger of Allah SAW commanded us.”<sup>42</sup> This incident demonstrates that early scholars upheld regional sighting as a determining factor. Finally, they used analogical reasoning (*qiyās*). Just as prayer times vary based on a location’s sunrise and sunset (a matter established by scholarly consensus), fasting must also follow the same principle. Since each region has distinct timings for Fajr, Dhuhr, and other prayers due to differences in the sun’s position, the same logic applies to moon sightings. Thus, each country should determine its own fasting based on local crescent visibility.<sup>43</sup>

Third, if two countries are geographically close and their moon sightings do not differ, then the ruling for both is the same as that for a single country.<sup>44</sup> In such a case, if the crescent moon is sighted in one country, the people of the other are also obligated to fast. However, if the distance between the two countries is significant, the people of the second country are not bound by the sighting of the first. This opinion is upheld in the Shafi’i school of thought.<sup>45</sup> Proponents of this view, however, differed on the criteria for determining proximity and distance. Their disagreements revolved around several factors, including the moon's rising point, regional considerations, the distance for shortening prayers (*qasr*), the moon's disappearance without a shadow, and differences in elevation and declination between the two locations.<sup>46</sup>

After reviewing the opinions of Islamic jurists, the researcher concludes that differences in moonrise timings should not be considered when determining the start of fasting, even between distant countries, as long as the regions share part of the night during which the moon is sighted. For instance, in eastern countries where nightfall occurs earlier than in western regions, the variation in moonrise times is inevitable. This aligns with the principle, “*Applying a combination of two verses is better than neglect.*”<sup>47</sup>

---

<sup>42</sup> al-Ḥusayn ibn Mas‘ūd al-Farrā’ al-Baghawī, *Sharḥ al-Sunnah*, vol. 6 (2nd ed., Beirut: al-Maktab al-Islāmī, 1983), ḥadīth no. 1724, 245.

<sup>43</sup> ‘Uthmān ibn ‘Alī al-Barrā’ī, *Tabyīn al-Ḥaqā’iq Sharḥ Kanz al-Daqā’iq*, vol. 1(1st ed., Egypt: al-Maṭba‘ah al-Kubrā al-Amīriyyah, Būlāq, 1313 AH), 316.

<sup>44</sup> This opinion is supported by Shafi and the Zaidis, see *al-Majmū’ Sharḥ al-Muhadhdhab*.

<sup>45</sup> Yahyā ibn Sharaf al-Nawawī, *al-Majmū’ Sharḥ al-Muhadhdhab*, vol. 6 (1st ed., Beirut: Dār al-Fikr, 1996), 280.

<sup>46</sup> Mohammad Mahmoud Talafa, ‘*Athar Ikhtilaf al-Matali’ fi Bad Saum wa al-Iftar,*’ *Majallat al-Sharī‘ah wa Dirāsāt al-Islāmīyah*, vol. 22, no. 71 (2007): 271.

<sup>47</sup> Muḥammad Muṣṭafā al-Zuḥaylī, *al-Qawā’id al-Fiqhiyyah wa Taṭbīqātuhā fi Madhāhib al-Arba‘ah*, vol. 1 (1st ed., Damascus: Dār al-Fikr, 2006), 365.

This view is further supported by the following rulings: (i) The Third Conference of the Islamic Research Academy (Cairo, Jumada al-Akhirah 1386 AH, Section B) states:

*"Differences in moon sightings should not be taken into account, regardless of geographical distance, as long as the regions share any portion of the sighting night, even if brief. Variation in sightings is only considered between regions that do not share any part of this night."*<sup>48</sup>

Another conference in Makkah (1406 AH) initially ruled that global moon sighting unification was unnecessary and that the decision should be left to local muftis or chief qadis.<sup>49</sup> However, the Fiqh Council later revisited this issue and revised its stance, declaring:

*"If the moon is sighted in any country, fasting becomes obligatory for all Muslims, irrespective of geographical differences in moon visibility (ikhtilāf al-maṭāli'). This ruling ensures adherence to the Qur'anic injunction."*<sup>50</sup>

The naked-eye sighting of the crescent moon for the commencement of Ramadan is no longer fully compatible with the modern era, given rapid technological development and significant advances in astronomy. Precise astronomical calculations have become highly reliable in determining the possibility or impossibility of sighting the crescent, whereas naked-eye observation remains vulnerable to weather conditions and practical difficulties. This discrepancy has created a gap between what is scientifically established knowledge and visual practice, prompting calls for the unification of lunar months through astronomy and satellite-based methods in order to address these challenges and promote unity within the Islamic nation.

---

<sup>48</sup> Muḥammad 'Uqlah, *Aḥkām al-Ṣiyām wa al-I'tikāf* (1st ed., 'Ammān: Maktabat al-Risālah al-Ḥadīthah, 1982), 48.

<sup>49</sup> Mohammad Mahmoud Talafa, 288.

<sup>50</sup> Majid Abu Rakhia, "Shari'a Rules and Regulations Concerning the Differences in Sighting the Moon," *UAEU Law Journal*, Article 4, no. 6 (1992), 266.

Modern technologies have emerged recently due to technological advancements, including astronomical observatories.<sup>51</sup> These observatories are sophisticated instruments used to observe the new moon, operated by expert astronomers. Their primary function is to observe the new moon, determine its position and altitude above the horizon, and its distance from the sun at sunset. An astronomical observatory can also determine the exact time of moonrise and moonset using a telescope, microscope, or artificial intelligence (AI).<sup>52</sup>

---

<sup>51</sup> Astronomy is the science that studies cosmic phenomena, the states of celestial bodies, and their relationships to one another. Astronomical calculations, as defined by modern astronomy, are the results used to determine the beginning of the lunar month. Ancient civilizations were able to calculate and record astronomical tables based on mathematics, drawing on their knowledge of the movements of the sun, moon, and planets. The oldest astronomical records date back to the reign of King Ammasiduqa, one of the kings of the First Babylonian Dynasty. However, the Arabs in the Arabian Peninsula had little knowledge of these astronomical sciences, or of the movements of the planets and stars. As a result, Arab astronomical heritage became mixed and unsystematic. Consequently, astronomy during the time of the Prophet Muhammad PBUH was not governed by organized scientific theories but rather consisted of a mixture of superstitions, astrology, and divination, an extension of the pre-Islamic knowledge. Undoubtedly, these astronomical conditions during the Prophet's time constitute one of the most important justifications for his reliance on visual observation in the textual sources and his rejection of mathematical calculations as a means of determining the beginning of the lunar month, in order to alleviate any hardship for the Muslim community. The lack of astronomical knowledge among Muslims persisted until the third century AH, which is considered the golden age of Islamic astronomy. During this period, foundational astronomical and mathematical works, such as those by Ptolemy and Euclid, were translated. Astronomy subsequently advanced, astronomical tables were compiled, and Muslim astronomers like al-Sufi, al-Battani, al-Biruni, al-Tusi, Ibn al-Shatir, and others excelled, developing new theories that paved the way for modern astronomical thought. Astronomical progress continued into the second half of the twentieth century, with the launch of satellites, spacecraft, and advanced computer systems. These developments enabled the study of the universe and its diverse phenomena through various methods, including visible light, infrared, ultraviolet, and gamma rays. Ultimately, astronomers became able to determine planetary orbits and positions with great accuracy, calculate the moon's position over extended periods, determine the beginning of months, and identify the precise moment of the new moon with near certainty-down to the hour, minute, and second. Astronomical tables are published by international astronomical institutions to provide these values and times decades in advance, including the British, American, and German tables, among others. See Jamīlah Nāṣir al-Qaḥṭānī, "al-Isti'ānah bi al-Ḥisāb al-Falakī wa al-Marāṣid fī Ithbāt Ahillati al-Shuhūr," *Journal of Shariah and Islamic Studies-Kuwait*, 123 (2020) 286-287.

<sup>52</sup> For the first time globally in 2025, the UAE has employed drones equipped with artificial intelligence (AI) to observe the Ramadan crescent moon. Traditionally, the start of Ramadan is determined by the visual sighting of the crescent. To enhance accuracy and

The study also highlights practical applications of AI in crescent observation, including the use of drones equipped with advanced imaging systems and algorithms capable of analysing astronomical data<sup>53</sup> and weather conditions. Such tools can enhance accuracy beyond the limits of unaided human sight and reduce errors associated with traditional observation methods. By integrating satellite data, observatory records, and historical sighting patterns, we are looking at models for future Ramadan determinations. As these systems continuously learn from accumulated data, their predictive reliability improves over time. Ultimately, the research considers whether AI, as an objective and scientifically grounded tool, can help narrow practical differences in Ramadan commencement without undermining established juristic frameworks. By bringing together classical legal scholarship and modern technological innovation, the study aims to contribute to ongoing discussion on unity, authenticity, and responsible adaptation within contemporary Islamic legal discourse.<sup>54</sup>

The permissibility of using astronomical calculations for determining the beginning and end of Ramadan has been the subject of discussion among Islamic scholars for decades. Some scholars maintain that astronomical calculations are not a legally valid method for establishing the start or end of Ramadan. This view is held by the majority of both early and later scholars.<sup>55</sup> Accordingly, the beginning of the month is established only by sighting of the new moon or by completing thirty days. They base their position on the Prophet's saying, "Fast when you see it (the new moon) and break your fast

---

minimize human error, the UAE has introduced AI-driven drones equipped with advanced imaging technology and intelligent algorithms. These innovations enable more precise sky analysis, ensuring a more reliable determination of Ramadan's commencement. In addition, Conventional moon sighting, which relies on visual observation, is often influenced by weather, human error, and regional differences, leading to disputes among Muslim communities over Ramadan's exact dates.

<sup>53</sup> The data included several parameters, such as the moon's age, time since conjunction, altitude difference between the sun and moon, illumination angle, atmospheric conditions, and geographic coordinates. After filtering out incomplete or inconsistent values and converting qualitative factors, such as clear or cloudy skies, into numerical values understandable by algorithms, the data was processed.

<sup>54</sup> Rafi, Barazi, *Kaifa Yusahim al-Dhaka' al-Istina'i fi Tabsit Ruy'at Hilal Shahri Ramadan?* Accessed from <https://bawabaai.com/> كيف - يساهم - الذكاء الاصطناعي - في - تبسيط - رؤى .

<sup>55</sup> This opinion is adopted by majority of Muslim jurists from Hanafi, Malik, Shafi'i and Hanbali schools, as well as by some contemporary muslim jurists such as Mohammad Ibrahim, Salih al-Luhaydan, among others.

when you see it,"<sup>56</sup> and his saying, "Do not fast until you see the crescent."<sup>57</sup> However, accurate and correct astronomical calculations do not contradict a legally valid and sound moon sighting that is not opposed by any reliable evidence; rather, such calculations may serve as corroborative evidence. Furthermore, the estimation referred to in the Prophet's statement, "Then estimate it," may be understood to include astronomical calculations for those who are skilled in them. In many cases, these calculations are more precise than visual sighting, which can be affected by factors such as weak eyesight or atmospheric conditions like dust or fog that do not influence astronomical calculations grounded in sound scientific principles.

Based on precedent, the Council of Senior Scholars in Saudi Arabia has addressed this issue for over thirty-five years, forming a specialized committee in 1403 AH under the leadership of Sheikh Abdul Razzaq Afifi, along with other experts. After careful deliberation, the council concluded that it is permissible to use advanced astronomical tools, including large observatories, telescopes, and binoculars, to determine the crescent moon's position and confirm the beginning and end of Ramadan.<sup>58</sup> The council's rulings include the following key points: (i) Establishing observatories to aid in moon sighting is Islamically valid. (ii) If the crescent is sighted with the naked eye, this observation must be upheld, as commanded in the Qur'an: "Whoever among you witnesses the month, let him fast"<sup>59</sup> This aligns with the Prophet's instruction: "Do not fast till you see the new moon, and do not break your fast till you see it; but if the weather is cloudy, calculate when it should appear"<sup>60</sup> (iii) A sighting confirmed through an observatory holds weight, as verified evidence takes precedence over unverified claims. On the other hand, the Permanent Committee for Scholarly Research and Ifta' has further affirmed this stance, stating:

*"It is permissible to use observatories for moon sighting, but reliance on purely astronomical calculations (without visual*

---

<sup>56</sup> Muḥammad ibn Khaṭīb al-Tibrīzī, *Mishkāt al-Maṣābīh*, vol. 1 (3rd ed., Bayrūt: Maktab al-Islāmī, 1985), ḥadīth no. 1970, 615.

<sup>57</sup> Muḥammad Fu'ād 'Abd al-Bāqī, *al-Lu'lu' wa al-Marjān fīmā Ittafaqa 'alayhi al-Shaykhān*, vol. 2 (1<sup>st</sup> ed., Cairo: Dar al-Hadīth, 1986), 3.

<sup>58</sup> Jamīlah Nāṣir al-Qaḥṭānī, 302.

<sup>59</sup> Surah al-Baqarah, 2:185.

<sup>60</sup> Malik, ḥadīth no. 1001, 407.

*confirmation) to establish Ramadan's start or end is not permissible.*"<sup>61</sup>

Sheikh Ibn Baz reinforced this distinction, clarifying that while astronomical calculations alone cannot determine the crescent, the use of observatories for visual confirmation remains acceptable.<sup>62</sup> The use of AI and drones builds upon the Islamic principle of crescent observation, as emphasized in the Hadith of the Prophet Muhammad SAW: "Do not fast until you see the crescent, and do not break your fast until you see it. If it is obscured from you, then estimate it."<sup>63</sup> The Prophet Muhammad SAW relied on naked-eye sighting when no other means were available. However, had a more accurate method existed, it would have been permissible to rely upon it for precise, definitive calculations, especially with the advancements in modern science, which offer greater reliability and accuracy in determining the crescent moon's visibility. In this regard, al-Qaylubi, a Shafī scholar, stated, "If conclusive astronomical calculations confirm that the crescent moon could not have been sighted, the testimony of even trustworthy witnesses is disregarded, their claim is rejected, and fasting is impermissible in such a case. To oppose this is mere obstinacy and stubbornness."<sup>64</sup>

In addition, Ahmad Shakir addressed the Prophet's SAW statement, "We are an illiterate people; we neither write nor calculate," by stating, "The early scholars were correct in their interpretation of the hadith but mistaken in their explanation. Their understanding that the ruling depends on sighting rather than calculations is sound. However, their assumption that even if someone proficient in calculations were present, fasting would still be determined solely by sighting is incorrect. This is because the command to rely on sighting was tied to a specific reason, one contingent upon the actual visibility or non-visibility of the crescent. Thus, if the nation moves beyond illiteracy, it becomes obligatory to rely on definitive astronomical certainty and adopt calculations as proof of the crescent's presence."<sup>65</sup>

---

<sup>61</sup> The Permanent Committee for Scholarly Research and Ifta', 9/99 (Riyadh: al-Ri'asa al-Ama Lidarat al-Buhuth), 1411.

<sup>62</sup> 'Abdul'Azīz ibn 'Abd al-Rahmān ibn Bāz, *Majmū' Fatāwā*, vol. 30 (Saudi Arabia: Ri'āsah Idārat al-Buḥūth al-'Ilmiyyah wa al-Iftā', n.d), 283.

<sup>63</sup> Abubakar Abdulrazak al-San'ani, *al-Musannaḥ*, vol. 4 (2nd ed., India: Al-Majlis Al-'Ilmi, 1403 AH), ḥadīth no. 7307, 156.

<sup>64</sup> Shihābuddīn al-Qalyūbī. *Hāshiyat al-Qalyūbī*, vol. 2 (1st ed., Lebanon: Dār al-Fikr, n.d.), 49.

<sup>65</sup> Aḥmad Shākīr, *Awā'il al-Ashhur al-'Arabiyyah: Hal Yajūz Shar'an Ithbātuhā bi'l-Ḥisāb al-Falakī?*, 1st ed. (Yemen: Maktabat Ibn Taymiyyah, 1407 AH), 17.

Finally, AI has become a significant tool for enhancing crescent moon observation, improving both accuracy and efficiency while increasing the reliability of determining the start of lunar months. It plays a crucial role in several areas. In data analysis, machine learning algorithms, like random forests, analyze large sets of astronomical and atmospheric data and outperform traditional methods in forecasting crescent moon visibility, achieving accuracy rates of up to 93%. In image processing, computer vision techniques help filter out light noise and enhance image contrast, enabling clearer detection of the crescent moon even under challenging lighting conditions or light cloud cover. In the United Arab Emirates, drones equipped with AI technology are deployed for crescent moon observation, expanding observational capabilities and generating highly accurate data. AI also enhances efficiency and precision by addressing weather-related challenges, reducing human errors, and improving the coordination of religious observances, thereby minimizing confusion regarding the start of lunar months. Importantly, artificial intelligence does not replace authentic lunar sightings made with the naked eye or through telescopes; instead, it complements these methods by providing precise predictions and identifying optimal locations for observation, thereby reinforcing traditional sighting practices.

## CONCLUSION

Disagreements have arisen among Muslims regarding the sighting of the new moon. The issue stems from the fact that Islamic jurisprudence recognizes both local and global sightings. As a result, some countries, such as Saudi Arabia, Malaysia, Pakistan, and Indonesia, may begin the month a day or two apart. Sight the new moon a day or two later. This situation highlights the need for coordination among Islamic countries to unify the sighting process and reduce such differences. In recent years, the United Arab Emirates has begun exploring the potential of artificial intelligence (AI) to support moon sighting efforts. When combined with technologies such as drones and precise astronomical data, AI can offer valuable assistance. The advanced system is capable of examining weather patterns, atmospheric clarity, astronomical calculations, and geographic factors to estimate the probability of crescent visibility. They can also help determine the most favourable observation sites, thereby guiding authorities and reducing inconsistency in official announcements.

From an Islamic legal perspective, the use of artificial intelligence is consistent with the principle of alleviating hardship and promoting unity among Muslims. Scholars agree that the obligation of moon sighting is fulfilled whether it is carried out individually or collectively. The use of artificial intelligence can be considered a form of collective sighting. In this context, AI should not replace direct visual observation; rather, it should serve as a supportive tool that enhances accuracy and directs observers to the most suitable times and locations for sighting. The actual confirmed sighting must remain the decisive legal basis for determining the commencement of Ramadan and other lunar months. Finally, it is recommended for Muslim countries to establish or further strengthen national lunar observation councils that include jurists, astronomers, and data scientists. Such a stakeholder can work toward developing clear, standardized criteria that harmonise Shariah principles with contemporary scientific advancements.

#### **ACKNOWLEDGMENT**

This paper was presented at the Jurnal Syariah International Conference 2025 (JSIC 2025), held at the University of Malaya, Malaysia, on 6 May 2025. The author sincerely appreciates the financial support extended by Islamic University in Uganda (IUIU).

#### **REFERENCES**

- ‘Abd al-Ḥaqq ‘Abd al-Raḥmān al-Ishbīlī. *al-Jam‘ bayna al-Ṣaḥīḥayn*, vol. 2. 1st ed. Riyāḍ: Dār al-Muḥaqqiq, 1999.
- ‘Abd Allāh al-Qurṭubī. *al-Jāmi‘ li-Aḥkām al-Qur‘ān*, vol. 2. 1st ed. Lebanon: Dār al-Kitāb al-‘Arabī, 1422 AH.
- ‘Abd Allāh ibn ‘Abd al-Raḥmān al-Dārimī. *Sunan al-Dārimī*, vol. 2. 1st ed. Saudi Arabia: Dār al-Mughnī, 200, n.d.
- ‘Abdul‘Azīz ibn ‘Abd al-Raḥmān ibn Bāz. *Majmū‘ Fatāwā*, vol. 30. Saudi Arabia: Ri‘āṣah Idārat al-Buḥūth al-‘Ilmiyyah wa al-Ifṭā’, n.d.
- Abdulrahman, M. M., and A. H. M. Walusimbi. “Artificial Intelligence Use in the Issuance of Inheritance Fatwas: Evaluating GPT-3.5 Compliance with Islamic Legal Principles.” *Asy-Syari‘ah* 26, no. 2 (2024): 129.

- Abdulrahman, Manswab, and Abdulhafiz Walusimbi. "Examining the Role of Artificial Intelligence (GPT-3.5) in Issuing Fatwas for Islamic Family Cases: A Comparative Analysis." *Journal of Contemporary Islamic Law* 9, no. 2 (2024): 30-38.
- Abū Ja'far Aḥmad al-Ṭaḥāwī. *Mukhtaṣar Ikhtilāf al-'Ulamā'*, vol. 2. 2nd ed. Bayrūt: Dār al-Bashā'ir al-Islāmiyyah, 1417 AH.
- Abubakar 'Abd al-Razzāq al-Ṣan'ānī. *al-Muṣannaḥ*, vol. 4. 2nd ed. India: al-Majlis al-'Ilmī, 1403 AH.
- Aḥmad bin Ḥanbal. *Musnad Imām Aḥmad*, vol. 2. 1st ed. Sūriyā: Mu'assasat al-Risālah, 2001.
- Aḥmad ibn 'Alī Abū Bakr al-Rāzī al-Jaṣṣāṣ. *Aḥkām al-Qur'ān*, vol. 1. 1st ed. Beirut: Dār al-Kutub al-'Ilmiyyah, 1994.
- Aḥmad ibn Muḥammad ibn Ḥanbal. *Musnad al-Imām Aḥmad*, vol. 7. 1st ed. al-Qāhirah: Dār al-Ḥadīth, 1995.
- Aḥmad ibn Shu'ayb al-Nasā'ī. *Sunan al-Kubrā*, vol. 3. 1st ed. Bayrūt: Mu'assasat al-Risālah, 2001.
- Aḥmad ibn Shu'ayb al-Nasā'ī. *Sunan al-Nasā'ī*, vol. 4. 1st ed. Cairo: al-Maktab al-Tijāriyya al-Kubrā, 1930.
- Aḥmad Shākir. *Awā'il al-Ashhur al-'Arabiyyah: Hal Yajūz Shar'an Ithbātuhā bi al-Ḥisāb al-Falakī?* 1st ed. Yemen: Maktabat Ibn Taymiyyah, 1407 AH.
- Albayrak, Ali. "Ithbāt al-Hilāl bayna al-Ru'yah bi al-'Ayn wa al-Ḥisāb al-Falakī." *Fırat Üniversitesi İlahiyat Fakültesi Dergisi* 30, no. 1 (2025): 137-149.
- Al-Ḥusayn ibn Mas'ūd al-Farrā' al-Baghawī. *Sharḥ al-Sunnah*, vol. 6. 2nd ed. Beirut: al-Maktab al-Islāmī, 1983.
- 'Alī 'Abd Allāh Muḥammad Ḥusayn. *Fiqh al-'Ibādāt*, vol. 1. 1st ed. Sūdān: Jāmi'at al-Sūdān al-Maftūḥah, 2005.

Emirates News Agency–WAM. “Lilmarrati al-Ūlā ‘Ālamiyyan Istikhdām Ṭā’irāt al-Drone wa al-Dhakā’ al-Šinā’ī fī Raṣd Hilāl Ramaḍān fī al-Imārāt.” Accessed from <https://www.wam.ae/ar/article/bifhkys-للمرة-الأولى-عالميا-استخدام-طائرات-الدرون-والذكاء>.

Ibn Ḥajar al-‘Asqalānī. *Faḥ al-Bārī Sharḥ Ṣaḥīḥ al-Bukhārī*, vol. 6. 1st ed. Egypt: Maṭba‘at al-Khayrīyah, 1329 AH.

International Astronomical Centre. “International Astronomical Centre.” Accessed from <https://astronomycenter.net/acut.html>

Jamīlah Nāṣir al-Qaḥṭānī. “Al-Isti‘ānah bi al-Ḥisāb al-Falakī wa al-Marāṣid fī Ithbāt Ahlilat al-Shuhūr: Dirāsah Shar‘iyyah.” *Majallat al-Sharī‘ah wa Dirāsāt al-Islāmīyah* 35, no. 123 (2020): 277-316.

Majid Abu Rakhia. “Shari‘a Rules and Regulations Concerning the Differences in Sighting the Moon.” *UAEU Law Journal*, article 4, no. 6 (1992): 266.

Mājid Abū Rakhīyyah. “Ithbāt al-Ahillah.” *Majallat al-Sharī‘ah wa al-Dirāsāt al-Islāmīyyah* 6, no. 13 (1989): 376.

Majmū‘ al-Mu‘allifin. *al-Fiqh al-Muyassar fī Ḍaw’ al-Kitāb wa al-Sunnah*, vol. 1. 1st ed. Saudi Arabia: Majma‘ Mālik Fahd li-Ṭibā‘at al-Muṣḥaf al-Sharīf, 1424 AH.

Majmū‘ al-Mu‘allifin. *al-Mawsū‘ah al-Fiqhiyyah al-Kuwaytiyyah*, vol. 42. 2nd ed. al-Kuwayt: Dār al-Salāsīl, 1427 AH.

Mālik ibn Anas. *al-Muwaṭṭa’*, vol. 3. 1st ed. Mu‘assasat Zayd ibn Sulṭān al-Nahyān li-l-A‘māl al-Khayriyyah, 2004.

Manṣūr al-Bahūtī. *Sharḥ al-Muntahā al-Irādāt*, vol. 3. 1st ed. Saudi Arabia: Dār ‘Ālam al-Kutub, 1996.

Mohammad Mahmoud Talafa. “Athar Ikhtilāf al-Maṭālī‘ fī Bad’ al-Ṣawm wa al-Iftār.” *Majallat al-Sharī‘ah wa Dirāsāt al-Islāmīyah* 22, no. 71 (2007).

Muḥammad Amīn ibn ‘Umar. *Majmū‘ Rasā’il al-‘Ābidīn*, vol. 1. 1st ed. Bayrūt: Dār Iḥyā’ al-Turāth al-‘Arabī, 1405 AH.

- Muḥammad ibn Ibrāhīm ‘Abd Allāh al-Tuwayjirī. *Mukhtaṣar al-Fiqh al-Islāmī fī Daw’ al-Qur’ān wa al-Sunnah*. 11th ed. al-Sa‘ūdīyyah: Dār Aṣḍā’ al-Mujtama’, 2010.
- Muḥammad ibn Ismā‘īl al-Bukhārī. *Ṣaḥīḥ al-Bukhārī*, vol. 31. 1st ed. Beirut: Dār Ṭuq al-Najāt, 1422 AH.
- Muḥammad ibn Khaṭīb al-Tibrīzī. *Mishkāt al-Maṣābīḥ*, vol. 1. 3rd ed. Bayrūt: Maktab al-Islāmī, 1985.
- Muḥammad ibn Ṣāliḥ al-‘Uthaymīn. *Majmū‘ al-Fatāwā*, vol. 19. 1st ed. Riyāḍ: Dār al-Waṭan, 1438 AH.
- Muḥammad ibn Yazīd al-Qazwīnī. *Sunan Ibn Mājah*. 1st ed. Lebanon: Dār al-Risālah al-‘Ālamīyah, 2009.
- Muḥammad Muṣṭafā al-Zuḥaylī. *al-Qawā‘id al-Fiqhiyyah wa Taṭbīqātuhā fī Madhāhib al-Arba‘ah*, vol. 1. 1st ed. Damascus: Dār al-Fikr, 2006.
- Muḥammad ‘Uqaylah. *Aḥkām al-Ṣiyām*. 1st ed. ‘Amān: Maktabat al-Risālah al-Ḥadīthah, 1982.
- Muḥammad ‘Uqlah. *Aḥkām al-Ṣiyām wa al-I‘tikāf*. 1st ed. ‘Ammān: Maktabat al-Risālah al-Ḥadīthah, 1982.
- Munā Sālim Muḥammad. “Raṣḍ al-Ahillah fī Zill Taṭawwur ‘Ilm al-Falak wa-l-Faḍā’ : Dirāsah Fiqhiyyah.” *Majallat al-Sharī‘ah wa-l-Qānūn* 42, no. 1 (2023): 639-731.
- Muslim ibn al-Ḥajjāj al-Naysābūrī. *Ṣaḥīḥ Muslim*, vol. 3. 1st ed. Turkiyā: Dār al-Ṭibā‘ al-Amīriyyah, 1334 AH.
- Muwaffaq al-Dīn Ibn Qudāmah. *al-Mughnī*, vol. 4. 1st ed. Egypt: Dār Hajr, 1992.
- Rafi, Barazi. “Kaifa Yusahim al-Dhakā’ al-Iṣṭinā‘ī fī Tabsīṭ Ru‘yat Hilāl Shahri Ramaḍān?” Accessed from <https://bawabaa.com/كيف-يساهم-الذكاء-الاصطناعي-في-تبسيط-رؤ>
- Rofiuddin, Ahmad Adib, and Moelki Fahmi Ardliansyah. “The Utilization of Artificial Intelligence in Determining the Beginning of Islamic

Calendar in Indonesia.” *Al-Marshad: Jurnal Astronomi Islam dan Ilmu-Ilmu Berkaitan* 10, no. 2 (2024): 82-94.

Şālih Ghānim ibn ‘Abd Allāh al-Sadlān. *Risālah fī al-Fiqh al-Muyassar*. 1st ed. al-Sa‘ūdiyyah: Wizārat al-Shu‘ūn al-Islāmiyyah wa al-Awqāf wa al-Da‘wah wa al-Irshād, 1425 AH.

Sayyid Sābiq. *Fiqh al-Sunnah*, vol. 1. 3rd ed. Beirut: Dār al-Kitāb al-‘Arabī, 1977.

Shams al-Dīn Abū al-‘Awnī al-Safarīnī. *Kashf al-Lithām ‘an ‘Umdat al-Aḥkām*, vol. 1. 1st ed. Kuwait: Wizārat al-Awqāf wa al-Shu‘ūn al-Islāmiyyah, 2007.

Shawqī Ibrāhīm ‘Allām. “Al-Qawā‘id wa-l-Ijrā‘āt al-Muttaba‘a li-Ru‘yat al-Hilāl fī Miṣr.” Accessed from <https://www.dar-alifta.org/ar/fatwa/details/12825-المتبعة-لرؤية-الهلال-في-مصر>

Shihābuddīn al-Qalyūbī. *Hāshiyat al-Qalyūbī*, vol. 2. 1st ed. Lebanon: Dār al-Fikr, n.d.

Suleman, Frangky, and Djamila Usup. “The Role of Modern Observation in Understanding the Beginning of the Hijri Month.” *Jurnal Ilmiah al-Syir‘ah* 19, no. 1 (2021): 106-121.

The Permanent Committee for Scholarly Research and Ifta’. *Fatwā* 9/99. Riyadh: al-Ri’āṣah al-‘Āmmah li-Idārat al-Buḥūth, 1411 AH.

‘Uthmān ibn ‘Alī al-Barrā‘ī. *Tabyīn al-Ḥaqā‘iq Sharḥ Kanz al-Daqā‘iq*, vol. 1. 1st ed. Egypt: al-Maṭba‘ah al-Kubrā al-Amīriyyah, Būlāq, 1313 AH.

Yahyā ibn Sharaf al-Nawawī. *al-Majmū‘ Sharḥ al-Muhadhdhab*, vol. 6. 1st ed. Beirut: Dār al-Fikr, 1996.

Yūsuf ibn ‘Abd Allāh ibn ‘Abd al-Barr. *al-Istidhkār*, vol. 3. 1st ed. Beirut: Dār al-Kutub al-‘Ilmiyyah, 2000.