

## THE INTEGRATION BETWEEN SYAR'I AND ASTRONOMY TO DETERMINE THE BEGINNING OF HIJRI CALENDAR: An Applied Study of Moon Elongation to Prove the *Hilâl* Testimony

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### Abstract

*This article was motivated by the fact that most observers in Indonesia are inconsistent in determining the theoretical and practical beginning of the Hijri month. They only consider the aspect of the height of hilâl, but ignore the angle of elongation during the process of observing hilâl. This inconsistency occurs in the theory and practice reflected in the Decision of the Ministry of Religious Affairs of the Republic of Indonesia. Based on this case, the authors want to analyze the decision, especially the data on the testimony stating that the new moon (hilâl) can be successfully seen, as received from 1962 - 2021 M. The type of research used is qualitative and descriptive using the data analysis technique adapted from the Millis and Huberman theory to obtain the data classification of that decision by using the scientific cum doctrine approach. The results of this study are first; the number of ithbât maşlahî reached 45% and ithbât takâmuli reached 55% of all decrees of the Minister of Religious Affairs of the Republic of Indonesia. Second; to minimize the number of ithbât maşlahî, a theory of the selection of the hilâl testimony is needed, which is known as the M2P theory.*

Artikel ini berawal dari fakta bahwa sebagian besar perukyat di Indonesia tidak konsisten dalam menentukan awal bulan Hijriah secara teoritis dan praktis. Mereka mempertimbangkan aspek ketinggian hilâl saja dan tidak menyebutkan serta menerapkan sudut elongasi dalam proses melihat hilâl. Inkonsistensi ini terjadi dalam teori dan praktik dalam keputusan Kementerian Agama Republik Indonesia. Berdasarkan hal tersebut, penulis ingin menganalisis keputusan tersebut khususnya data kesaksian berhasil melihat hilâl yang diterima dari tahun 1962–2021. Jenis penelitian yang digunakan adalah kualitatif dan deskriptif dengan analisis data Millis dan Hubermann untuk mendapatkan data klasifikasi dari keputusan tersebut serta pendekatan scientific cum doctriner. Hasil dari penelitian ini adalah pertama; jumlah *ithbât maşlahî* mencapai 45% dan *ithbât takâmuli* sebesar 55% dari seluruh keputusan Menteri Agama RI. Kedua; untuk meminimalisir jumlah *ithbât maşlahî* maka diperlukan teori penyelesaian kesaksian hilâl yang disebut dengan teori M2P.

**Keywords:** *hilal testimony; moon elongation; syar'i astronomy; the decision of the ministry of religious affairs*

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## Introduction

It is known that the Ministry of Religious Affairs of the Republic of Indonesia is the only one organizing the sighting of the crescent moon (*hilâl*) and urged its implementation before the beginning of Ramadan, Shawwal and Dzulhijjah. The ministry asked the courts to report any claims regarding the testimony of the sighting of *hilâl*. Then, the Ministry of the Religious Affairs of the Republic of Indonesia held an *ithbât* session (determination trial) for the determination the beginning of three months of Hijri (Ramadhan, Shawwal, and Dzulhijjah) after collecting some *hilâl* sighting testimonies from all *hilâl* observation places in Indonesia. The minister then announced the results of *ithbât* session directly to the public and recorded it as the decision or decree of the Minister of Religious Affairs of the Republic of Indonesia.

After reviewing some notes, the authors found an inconsistency in the implementation of all indicators for the appearance of *hilâl* mentioned in

the decision of the Ministry of Religious Affairs of the Republic of Indonesia. It was identified that the decision did not mention the magnitude of the angular dimension (elongation) as one of the important parameters in the visibility of *hilâl* (Austin et al. 1976, 741-748). It only mentioned the altitude of *hilâl*. This inconsistency has become common for most observers in Indonesia both in theory - (for example, look at the Ministry of Religious Affairs of the Republic of Indonesia's guide book and other astronomy books) (Departemen Agama R. I 1994, 47-50) and practice when they wanted to observe *hilâl*. There are some parameters mentioned in MABIMS (Ministers of Religious Affairs of Brunei Darussalam, Indonesia, Malaysia, and Singapore) as the criteria for the visibility of *hilâl*, which have been agreed and implemented by the four countries (Sado 2014, 22-36; Wahidi et al., 2021). MABIMS' visibility of *hilâl* requires the moon's altitude to be no less than 2 degrees, the elongation should not be less than 3 degrees, and the age of the moon should not be less than 8 hours. The criteria given by MABIMS began to be applied in 1989, and there were some changes as well as corrections regarding the criteria limit in 2017 until it was finally implemented in 2022. Because of the changes of MABIMS' criteria, it is currently called Neo-MABIMS.

Schaefer said that astronomers should provide the complete conditions for the *hilâl* visibility during the process of sighting and observing *hilâl*. They must at least fulfill the two conditions, both the altitude and elongation of *hilâl* (Siddiq 2009, 9; Schaefer 1993, 311-361). The criteria which had been widely used so far were closely related to several important requirements, such as the length of the *hilâl* above the horizon, the altitude of the *hilâl*, the size of the angle (ARCL), the difference in the height of the angle from the vertical side between the center of the sun and the center of the moon (ARCV), the difference in the azimuth of the sun and moon (DAZ), and the width of *hilâl* (Siddiq 2009, 9; Odeh 2004, 39-64). Among some of the conditions for the appearance of *hilâl*, some astronomers, such as Ilyas and Bruin, had used the dimensions of the elongation angle specifically to determine the criteria for the possibility of seeing *hilâl*. Their reasoning was that the elongation was closely related to the width of the moon being observed (Ilyas 1984, 97; Qulub 2017, 21-46).

Sultan has explicitly said in his research about the importance of applying the angle of elongation in *hilâl* observations. He said that astronomers, with all different criteria, infer the observational data of *hilâl*

sightings after some years to find out the minimum angular value for the elongation of the moon. This proves how important the angle of elongation is in observing the appearance of *hilâl*. This is due to the relationship between the elongation angle and the width of the *hilâl* (Sultan 2007, 53-59).

Fortringham also argued in his research that the minimum angular dimension (extension) of the visible *hilâl* cannot be less than 12 degrees, 11 degrees in Maunder's opinion, 10 to 10.5 degrees in Yallop and Ilyas' opinion, 7.5 degrees in Fatoohi's opinion, and 7 degrees according to the opinion of Danjon and Schaefer, and 6.4 degrees according to Syaukat Odeh's opinion, and 5 degrees according to Mc Nally's opinion (Sultan 2007, 53-59).

Then, the research was conducted by F. Fatoohi et al. on Danjon's analysis in 1932 and 1936, which was entitled "The Danjon Limit of First Visibility of The Lunar Crescent". It was mentioned that with 75 data collected by Danjon, he analyzed the relationship between the angular distance of the sun-moon and the magnitude of the angle of *hilâl* and the sun towards the new moon. Based on the analysis, it can be concluded that the closer the sun-moon angle is, the smaller the observable *hilâl* curvature will be. These data indicate that it is impossible to observe *hilâl* if the distance between the sun and the moon (elongation) is less than 7 degrees. This formula was known as the Danjon limit. Based on the Danjon limit, astronomers reject any reports about observing *hilâl* with the naked eye when the angular distance of the sun-moon is less than 7 degrees (Fatoohi et al. 1998, 65-72). Abdul Karim also said, through his book, that this information was scientifically proven in the Islamic conference that was held in 1978 in Istanbul, Turkey. *Hilâl* can be seen by the observers with the naked eye, with the angular distance between the sun and the *hilâl* that is not less than 8 degrees in the evening during sighting (Nashr 2013, 255).

Agreeing and confirming what the Sultan and Nizar said, Thomas Djamaluddin added that the influential aspect for the criteria of *hilâl* appearance cannot be separated from two parameters. Those are the parameters related to the shape of *hilâl* that is related to the light of *hilâl*, and the light of *hilâl* is always related to the angular dimension, i.e. the ideal distance between the sun and the moon, as Nizar said earlier. Furthermore, the other parameter relates to the bright sunlight scattered in the atmosphere on the horizon just after sunset (Djamaluddin et al. 2011, 12).

Based on what has been shown previously regarding the inconsistency in the process of the appearance of the *hilâl*, most observers of the moon in Indonesia and the Ministry of the Religious Affairs ignore the importance of the angular dimension as a result of the *ithbât* session. Thus, the authors want to do further research by recalculating the accepted astronomical data from a number of *hilâl* sightings during the *ithbât* session to determine the beginning of Ramadan, Shawwal and Dzulhijjah. They were mentioned in the decision of the Ministry of Religious Affairs of the Republic of Indonesia from 1962 to 2021. The recalculation is carried out to determine the value of the elongation angle in order to determine the validity of the *hilâl* testimony claim and to test the astronomical data with the applicable *hilâl* visibility limit in Indonesia.

### Research Method

The type of research used in this research is qualitative descriptive, using the data analysis model of Miles and Huberman (Sugiyono 2014, 252). Meanwhile, the approach of this research is an integrative approach between syar'i law (Islamic law) and science, known as the "Scientific Cum Doctrine" approach (Mukti 2004, 57). The purpose and objective of this approach is reaching the harmony of the Islamic theory and science in analyzing the object of research. The main data are the decisions of the Ministry of Religious Affairs of the Republic of Indonesia from 1962 - 2021 / 1381-1436 H and the supporting data are obtained from interviews and other things supporting this research.

### Results and Discussion

#### *Hilâl* in Sharia Perspective

Basically, *rukyat al-hilâl* consists of two words in Arabic; they are *rukyat* and *hilâl*. The word '*rukyat*' can also mean "*aḅsara*" and can be "*adraka*". *Rukyat*, in terms of epistemology, is grouped into two opinions; *first*, the word *rukyat* is from the root word *ra'a* which literally means to see with the naked eye. *Second*, the word *rukyat* is a root word which means to sight; in English, it is called vision which means seeing, both outwardly and inwardly (Subhan et al.1995, 15).

In another perspective, Bakhit al- al-Muṭṭi'i said that *rukyat* is:

*The understanding of rukyat that can be quickly understood is to see bi al-fi'li (with the naked eyes). This understanding is a mercy and makes it easier*

for those who are burdened with the law (*mukallaf*), and to be a *khitâb* (speech) about something that everyone knows. It is in contrast to reckoning because it is only known by a few people (al-Muṭî'i 1329, 34).

The new moon, which is known as *hilâl* in astronomical terms, is the part of the moon that looks bright from the earth due to the rays of the sun on the day after *ijtimâ'* or "conjunction" shortly after sunset. At that time, when *hilâl* has appeared and can be observed; then, that night and the next day is the first day of the following month.

In the Arabic-English dictionary written by Hans Wehr, the word *hilâl* has the plural form *ahillah*, which means a new moon (young moon) or *hilâl* (Wehr 1993, 498). This definition is also developed in English-language books, such as the book of A. Yusuf Ali entitled *The Holy Quran Text, Translation and Commentary*. In Philip's Astronomy Encyclopedia, it is stated that *hilâl* is the phase of the moon between the new moon and the first quarter, or between the last quarter phase and the new moon phase. *Hilâl* is also called the inferior planetary phase of the inferior conjunction with the greatest elongation when less than half of its side is visible (Patrick 2002, 106).

Ibn Manzûr tried to define the word *hilâl* in his book titled *Lisân al-'Arabi* that the meaning of *hilâl* is the *hilâl* on the first and second days of the Hijri month or its last two nights (Manzûr, 2016, 227-230). Furthermore, al-Qamus al-Muhîṭ explains that *hilâl* refers to 2-3 nights from the beginning of the month/7-2 nights from the end of the month) (Abadi 2008, 966). The al-Munawwir dictionary then also used this opinion, but it added an explanation of various meanings of the word *hilâl*. According to Munawwir, the word *hilâl* has twelve meanings, some of them are (1) the *hilâl*, (2) the stamp, the rope on the camel, (3) the moon seen at the beginning of the month, (4) the thin camel, (rainfall), (5) the snake skin cladding, and (6) the coming of rain (Munawwir 1997, 460). If both the words *rukyat* and *hilâl* and their meanings are combined, they become *rukyat al-hilâl*. Muhyidin Khazin defines it as an observation with the eye or optical aids to see the appearance of *hilâl* shortly after sunset on the day when *ijtimâ'* has occurred (Khazin 2005, 30).

The meaning of *rukyat al-hilâl* in the perspective of *syara'* is observing *hilâl* with the eyes after sunset on the twenty-ninth day before the new Hijri month. People's testimony can be accepted as long as it is reliable. The person's testimony is used as a guide to determine *hilâl*. In the dictionary of

astronomy, it is stated that *rukyyat al-hilâl* is an attempt to see or observe *hilâl* in the open place with the naked eye or equipment at sunset before the Hijri month (Khazin 2005, 30; Putri 2012, 101-114).

Undoubtedly, the Islamic world has faced a recurring problem in the *hilâl* sighting in lunar months since a long time ago, especially in Ramadan, Shawwal and Dzulhijjah. In the beginning era of Islam, the era of Prophet Muhammad, the first lunar months were determined by sighting *hilâl* in the evening of the twenty-ninth day of each month. The schools of jurisprudence have agreed on this by citing the saying of the prophet when he said: “Fast when you see it, and break your fast when you see it” (al-Bukhari 1981, 481).

There are several verses and hadiths that discuss the determination of the beginning and end of fasting. However, the authors will convey the most popular verses and hadiths about the testimony of *hilâl* as an indicator. In Q.S. al-Baqarah {2}:185, in particular, Allah the Almighty specifically gives special legitimacy to the existence of the witness of *hilâl* as an early marker of fasting. The criteria for the expected observers that will be accepted are as Q.S. al-Baqarah {2}:185,

*So whoever of you witnesses the month, then he shall fast it. But whoever is sick or on a journey, then (he must fast) a period of other days. Allah wants ease for you and does not want hardship for you.*

The verse provides a general explanation of the obligation to fast in Ramadan if one succeeds in seeing *hilâl*. This verse was later strengthened by one of the hadiths regarding the determination of the beginning and the end of fasting:

*From Abu Hurairah r.a. The Messenger of Allah (Muhammad) said: "Fast because you see the date (hilâl) and break your fast because you see the date (hilâl). If your view is blocked by clouds, then complete the number of months of Sha'ban (to 30 days. (Muslim 1995, 481).*

The interpreters have different interpretations for the verse. Al-Marâghî argues, as mentioned in his commentary, that people who can see *hilâl*, if they are not traveling, are required to fast. Likewise, fasting is obligatory for people who hear authentic information about the sighting of *hilâl* (al-Marâghî 1993, 73).

Through his interpretation, al-Râzî stated that there are several problems regarding the verse. One of which is the problem in defining the

meaning of the word "شهد". He said that the object of the hidden verb "شهد" is the word *البلد* or *البيت* as the object, while the word *الشهر* is an adverb of time. Thus, it means that people who claim to see *hilâl* using the reckoning "*hisâb*" method and *rukyyat al-hilâl* are obliged to fast (al-Râzî 1981, 95-96; Arif Royyani et al., 2021).

From the verse and hadith above, it can be understood that the beginning and end of Ramadan fasting is determined by seeing *hilâl* of the Ramadan month based on some *hilâl* testimonies. These testimonies should really be able to be proven even if they are only conveyed through the news given by someone who is well-known as a fair one. If the observer's view is obstructed by clouds, both for the beginning and the end of the month of Ramadan, then the number of months will be completed to thirty days.

### Fiqh of *Hilâl* Testimony

According to Hanafiah scholars in Fiqh Perspective, *hilâl* testimony must be witnessed by a group of experienced and knowledgeable witnesses (observers) to determine the beginning of Ramadan. It is on condition that the sky is clear of obstructions and a number of personnel who have been determined by local policy holders are present. At the fiqh level, the observers who claim to have seen *hilâl* must say the word "أشهد". However, if the sky is cloudy or there are thick clouds, the testimony of a fair, reasonable, and mature observer is sufficient (al-Jâzîrî 1999, 499; Aris 2018, 232-267).

Maliki scholars said that the beginning of the month of Ramadan must be witnessed by two fair observers, and the sky must be clear without any obstruction (al-'Azârî 1998, 140). The other alternative is the provision of testimony given by a group of experienced and knowledgeable observers as long as the agreement containing the prohibition to utter dishonesty exists (al-Jâzîry 1999, 499). The Shafi'i scholars said that the testimony of *hilâl* to decide the beginning of Ramadan cannot be accepted except two testimonies (al-Nashrîrî 1992, 534).

Hanabilah scholars said that the testimony of *hilâl* regarding Ramadan can be obtained from one observer with the criteria that the witness must be legally capable, fair, male or female, free or slave, and is not obliged to say the word "أشهد" (al-Zuhailî 2005, 1654). Whereas, for the *hilâl* of Shawwal, the Hanâfiah scholars argued that the beginning of the month of Shawwal



under the condition that the sky is clear must be accompanied by two fair testimonies from both men and women. However, when the sky is cloudy, there must be some testimonies, and the witnesses are asked to say the word "أشهد" (al-Jâzîrî 1999, 502).

The Mâliki scholars argued that the testimony of *hilâl* to determine the beginning of Shawwal cannot be accepted except some observers give two fair testimonies (al-Jâzîrî 1999, 502). Similarly, the Shâfi'i scholars argued that *hilâl* to decide Shawwal cannot be accepted except two or more observers provide their testimonies (al-Nashrîti 1992, Juz 3, 534). The Hanâbilah scholars argued that *hilâl* to decide Shawwal must be determined by two fair testimonies, and it should not only be based on one testimony from either a man or a woman (al-Nashrîti 1992, Juz 3, 517). As for the *hilâl* of Dzulhijjah, the four scholars also agreed that the beginning of Dzulhijjah is not enough if there is only one testimony. There must be two fair observers or witnesses (al-Nashrîti 1992, Juz 3, 462).

Furthermore, the term 'fair' in the *hilâl* testimony means that the indicator concerns the one giving the testimony. That person should be a clean person or there are other people who can support it (al-Nashrîti 1992, Juz 3, 530). A witness can conform to the indicator related to term "fair" if they fulfill four conditions; *first*, being physically healthy, especially related to eyes, *second*; being mentally healthy (mind), *third*; maintaining faith and piety, and *forth*; knowing the time and position of the *hilâl* in detail (al-Wahhâb 2002, 75-90).

Husain Kamâluddîn argued, as he quoted from Imâm al-Subkî about the reasons for the rejection of the *hilâl* testimony, that not every testimony given by the observer can be accepted and used. A weak testimony concerning the appearance of *hilâl* caused by the incompatibility with the agreed astronomical parameters can be rejected. This is in accordance with the consensus view of the fiqh scholars. Imâm al-Subkî also advised the judge to examine the claims of the one witnessing *hilâl* from two factors. Those are the physical aspect, such as the health of the eyes of the observer and the spiritual aspect, such as the cleanliness of the observer. The observer should not have despicable traits such as lying. Another aspect which is no less important than the other two aspects is about paying attention to the condition of the horizon at the time of *rukyat al-hilâl*. It is related to knowing the position of *hilâl* and the minimum limit of the possibility of *hilâl* to be seen (*imkân al-rukyat*) (Kamâluddîn 2005, 375-376;

al-Subkî 1329, 23). Muhammad Ahmad also argued that a policy holder must strictly clarify every claim of testimony about *hilâl*, both scientifically and naturally (Ahmad 2011, 80).

Jurisprudence experts provide several conditions that must be met by observers to make the claim accepted, such as; *first*, being fair according to the elements of justice set by the scholars. *Second*, it involves the integrity of vision, skill, practice of debating and repetition; thus, it concerns more than one effort. *Third*, the claim should have no connection with any psychological factors that lead to the action assuming objects as *hilâl*, which is known as visual hallucinations. *Fourth*, the apparition must occur after the *hilâl* shows up, and stay for some time after sunset so that the observer can see it. *Fifth*, there should be no clouds or other obstructions to distract the view (Husain 2005, 33).

Regarding the testimony of *hilâl*, al-Subkî said that there are several things that the judge needs in examining the testimony of seeing *hilâl*, such as the witness' justice, witness' control, and witness' conditions (al-Subkî 1329, 79-99).

### **Hilâl Criteria in Astronomical Perspective**

Astronomy has evolved relentlessly over time, which tends to lead to a higher degree of accuracy as a whole as a result of calculations. The *rukyyat* or observation of the position and movement of celestial bodies is very important to foster the development and progress of astronomy today. This is evidenced by the discovery of more modern and sophisticated observation tools, science and technology as well as more modern measuring instruments such as spherical trigonometry. One of the celestial bodies that marked the beginning of the Hijri month is the moon. The moon is a natural satellite that always orbits the earth, which has phase changes that can be witnessed every day from the new moon phase to the waning *hilâl* phase (Jamaludin 2018, 156-171; Nawawi et al., 2012).

Hussein Kamâluddin mentions the definition of moon is the scientific name for a planet which illuminates the Earth's sky on several nights, and it is also called a satellite of the planets in astronomical terminology. Therefore, the moon follows a planet and revolves around it. Astronomy is an empirical science; it means that science is developed through empirical observations in real life. The method used in the observation is the scientific method. The scientific method is a system that

deepens and expands knowledge by formulating questions and collecting data related to these questions through observations and experiments. It then formulates the answers in the form of hypotheses based on the data. Afterward, it tests the answers to the hypotheses and applies them as a theory or model about the nature in question. Hence, observation and numerical analysis theory will always need each other for the development of a qualified theory (Kamâluddin 2005, 393).

Theoretically, the conditions for the appearance of *hilâl* are made as a means to assist people in determining and identifying the object of observation correctly and precisely. These conditions should be completely applied in a balanced manner. Suwandojo Siddiq asserted that the parameters of the appearance of *hilâl*, which are often used by observers in the related field, are closely associated with important requirements or aspects, such as the image, altitude, elongation (arc of light), ARCV (arc of vision), DAZ (delta azimuth, relative azimuth), and width of *hilâl* (Siddiq 2009, 9; Nazhatulshima et al. 2020, 859-870).

Accordingly, each astronomer has his own method, which is still connected to these parameters. For example, Bruin and Ilyas use ARCL as one of the crucial tools in observing *hilâl* since ARCL is closely related to the width of *hilâl*. It becomes the core and target of observing *hilâl* (Ilyas 1984, 96-97). Odeh said that at least two aspects of the parameters mentioned above must be used simultaneously in order to obtain accurate results (Odeh 2004, 39-64; Hasanzadeh 2012, 211-221). Odeh's view has been applied in the *Imkân al-rukyat* of MABIMS criteria. There are three parameters: the height, elongation, and age of *hilâl*. Further, Thomas Djamaluddin did the same thing by making the criteria for the visibility of *hilâl* with two parameters; they are the altitude and elongation of *hilâl* (Djamaluddin 2001; Raharto et al. 2019, 1-9).

Sultan, one of the researchers of astronomy, even further emphasized that a group of astronomers uses various methods, which resulted in the determination of the minimum amount of elongation of the moon at the new moon phase. This certainly emphasizes and clarifies the urgency of the elongation. Moreover, Nazar Mahmud reinforces the statement that one of the important conditions for the appearance of *hilâl* is the distance of the moon from the sun after conjunction and after sunset. He said that, scientifically, *hilâl* can be detected by the naked eye with a minimum elongation of 6 degrees. If the distance between the moon and the sun is

too close, the light of the astronomical twilight "*shafaq*" (the red rays of the sun after sunset) will defeat the very weak light of *hilâl* and make the *rukyyat al hilâl* very difficult (Sultan 2007, 53-69).

As previously mentioned, the condition for the validity of *hilâl* as a marker of the beginning of the month in the Islamic calendar is the certainty that *hilâl* must be visible after sunset. However, if the distance between the sun and the moon is too close, even though the sun has set, the intensity of the light is still too strong. Hence, *hilâl* remains visually invisible. On the other hand, the provisions used to determine the beginning of the Hijri month are *rukyyat al hilâl bi al-fi'li* (direct observation of the *hilâl*); thus, if there are any factors that cause the hilal to be invisible, it will cancel the determination of the beginning of the month when the sun sets on that day. Then, there needs to be a minimum and ideal distance between the sun and the moon. One of the criterias is known as the Danjon criterion. This criteria is basically needed to avoid conditions when the distance between *hilâl* and the sun is too close. Distance includes some components, such as relative azimuth distance and minimum elevation distance varying between 2°, 4°, 5°, and 7° or a combination of both. Ilyas' criteria states that the minimum altitude of *hilâl* is 5° (Saksono 2007, 90-91). Starting in 2021, the Ministry of Religious Affairs of the Republic of Indonesia uses new criteria for the visibility of *hilâl*, called "Neo MABIMS" with a minimum altitude, which is 3 degrees, and 6.4 degrees of elongation after previously used the old MABIMS criteria (2°, 3°, 8 hours) (Sabda 2019, 83; Azhari, 2013).

### Moon Elongation

Elongation or commonly called angular distance is the angular distance between the moon and the sun. In Arabic, it is called *al-Bu'du al-Zawî*; while in the *Sullamun Nayyirain* book, it is mentioned as *bu'du baina annayyirain* (Azhari 2008, 61). In the dictionary of astronomy, it is stated that *al-bu'du al-Zawî* is the difference in azimuth between two celestial bodies, for example between the azimuth of the sun and the azimuth of the moon after sunset. So, it is very reasonable that the calculation of the elongation angle can be determined by finding the azimuth difference (Khazin 2005, 14).

In its application, the use of elongation as an aspect of the visibility of *hilâl* can be seen from the important requirements as the criteria for the

*hilâl* to be seen (*imkân al-rukyat*). With an ideal elongation, the *hilâl*'s light can defeat the light of *shafaq* (twilight light), so *hilâl* can be seen. In order to differentiate a contrast between the light of *hilâl* and the light of the night, certain conditions need to be met. These become an interesting topic for astronomical research related to the visibility of *hilâl* (*hilâl* sighting). Hence, the visible *hilâl* sample is the basis for making the criteria for *imkân al-rukyat* by adding other conditions for *hilâl* sighting until they are fulfilled, both from the syar'i and astronomical aspects (Utama 2011, 32).

The parameter of *hilâl* sighting is influenced by the contrast between the dim light of *hilâl* and the light of *shafaq*, which is still quite bright. The contrast is not only influenced by the height of the horizon, the consideration of the time of *ijtimâ'* and the position of *hilâl* (it is estimated that *hilâl* can be seen after sunset), but also its distance from the sun. Angle units are also commonly used to express physical measurements of celestial bodies such as diameter or radius. Astronomers often express the size of celestial bodies with these two terms (Utama 2011, 32; Nashirudin, 2011).

### **The Role of Indonesian Ministry of Religious Affairs in Determining the Beginning of Hilâl**

One of the tasks of the Ministry of Religious Affairs of the Republic of Indonesia is to hold an *ithbât* session to determine the beginning of the month of Ramadan, Shawwal and Dzulhijjah. This *ithbât* session is a part of the government's efforts to provide legal certainty to the Indonesian people regarding the time to start and end the worship. This *ithbât* session aims at realizing the unity and integrity of the nation while maintaining good relations between religion and the state. In addition, the *ithbât* session minimized the sentiment towards the government's decisions due to different perspectives that each group or mass organization has (Kementerian Agama RI, 2022; Marpaung 2019, 278-293).

In addition, other efforts made by the government are holding deliberations on reckoning "*hisâb*" system studies, training, seminars, workshops, joint observations, and joint work meetings of reckoning "*hisâb*." The efforts also include compiling reckoning system alignments, observing eclipses, forming Rukyat Hisab Team, conducting the

International Islamic Calendar Unification Conference, forming the Cooperation of International Affairs of *rukyat* and *hisâb*, conducting the Conference of the Four Countries (Brunei Darussalam, Indonesia, Malaysia, Singapore), creating the provision of *rukyat* techniques, forming *ithbât* sessions, carrying out the publication of the Indonesian Taqvim Standard, and conducting the meetings of Islamic organizations (Izzuddin 2012, 1-16; Fuscha 2021, 107-128).

Furthermore, in other aspects, the government issued special policies in determining the beginning of the Lunar month in Indonesia; *First*, it uses the *hilâl* visibility "*imkân alrukyat*" criteria. *Second*, the beginning of Ramadan, Shawwal and Dzulhijjah are based on reckoning "*hisâb*" and *rukyat* (Mudzakir 2006, 3; Khazin 2002, 5). This idea is certainly designed as a liaison effort and a solution to reduce the differences between the *rukyat* group and the reckoning "*hisâb*" group. It happens because the root of the problem of determining the beginning of the lunar month basically boils down to these two groups (schools) (Izzuddin 2007, 43-46).

#### **Data Recalculation of *Hilâl's* Testimony at the KMA RI 1962 - 2021 M**

It has been mentioned in the background of this research that there is an inconsistency in the application of the theory of *hilâl* visibility, which has been decided by the Ministry of Religious Affairs of the Republic of Indonesia. This is clearly seen in all of the decisions made by the Ministry of Religious Affairs of the Republic of Indonesia as the results of the *ithbât* session for determining the beginning and end of fasting. In this case, the authors recalculate all data on the appearance of *hilâl* by using the Accurate Hijri Calculator 2.2.1 application. As for the recalculated data, all testimonies of *hilâl* during 1962-2021 have been accepted and used as the basis of determination by the Ministry of Religious Affairs of the Republic of Indonesia. From all the data related to the decision of the Ministry of Religious Affairs about the beginning and ending of fasting during 1962-2021, there are 56 data on *hilâl* testimony that have been received and used as the basis for the trial to determine the beginning of Ramadan, Shawwal & Dzulhijjah. Subsequently, to obtain the classified data and validate the decision, the researcher used the latest *hilâl* visibility criteria with 3 degrees *hilâl* height and 6.4 degrees elongation as a reference to determine the

decision of the Ministry of Religious Affairs that meets the syar'i and astronomical aspects.

Figure 1  
The Curve of Hilal Data's Calculations from 1962 -2021

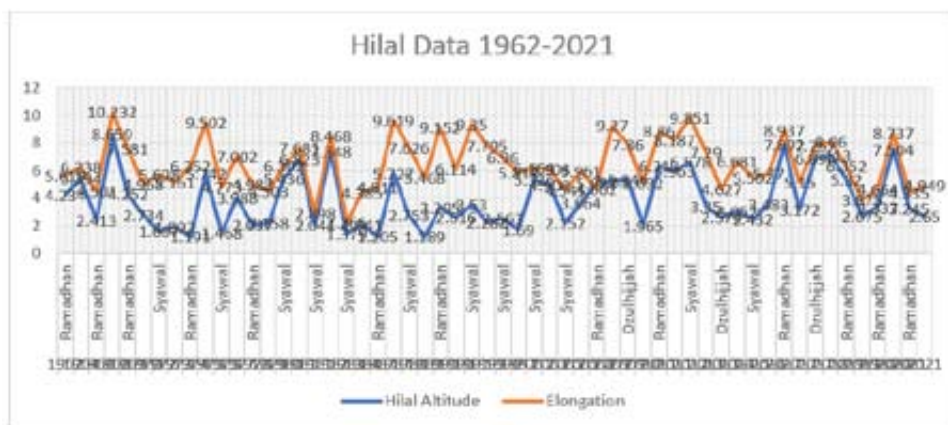


Figure 1 is a recalculation curve of the visible *hilal* and the astronomical data contained in the decision of the Ministry of Religious Affairs of the Republic of Indonesia after it was stipulated from 1962 to 2021. This data is used to determine the classification of the validity of the *ithbat* session from a shar'i and astronomical perspective. To provide an overview of the results of the recalculation of the *hilal* data, the authors present two examples of calculating the *hilal* data in terms of the latest *hilal* visibility criteria.

Meanwhile Figure 2, shows the initial determination of the month of Dzulhijjah 1441 H/2020 M. It can be seen that the height of *hilal* is about 7 degrees higher than 3 degrees and the elongation is about 8 degrees wider than 6.4 degrees. With this strong *hilal* data, the *hilal* testimony claim can be accepted because, from the astronomical aspect, an elongation of about 8 degrees makes the observers see *hilal* easier either with the naked eye or using tools such as telescopes.

Figure 2  
*Hilal* data at the beginning of the month of Dzulhijjah 1441 H

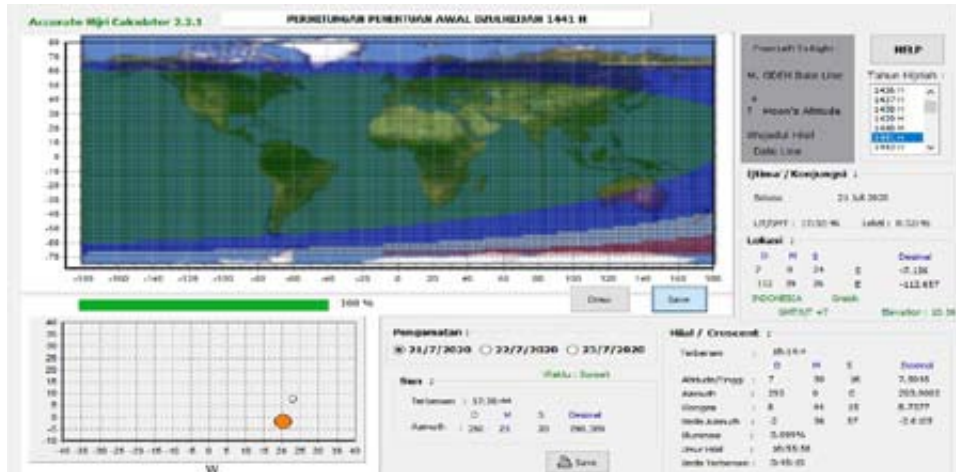
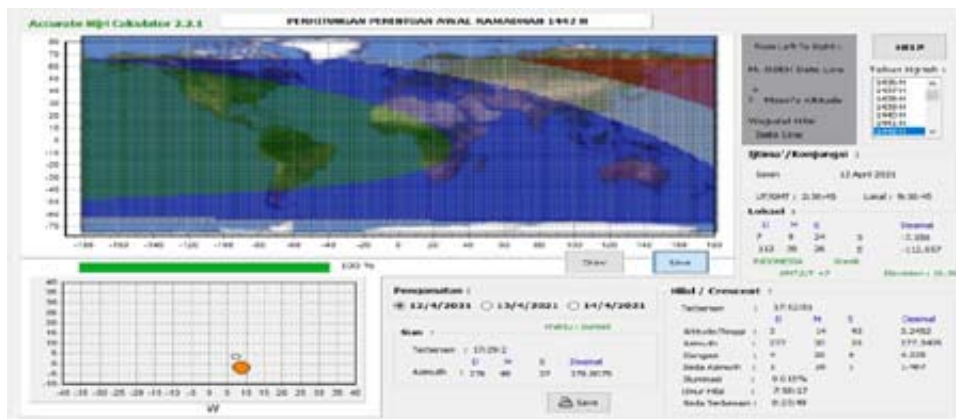


Figure 3  
*Hilal* data at the beginning of the month of Ramadan 1441 H



As the initial determination of the month of Ramadan of 1441 H/2020 M (Figure 3), the height of *hilal* is about 3 degrees higher and the elongation is about 4 degrees longer. The requirement based on the height aspect of the *hilal* data has been fulfilled, but the requirement for the elongation aspect has not. With this weak *hilal* data, the *hilal* testimony claim cannot be accepted. It is because of the fact that, from the astronomical aspect, the elongation is less than 6.4 degrees. Thus, it is difficult or even almost impossible for the observers to see *hilal* either with the naked eye or using tools such as telescopes.



### The Decision of the Ministry of Religious Affairs of the Republic of Indonesia's Classification for the Visible *Hilâl*

From the elongation recalculation for all data about the appearance of *hilâl* which had been decided by the Ministry of Religious Affairs of the Republic of Indonesia in 1962 - 2021 M, there were 56 astronomical data generated as the results of *rukyyat al-hilâl* in the determination of the beginning of Ramadan, Shawwal & Dzulhijjah (Direktorat Jenderal Bimbingan Masyarakat Islam 2011, 1-478). There are two types of *hilâl* classification, namely the *syar'i hilâl* and the *syar'i scientific hilâl*.

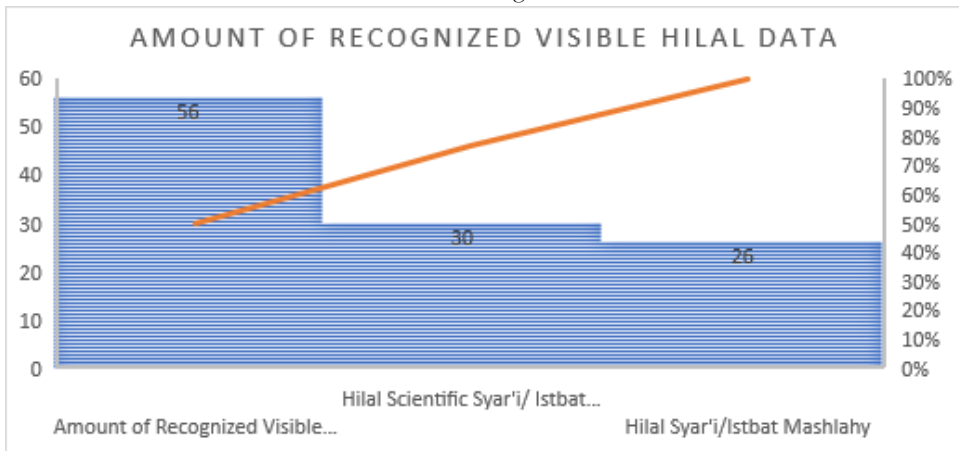
As the authors have mentioned in the background of the study, the specific standard used by the countries in Southeast Asia such as Indonesia is the MABIMS criteria (2,3,8). These criteria were the most appropriate and best criteria in determining the beginning of the Hijri month in Indonesia, and it had been used for a very long time. However, along with the observations of the astronomers and a number of local and international observational data, it was concluded that *hilâl* would be very difficult to see using the old MABIMS criteria. Afterward, the Neo MABIMS criteria ( $3^\circ$  &  $6.4^\circ$ ), which were proposed since 2017 at the national level meeting on August 14-15 in 2015 M/29-30 Shawwal 1436 H in Jakarta have appeared (Sabda 2019, 83). Next, in terms of recalculation of the *hilâl* data, the authors use the Neo-MABIMS criteria.

Table 1 is the classification result of the types of determination of the beginning of Ramadan, Shawwal and Dzulhijjah after recalculation. The data show that there are 30 strong *hilâl* data and 26 weak *hilâl* data. Strong *hilâl* data are referred to as the *scientific syar'i hilâl*, while the other 26 are called weak data because they only meet the *syar'i* aspect and are called *syar'i hilâl*. The authors equate the *syar'i scientific hilâl* as *takâmuli's ithbât* (55%) and the *syar'i hilâl* as *maşlahî ithbât* (45%).

Table 1  
The Amount of Recognized Visible *Hilâl* Data from the Ministry of Religious Affairs of the Republic of Indonesia in 1962 - 2021 M

The Amount of Recognized Visible Hilal Data	56
<i>Hilâl syar'i/ithbât maşlahî</i>	26
<i>Hilâl Scientific syar'i/ Ithbât Takâmuli</i>	30

Figure 4  
The Amount of Recognized Visible *Hilâl* Data



For the figure 4 above, Thomas Djamaluddin said that the syar'i *hilâl* is a testimony of the *hilâl* whose validity does not meet the parameters of the *hilâl* visibility criteria. However, according to syar'i, it is valid as a basis for making decisions because the witness has been sworn in by a judge of religious affairs without considering astronomical aspects and the minimum limit for the *hilâl* to be seen perfectly (Djamaluddin, 2021).

The *syar'i scientific hilâl* in this study is the *hilâl* which meets astronomical parameters. Thomas Djamaluddin calls it the astronomical *hilâl*, while Mutoha Arkanuddin calls it the *falakî hilâl* (Arkanuddin, 2021). In this classification, of course, it is very easy for the Ministry of Religious Affairs of the Republic of Indonesia to accept the testimony and consideration because this type of *hilâl* must have met the criteria of science and syar'i. So, it's hard to doubt whether the testimony is accompanied by the evidence of the image of *hilâl* (video or photo) or not. In addition, in terms of its determination by the Ministry of Religious Affairs, there are two classifications. They are *ithbât maşlahî* (the determination of the beginning of the *Hijri* month, based on the benefit and intention of preventing conflict) and *ithbât takâmuli* (the determination of the beginning of the *Hijri* month which is integrated between syar'i and astronomical aspect).

The number of 45% of the total *hilâl* testimony claims that have been received by the Ministry of Religious Affairs of the Republic of Indonesia is not a small amount. It is almost half of the total; hence, detail and seriousness of the type of *hilâl* syar'i or *ithbât maşlahî* are required in

selecting the claim of *hilâl* testimony. The authors propose the M2P theory as a way to select the *hilâl* testimony claim. M2P stands for man, method, and place. *Man (M)* in this case is a *hilâl* observer who must have special skills in *hilâl* observation so that he knows the *hilâl* data and the position of the *hilâl* well (Nurkhanif 2020, 67-85). The *Method (M)* in this case is the method used by observers in calculating the *hilâl* prediction data. The more modern the theory used, the more valid the calculation results. In addition to the way he calculates, he also considers the way he observes *hilâl*, whether using the naked eye or sophisticated tools such as a telescope. As for the *Place (P)*, it refers to a representative and worthy place for observing *hilâl* on a horizon that is clear of obstructions from a radius of 240 degrees from the South to 300 degrees to the North (Nurkhanif 2020, 117-138).

With this M2P theory, the *hilâl* testimony claim will be judged valid from an astronomical perspective and observers can swear an oath in front of a judge. When these two aspects are met, the type of *hilâl* syar'i can be minimized.

## Conclusion

Regarding the acceptance of the *hilâl* observation report as outlined in the decisions of the Minister of Religious Affairs of the Republic of Indonesia, it seems that there are still many observers who depend on the two-degree *hilâl* height data which is used as the basis for acceptance without considering the elongation aspect. On the other hand, if the altitude of *hilâl* is less than two degrees, then, the result of the claim of *hilâl* testimony can be rejected. After recalculating the data of the elongation recalculation on the appearance of *hilâl* mentioned by the Ministry of Religious Affairs of the Republic of Indonesia, there are 56 astronomical data generated from the results of observing *hilâl* for determining the beginning of Ramadan, Shawwal & Dzulhijjah. There are two types of *hilâl* classification; those are the *syar'i hilâl* and the *syar'i scientific hilâl*. In addition, in terms of its determination made by the Ministry of Religious Affairs of the Republic of Indonesia, there are two classifications. Those are *ithbât maşlahî* and *ithbât takâmuli*. Of the total 56 data on *hilâl ithbât* based on the received testimonies, there are 30 data (54%) that can be called *scientific hilâl syar'i*, which can also be called *ithbât takâmuli*. The remaining 26 data (46%) are called *hilâl syari'* or referred to as *ithbât maşlahî*, which only fulfills the *syar'i* aspect requirement and does not meet the

astronomical aspect requirement. Thus, in order to single out the *hilâl* testimony, it is necessary to be careful and thorough in accepting the *hilâl* testimony claim. The authors propose a theory of selecting *hilâl* testimony claim, which is called the M2P theory. This theory will be discussed in further research.

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