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DETERMING THE BEGINNING OF THE HIJRIYYAH MONTH USING RADIO TELESCOPE IN THE PERSPECTIVE OF ISLAMIC JURISPRUDENCE (Fiqh)

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Abstract

The determination of the beginning of the Hijri month has become a significant issue in the Islamic calendar, affecting the observance of crucial religious practices such as Ramadan fasting and the Hajj pilgrimage. In recent years, technological advancements have introduced new methods, including the use of radio telescopes, to observe the moon's cycles and related astronomical phenomena. However, the use of radio telescopes for determining the start of the Hijri month has raised questions regarding its legitimacy from a fiqh (Islamic jurisprudence) perspective. This research aims to investigate whether the use of radio telescopes can be recognized as a valid tool for establishing the beginning of the Hijri month based on the principles of fiqh. An interdisciplinary approach is employed, combining the knowledge of Islamic astronomy (ilmu falak) and fiqh to analyze the potential of this technology as a means to achieve religious objectives. The research findings indicate that the use of radio telescopes can provide accurate and objective astronomical data for monitoring the moon's position, irrespective of weather conditions that may affect visual observations. In the context of fiqh, the using of radio telescopes for determining the beginning of the Hijriyyah month cannot be considered as an optional wasīlah with the potential for wadh'i legal rulings. This is because the operational techniques of radio telescopes involve the reflection of radio waves, which differs from the primary role of conventional telescopes as visual aids for observing the crescent moon to make it more distinct. When using a radio telescope, the moon consistently appears as a full disk, in contrast to visual observations that might reveal the crescent moon in a thin or crescent phase. Nevertheless, radio telescopes still hold the potential as supportive tools for verifying the results of hisab (mathematical calculations).

Keyword:
Determining, Radio Telescopes, Hijriyah month, Fiqh, Law.

Abstrak

Penentuan awal bulan Hijriah telah menjadi isu penting dalam kalender Islam, mempengaruhi pelaksanaan praktik keagamaan penting seperti puasa Ramadan dan ibadah haji. Dalam beberapa tahun terakhir, kemajuan teknologi telah memperkenalkan metode baru, termasuk penggunaan teleskop radio, untuk mengamati siklus bulan dan fenomena astronomi terkait. Namun, penggunaan teleskop radio untuk menentukan awal bulan Hijriyah telah menimbulkan pertanyaan mengenai keabsahannya dari perspektif fiqh (hukum Islam). Penelitian

ini bertujuan untuk menyelidiki apakah penggunaan teleskop radio dapat diakui sebagai alat yang sah untuk menetapkan awal bulan Hijriyah berdasarkan prinsip-prinsip fiqh. Pendekatan interdisipliner digunakan, menggabungkan pengetahuan astronomi Islam (ilmu falak) dan fiqh untuk menganalisis potensi teknologi ini sebagai sarana untuk mencapai tujuan keagamaan. Temuan penelitian menunjukkan bahwa penggunaan teleskop radio dapat memberikan data astronomi yang akurat dan objektif untuk memantau posisi bulan, terlepas dari kondisi cuaca yang dapat mempengaruhi pengamatan visual. Dalam konteks fiqh, penggunaan teleskop radio untuk menentukan awal bulan Hijriyah tidak dapat dianggap sebagai wasīlah opsional dengan potensi untuk hukum wadh'i. Ini karena teknik operasional teleskop radio melibatkan refleksi gelombang radio, yang berbeda dari peran utama teleskop konvensional sebagai alat bantu visual untuk mengamati bulan sabit agar lebih jelas. Ketika menggunakan teleskop radio, bulan selalu muncul sebagai cakram penuh, berbeda dengan pengamatan visual yang mungkin menunjukkan bulan sabit dalam fase tipis atau sabit. Namun demikian, teleskop radio masih memiliki potensi sebagai alat pendukung untuk memverifikasi hasil hisab (perhitungan matematis).

Kata kunci:
Penentuan, Teleskop Radio, Awal Bulan Hijriah, Fiqih, Hukum.

A. Introduction

From the perspective of the positions of the moon and the sun, Indonesia should ideally have minimal potential for differences in determining religious holidays in recent years and in the future. This is because the orbit of the moon and the sun, which serve as the basis for determining the dates of religious holidays, is regular and predictable. However, the issue becomes more complicated, especially in determining Eid al-Adha. This issue involves not only the positions of the moon and the sun but also concerns differences in decisions made by the Saudi Arabian government. This creates its own complexity in determining the date of Eid al-Adha in Indonesia, as there are two different sources of authority involved. Moreover, society often simplifies this issue with the idea that technology will solve everything. It is as if the issue of determining the dates of religious holidays can be resolved with advanced equipment such as telescopes. Although technology can assist in observing the crescent moon, it must be remembered that in this context, there are religious laws that must be considered. Therefore, the issue of determining religious holidays in Indonesia is not only a

visual matter of observing the moon but also involves more complex religious aspects.[1]

The determination of the beginning of the Hijri month is a critical aspect of the Islamic calendar that affects various religious practices and activities for Muslims. Traditionally, this timing relies on the direct observation of the hilal (first crescent moon) with the naked eye, a method known as rukyat. However, with the advancements in modern astronomical technology, particularly the use of radio telescopes, questions arise as to whether radio telescopes can be used as a legitimate means to conduct rukyat from a jurisprudential perspective.

The using radio telescopes for rukyat is a significant step in exploring the determination of the beginning of the Hijri month. Determining the start of the Hijri month is not just an astronomical issue but also has implications for important religious practices such as Ramadan fasting and Hajj pilgrimage. For centuries, the Muslim community has relied on naked-eye observations, or rukyat, to identify the hilal, which marks the beginning of a new month in the Hijri calendar. However, with advancements in technology in recent years, new options or methods for observing natural phenomena have emerged, one of which is the use of radio telescopes. To many, this step represents a breakthrough. However, the impact of using radio telescopes in hilal observation goes beyond just a technological issue. It also raises fundamental questions about the validity of using radio telescopes in determining the start of the Hijri month from a jurisprudential perspective. How does this technology affect the determination of the beginning of the month in Islam? Can the use of radio telescopes be recognized as a legitimate tool in determining the start of the Hijri month?

The importance of this research cannot be overlooked. Changes in the method of determining the beginning of the Hijri month can have significant implications for the practice of Islamic worship. Therefore, it is crucial to

[1] S. Farid Ruskanda, *Rukyah dengan teknologi,* (Jakarta:Gema Insani Press, 1994), 2

understand the implications of using radio telescopes in hilal observation and whether this aligns with the existing principles of jurisprudence. By focusing on the importance of this research, we will further understand how the determination of the beginning of the Hijri month affects religious practices in Islam and whether the use of radio telescopes can be accepted as a legitimate tool in achieving religious goals. This research will also encompass the views of various scholars and jurists on this issue, to provide a broader understanding of the evolving debate among Muslims regarding this issue.

B. Methods

This research will adopt an interdisciplinary approach between astronomy (Islamic astronomy) and jurisprudence. The research method aims to understand and analyze whether the using of radio telescopes can be recognized as a legitimate tool in determining the beginning of the Hijri month in the context of jurisprudence. The jurisprudential approach will involve examining relevant hadiths, scholars' views on traditional methods of determining the beginning of the Hijri month, and Islamic legal considerations related to determining time based on astronomical evidence. Additionally, this research will identify diverse perspectives from various schools of jurisprudence in Islam regarding this issue. In conclusion, clear conclusions are expected to be obtained regarding whether radio telescopes can be considered legitimate tools in determining the beginning of the Hijri month from the perspective of jurisprudence. The findings of this research are expected to make an important contribution to the context of Islamic astronomy and jurisprudence, as well as provide practical guidance for Muslims in accurately determining the beginning of the Hijri month based on advancements in modern astronomical technology.[2]

[2] Moh. Nazir, *Metode Penelitian,* (Bogor: Ghalia Indonesia, 2009), 76.

C. Results and Discussion

1. Understanding the Context of *Rukyat al-Hilāl*

Rukyat al-hilal etymologically originates from the Arabic language. The term *rukyat* is a form of *isim masdar* which means seeing with the eyes (*an-nadhar*), derived from the root word *raā' – yarā' – ra'yan – ru'yatan*,[3] *Rukyat al-hilāl* etymologically originates from the Arabic language. The term *rukyat* is derived from the root word *rukyah*, which means seeing with the eyes. Meanwhile, *al-hilāl* is a form of *isim* (noun) that refers to the crescent moon. It is called as such because of its appearance at the beginning of the Hijri month. Ibn Manshur explained that the term *al-hilāl* can have several interpretations related to the moon's appearance. The first meaning is that the hilal is the moon's appearance that becomes visible (*yahillu*) to humans. This refers to when the moon first appears and becomes visible in the sky.

When the hilal appears, it often marks the beginning of determining the start of the Hijri month. The second definition is that the hilal refers to the moon's appearance on the first two or three nights of the new moon (*yuhajjir*). This indicates the initial period when the moon first appears in the sky. The third meaning implies that the hilal can be used to describe something that has a shape or appearance similar to the crescent moon, although it is not actually the moon. This term is used in a visual comparison context. The last interpretation refers to the gleam or light seen at night. This can refer to the moonlight seen at night.[4]

As a word with rich origins in the Arabic language, *rukyat* encompasses meanings that include the concepts of seeing, understanding, and assuming. However, its usage in a religious context often refers to the observation of the crescent moon at the beginning of the month in the Hijri calendar. In astronomy, the term *rukyat* has two main meanings: Firstly, it can be interpreted as the act of seeing or observing celestial objects, particularly the crescent moon. This refers to

[3] Louis Ma'luf, Al-Munjid, (Beirut: Al-Maktabah al-Katulikiyah, 1952), 242.

[4] Ibn Manshur, *Lisan al-'Arab,* Jilid 15 (Beirut: Dar Shadir, 2005) 83-84

visual observations conducted by humans. Secondly, *rukyat* can mean observing or monitoring other celestial bodies such as stars, planets, or other astronomical phenomena. However, when the term *rukyat* is combined with *al-hilāl,* the concept of *rukyat al-hilāl* emerges. In this context, *rukyat al-hilāl* refers to the effort or action of seeing or observing the crescent moon in the open sky. This observation can be done with the naked eye or using tools such as binoculars or telescopes. *Rukyat al-hilāl* is usually associated with determining the beginning of the Hijri month in the Islamic calendar, especially before the month of Ramadan or other months.[5]

In terminology, the usage of the word *rukyat* has various interpretations based on its context of use. There are two main interpretations of the term *rukyat*: cognitive rukyat, later known as *rukyat bi al-'Ilm* (seeing with understanding), and visual rukyat, later known as *rukyat bi al-Fi'li* (seeing with actual action). *Rukyat bi al-Fi'li*, literally meaning seeing with actual action, is the method in which individuals directly observe the crescent moon at the beginning of the Hijri month. Observers view the crescent moon with the naked eye or with the assistance of simple observation tools such as binoculars. This is a traditional method that has been utilized by pre-Islamic Arab communities and is still practiced by some astronomers today. This method is seen as a verificative method as it involves direct observation. However, there is still uncertainty because individuals' ability to see the crescent moon can vary depending on weather conditions, geographic regions, and the observer's ability.

Rukyat bi al-'Ilm, literally meaning seeing with knowledge or seeing with understanding, is a method in which the determination of the beginning of the Hijri month is based on astronomical calculations and the science of hisab (calculations). This method combines mathematical knowledge and scientific calculations to predict when the crescent moon will appear. Rukyat bi al-'Ilm relies

[5] Muhyiddin Khazin, *Kamus Ilmu Falak*, (Jogjakarta: Buana Pustaka, 2005), 69

on the use of science and mathematics to calculate the position of the crescent moon. This method reduces reliance on human visual observation, which is prone to uncertainty and varies based on geographical location. The Quran, as the foundation of Islamic law, does not provide specific details about the procedures or methods for determining the beginning of the month through rukyat al-hilāl. However, the Quran contains verses that speak about the command to fast, especially during the month of Ramadan, indicating the significance of determining the start of the month.

شَهْرُ رَمَضَانَ الَّذِيْٓ اُنْزِلَ فِيْهِ الْقُرْاٰنُ هُدًى لِّلنَّاسِ وَبَيِّنٰتٍ مِّنَ الْهُدٰى وَالْفُرْقَانِۚ فَمَنْ شَهِدَ مِنْكُمُ الشَّهْرَ فَلْيَصُمْهُۗ وَمَنْ كَانَ مَرِيْضًا اَوْ عَلٰى سَفَرٍ فَعِدَّةٌ مِّنْ اَيَّامٍ اُخَرَۗ يُرِيْدُ اللّٰهُ بِكُمُ الْيُسْرَ وَلَا يُرِيْدُ بِكُمُ الْعُسْرَۖ وَلِتُكْمِلُوا الْعِدَّةَ وَلِتُكَبِّرُوا اللّٰهَ عَلٰى مَا هَدٰىكُمْ وَلَعَلَّكُمْ تَشْكُرُوْنَ

Translation:

> "Ramadan is the month in which was revealed the Quran, a guidance for mankind and clear proofs of the guidance and the criterion (of right and wrong). So whoever of you sights (the crescent on the first night of) the month (of Ramadan), he must fast that month, and whoever is ill or on a journey, the same number (of days which one did not observe fasts must be made up) from other days. Allah intends for you ease, and He does not want to make things difficult for you. (He wants that you) must complete the same number (of days), and that you must magnify Allah for having guided you so that you may be grateful." (QS. Al-Baqarah: 185)

The interpretation of the term *syahida* entails various meanings. There are four common interpretations utilized, namely *akhbar* (reporting), *iṭṭala'a* (knowing), *ḥaḍara* (being present), and *'alima* (knowledgeable). Mufassirin and Fuqaha often interpret the term *syahida* with the meaning of *ḥaḍara*, indicating a state where one is not on a journey or safar. In the context of fasting during Ramadan, Ibn Kathir elucidated that the meaning of *syahida* is sighting the crescent moon of that month, and whoever observes Ramadan fasting must be residing (not on a journey or safar) and in good health at the onset of the month of Ramadan. This indicates that fasting during Ramadan is obligatory for someone

who is in their place of residence and in good health at the beginning of Ramadan. *As-syahra*, which denotes a time reference or *ẓaraf zaman*, explains that the individual referred to is someone who is not on a journey (not on safar) and in good health at the beginning of Ramadan. In the verse, the command *falyaṣumhu* (so let him fast) is used, and according to the jurisprudential principle, the original ruling of the command is obligatory. Thus, in the context of the verse, *syahida* refers to someone who is not on a journey and in good health at the beginning of Ramadan, and they are obliged to observe fasting.[6]

In general, the Quran mentions the crescent moon (*hilal*) as a time marker and as one of the celestial bodies that follow a regular course in their orbits. This indicates that sky observation, including monitoring the crescent moon, holds value in determining the beginning of months in Islam. The Quran provides a basis justifying the use of sky observation and the crescent moon as determining factors in establishing the start of months in the Hijri calendar. Although the Quran does not provide technical details or procedures for moon sighting (*rukyat al-Hilāl*), the use of time markers and the regular movement of celestial bodies has been acknowledged in the Quran. Therefore, the radio telescope as an aid in moon sighting can be seen as a step toward a better understanding of how to fulfill the command of fasting more accurately and objectively in Islam, in line with technological advancements.

Furthermore, the observation of the crescent moon (*rukyat al-hilāl*) is elucidated by the Prophet Muhammad in several of his hadiths, including the authentic hadith narrated by Imam al-Bukhari and Imam Muslim from the companion Abu Hurairah (may Allah be pleased with him). Additionally, it is narrated from Abdullah Ibn Umar RA :

[6] Al-Ṣābūnī, Muhammad ‘Ali, *Rawāi’ al-Bayān tafsīr Ayāt al-Aḥkāmmin al-Qur’an*, (Jakarta: Dār al-Kutub al-Islāmiyyah, 2001), 153. Lihat juga Ibnu Katsir, *Tafsīr Ibn Kaśīr*, Juz I, 503

صوموا لرؤيته وافطروا لرؤيته فإن غبي عليكم فأكملوا عدة شعبان ثلاثين[7]

Meaning:

"Fasting (Ramadan) is incumbent upon you upon sighting the crescent moon (indicating the beginning of Ramadan). And terminate your fasting (at the end of Ramadan) upon sighting the crescent moon (indicating the beginning of Shawwal). If you are obstructed from seeing it, then complete the month of Sha'ban thirty days." (HR. Bukhari Muslim)

لاتصوموا حتى تروا الهلال ولاتفطروا حتى تروه فإن غم عليكم فاقدروا له[8]

Meaning:

"Do not fast (Ramadan) until you see the crescent moon (indicating the beginning of Ramadan). And do not break your fast (at the end of Ramadan) until you see the crescent moon (indicating the beginning of Shawwal). If you are obstructed by clouds, then estimate." (HR. Bukhari Muslim)

The practice of *rukyah* has a long historical root in Islam, starting from the time of the Prophet Muhammad, followed by his companions, and remains a common practice to this day. When direct observation of the crescent moon is not possible, such as when the sky is covered with thick clouds, traditionally the Islamic month is considered to be completed at 30 full days, both for the month of Sha'ban and Ramadan. The observation of the moon and the practice of completing the month are described as methods consistent with the guidance left by the Prophet Muhammad, which is then acknowledged and followed by most Islamic jurists. Moreover, even contemporary scholars often adhere to this opinion, considering the observation of the crescent moon with the assistance of tools such as telescopes and other devices that enhance vision as equivalent to direct observation with the naked eye. Thus, if these tools are used to aid vision, this action is considered a form of seeing with the eyes. Consequently, in the view of

[7] Shahih Bukhari, *kitab as-shaum bab qawl an-nabiy idza ra'itum al-hilal*. Hadis nomor 1776. Shahih Muslim, *kitab as-shiyam bab wujub shaum ramadhan li ru'yati al-hilal*. Hadis nomor 1796.

[8] Shahih Bukhari, *kitab as-shaum bab qawl an-nabiy idza ra'itum al-hilal*. Hadis nomor 1774

many scholars, this practice is acceptable and permissible as a valid method for determining the beginning of the Hijri month.[9]

2. Getting to Know Radio Telescopes

Modern *rukyah* technology now truly exemplifies a fusion of scientific and Islamic principles. Muslim scientists have demonstrated how they can contribute by leveraging their expertise for the benefit of the Muslim community, particularly in uniting them in worship. Several alternative science and technology solutions have been proposed.

In addition to optical telescopes that use mirrors or lenses, astronomers also use other types of telescopes such as radio telescopes. According to the KBBI, a radio telescope is a sensitive and powerful radio receiver used to study celestial objects through radio waves. A radio telescope consists of a parabolic antenna that captures radio waves emitted by celestial objects. The combination of the telescope and its detector determines the reliability of astronomical devices in unraveling the darkness of the universe.[10] Radio telescopes are specifically designed to observe objects in the sky within the radio wave spectrum. This is different from optical telescopes, which are used to observe visible light and have the capability to view celestial objects across various radio wave lengths, including microwaves, millimeter waves, and centimeter waves.

Radio telescopes operate by detecting radio signals emitted or reflected by objects in space, such as stars, planets, galaxies, and other celestial bodies. These signals are then analyzed to understand the physical properties and behavior of these objects. Radio telescopes are used in various astronomical research, including studying the characteristics of stars, observing celestial objects obscured

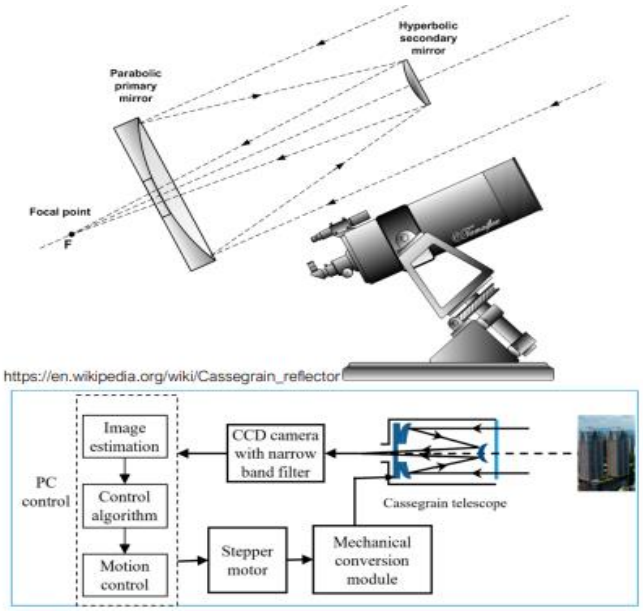
[9] Muhammad Nashiruddin, *Kalender Hijriyah Universal*, (Semarang: El-wafa, 2013),104.

[10] Peberlin Sitompul, *Teknologi Teleskop Radio Untuk Pencarian Objek Antariksa*, Pusat Pemanfaatan Sains Antariksa – LAPAN, 34

by dust or gas clouds, and exploring radio astronomical phenomena such as pulsars and distant radio sources in the universe.[11]

Radio telescopes typically have a large parabolic antenna shape and are used singularly. Both types of telescopes are usually placed far from urban centers or populated areas to avoid electromagnetic interference, such as from television broadcasts, radio, radar, and other sources of electromagnetic interference. Radio telescopes are often located in valleys, while optical telescopes are more commonly placed on mountain peaks. The fundamental difference between radio telescopes and conventional optical telescopes lies in the signals they capture. While optical telescopes receive electromagnetic waves in the form of visible light, radio telescopes capture electromagnetic waves in the form of radio signals. This means that optical telescopes are designed to observe objects in the spectrum of light visible to the human eye, whereas radio telescopes can detect radio signals far beyond the visible light spectrum, such as radio waves reflected by celestial objects.

Image 1: Illustration of How Optical Telescopes Work

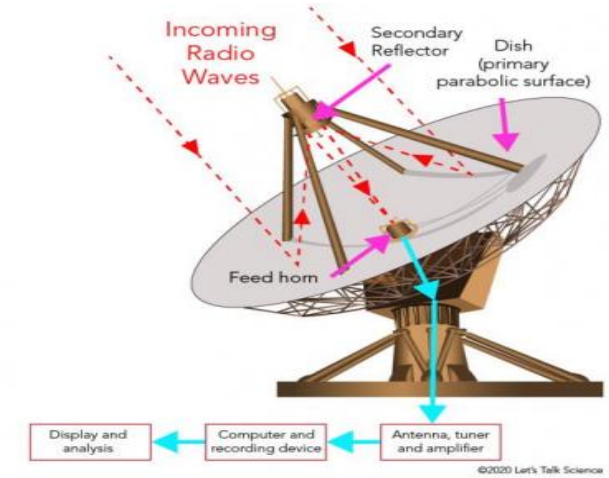


[11] Peberlin Sitompul, *Teknologi Teleskop Radio…*, 37

In contrast to the operational mechanism of optical telescopes, which observe celestial bodies using visible light. The operation of optical telescopes involves the collection of light emitted by the celestial body under observation. This light collection is facilitated by a lens or mirror known as the objective. The objective, characterized by its large diameter, functions to gather light from the celestial object. Subsequently, the collected light converges into an image at the focal point. This phenomenon arises from the refraction and concentration of light from various angles onto a single focal point. The focal point is where the image of the celestial object forms.

Certain modern optical telescopes employ additional lenses or mirrors called eyepieces to magnify the image formed at the focal point. These eyepieces serve to produce larger and more detailed images observable by astronomers. Positioned behind the eyepiece, observers view the enlarged image of the celestial object. They can utilize the eyepiece to adjust magnification or focus, enhancing clarity in observing the object. The primary advantage of optical telescopes lies in their capacity to deliver clear and detailed visual representations of celestial bodies. This capability enables astronomers to observe and analyze objects such as planets, stars, nebulae, and galaxies with heightened effectiveness.

Image 2: Illustration of How Radio Telescopes Work



Radio telescopes operate differently compared to optical telescopes that observe visible light. Radio telescopes collect electromagnetic radio signals emitted by celestial objects. These signals are often very weak and invisible to the human eye. The collected signals are focused into a single focal point. This is achieved using a large parabolic antenna and a parabolic reflector, typically made of metal. The focused radio signals then enter the receiver of the radio telescope. This receiver can detect weak signals and amplify them. The use of amplifiers in the receiver is a crucial step in this process. Subsequently, the amplified signals are converted into digital data. This data can be recorded and processed by computers for further analysis. Data obtained from radio telescopes can be processed using various mathematical and statistical techniques. This can reveal information about celestial objects, such as radial velocity, chemical composition, or signal intensity distribution. The main advantage of radio telescopes is their ability to observe celestial objects across various radio wavelengths, often inaccessible to optical telescopes. This enables astronomers to explore different aspects of the universe that may not be visible in visible light or other electromagnetic spectra.[12]

Observing celestial objects using radio telescopes often requires a larger allocation of funds compared to the use of optical telescopes.[13] This is because radio telescopes have more complex and expensive equipment, such as large parabolic antennas, sensitive radio signal receivers, and sophisticated data processing systems. Additionally, the location for installing a radio telescope must be carefully chosen to minimize electromagnetic interference, which sometimes requires additional investment in infrastructure development and maintenance. This funding also includes operational costs related to equipment maintenance

[12] Peberlin Sitompul, *Teknologi Teleskop Radio…,* 37

[13] Dhani Herdiwijaya, Hendro Setyanto, Akh Mukarram, *Peluang dan Tantangan Teleskop Radio dalam Penentuan Awal Bulan Hijriyah,* disampaikan pada webminar Diesnatalis HIMA Prodi Ilmu Falak UINSA, September 2021

and skilled staff. Despite the higher cost of observing with radio telescopes, the benefits are also significant. Radio telescopes can provide valuable data in understanding astronomical phenomena and celestial dynamics. With sensitivity to radio waves, these telescopes can detect signals that cannot be seen with the naked eye or optical telescopes, such as electromagnetic radiation emitted by neutron stars, black holes, and other celestial objects.

Radio telescopes have a significant advantage in their independence from weather conditions. Unlike visual observations, which are heavily influenced by weather that can hinder the observation of the crescent moon (hilal), radio telescopes can detect radio waves emitted by astronomical objects, including the crescent moon, without being affected by weather obstacles. This means that radio telescopes can be used for observing celestial objects even in adverse weather conditions such as thick clouds or rain, which often impede visual observations. Radio telescopes provide a greater possibility of obtaining consistent and accurate data in determining the appearance of the crescent moon as the sign of the beginning of the Hijri month without being overly influenced by weather factors.

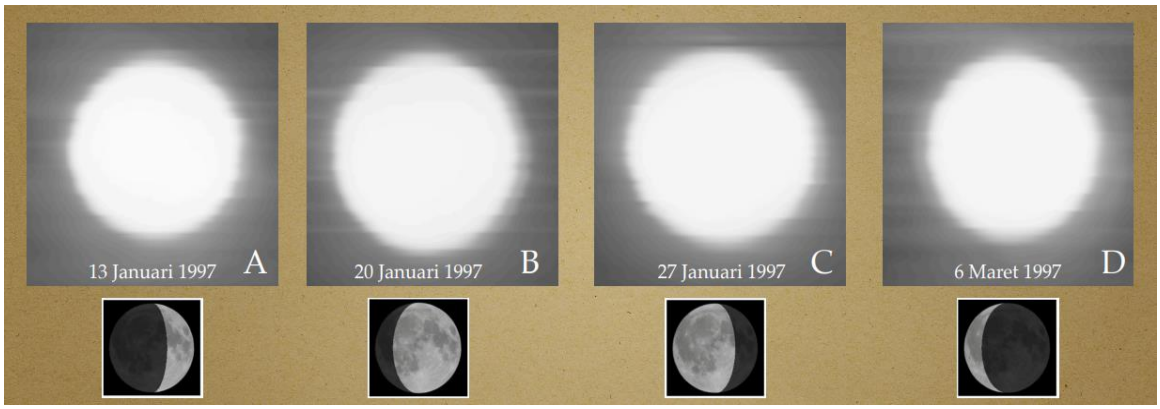


Image 3: Illustration of Radio Wave Capture from the Moon[14]

[14]Dhani Herdiwijaya, Hendro Setyanto, Akh Mukarram, *Peluang dan Tantangan Teleskop Radio dalam Penentuan Awal Bulan Hijriyah,* disampaikan pada webminar Diesnatalis HIMA Prodi Ilmu Falak UINSA, September 2021

The disk of the moon captured by a radio telescope does not always appear as the crescent moon. [15] The crescent moon phase occurs when only a small portion of the moon's surface is illuminated from Earth, indicating the beginning of a new moon. However, radio telescopes, operating at radio wavelengths, can detect radio wave sources from various perspectives on the moon. As a result, when observed through a radio telescope, the moon often appears as a full disk shining with consistent intensity. The main difference between radio wavelengths and visual light is that radio waves have the ability to penetrate much of the Earth's atmosphere without significant hindrance. Therefore, when a radio telescope observes the moon, it receives radio wave reflections that consistently show the moon in a full disk phase, even if it may appear as a crescent or thin phase to the human eye.

3. Radio telescopes in the perspective of Islamic jurisprudence (Fiqh)

The issue of using telescopes as aids for moon sighting (*rukyah*) in the perspective of Islamic jurisprudence (*fiqh*) remains a subject of contention among Islamic scholars, causing differences of opinion (*ikhtilaf*). There are two main perspectives regarding this issue. The first opinion considers *rukyah* (moon sighting) as an *ibadah mahdlah*, meaning worship that must be performed in the same manner as during the time of the Prophet Muhammad. In this view, some scholars argue that moon sighting should be done traditionally, with the naked eye without the assistance of any tools. They adhere to the principle of following the Prophet's *Sunnah* in carrying out worship practices. The second opinion holds that rukyah is not an *ibadah mahdlah*, but rather a method to determine the appearance of the new moon, i.e., determining the beginning of the Islamic month. According to this perspective, the use of aids in moon sighting is permissible. Scholars who respond positively to this view argue that modern

[15]Dhani Herdiwijaya, Hendro Setyanto, Akh Mukarram, *Peluang dan Tantangan Teleskop Radio dalam Penentuan Awal Bulan Hijriyah,* disampaikan pada webminar Diesnatalis HIMA Prodi Ilmu Falak UINSA, September 2021

technology, such as telescopes, is merely a tool that can assist in clarifying moon observations.

In Indonesia, Farid Ruskanda and several other scientists lead efforts to modernize traditional moon sighting (*rukyat*) by incorporating technology into the observation process. They seek to integrate tradition with technological advancements to facilitate and enhance the moon sighting process. Essentially, while moon sighting is fundamentally done through visual observation, there is an understanding that technology can be utilized to support human senses in the moon sighting process, as long as it adheres to the principles of Islamic law. This reflects a response to the changing times and the practical needs of the Muslim community in determining the beginning of the lunar month..[16] There is no explicit command or prohibition mentioning the use or prohibition of specific tools in the practice of moon sighting (rukyah) in the hadiths of the Prophet Muhammad (peace be upon him). Therefore, scholars of astronomy tend to interpret this issue as one that allows for flexibility. The use of moon sighting aids is considered a rational effort to achieve religious goals and make the practice of moon sighting more reliable.

Muhammad Bakhīt al-Muṭī'i is one of the scholars who permit the use of telescopes in the practice of moon sighting (*rukyat al-hilāl*), which involves observing the early crescent moon. His argument is that the telescope is actually used to observe the crescent moon itself (referred to as *'ainul hilāl*), and the device only serves as an aid to enhance vision of distant objects. Its usage can be likened to the use of eyeglasses for reading. In the view of Muhammad Bakhit al-Muti'i, the telescope is a tool that enables observers to see more clearly and accurately, similar to what is produced by the human eye when observing directly. In other

[16] S. Farid Ruskanda, "*Teknologi untuk Pelaksanaan Rukyah*", dalam Selayang Pandang Hisab Rukyat, (Jakarta: Direktorat Jenderal Bimas Islam dan Penyelenggaraan Haji Direktorat Pembinaan Peradilan Agama, 2004), 77

words, the telescope is used as an aid to better understand the phenomenon of moon sighting.[17]

Similarly, Ibn Qudamah al-Maqdisiy expresses his view that the use of optical tools, such as binoculars or observation glasses, can help improve the visual capabilities of the human eye during the process of moon sighting. This opinion reflects the view that the use of optical tools is a way to enhance the accuracy of observations and assist observers in situations where naked-eye observations may not be adequate, such as when the crescent moon is very thin or when weather conditions are unfavorable.[18]

This view is further affirmed by al-Syarwani, who explicitly states that the use of tools aimed at supporting or enhancing the sighting of the crescent moon in the practice of moon sighting is still considered rukyat (observation). In other words, al-Syarwani considers that the use of assisting tools intended to help observers see the moon more clearly or accurately remains consistent with the practice of moon sighting. In this context, even though such tools are used, the action is still regarded as rukyat because its purpose is to assist in the process of observing the moon, which remains the primary focus.[19]

Nusantara's Islamic astronomer, Manshur Betawi, also supports the use of aids in moon sighting (*rukyat al-hilāl*). Manshur Betawi, whose full name is Syeh Muhammad Manshur ibn Abdul Hamid ibn Muhammad, stated that observing the moon using a magnifying glass is equivalent to observing it directly with the naked eye, without any significant difference. This view is recorded in his book titled

[17] Muhammad Bakhit al-Muṭī'i, *Irsyad al-ahli al-Millah Ila Itsbat al-Ahillah,* (Mesir: Mathba'ah Kurdistan al-Ilmiyah, 1329 H), 293-294.

[18] Ibn Qudamah al-Maqdisiy, *Al-Mughniy 'ala Mukhtashor Al-Khoroqiy*, Beirut: Daar Al-Kutub Al-Ilmiah, 1996, 66

[19] Abdul Hamid al-Syarwani, *Hasyiyah Al-Syarwani ,* Jilid 3, (Beirut: Dar Al-Kutub al-Ilmiyah, t.t.), 332.

Mizan al-I'tidal fi Takmilati Jawab as-Su'al fi Mas'alati Ikhtilafi al-Matali'i wa Ru'yat al-Hilal.[20]

The majority of the scholars mentioned above view this technology as a useful tool to enhance the accuracy of observation. In the Middle East, for example, the Permanent Committee for Scholarly Research and Ifta' (al-Lajnah ad-Da'imah li al-Buhuts al-'Ilmiyyah wa al-Ifta') presents an analogy between the use of modern technology in moon sighting (ru'yatul hilal) and past practices. They refer to the fact that since ancient times, when there was not as much advancement in knowledge and technology as today, the Muslim community has been using aids such as towers to facilitate sighting of the moon.[21]

Furthermore, although Muhammad Bakhīt al-Muṭī'i explicitly states the permissibility of using tools in moon sighting (*rukyat al-hilāl*), there are some important notes to consider. First: The tools used in moon sighting must function to aid human vision in observing distant or small objects that may be difficult or impossible to see with the naked eye. In other words, these tools are designed to enhance the accuracy and clarity of human observation. Second: The use of aids in moon sighting must not involve light reflection. This is because the view is that if the use of a tool involves reflection, then what the observer sees is not the actual crescent moon itself, but only an image or shadow of the crescent moon reflected by the tool. Therefore, in this view, reflection is not considered valid for determining the beginning time of the Hijri lunar month. Thus, Muhammad Bakhīt al-Muṭī'i, while allowing the use of aids, sets important limitations regarding the types of tools that can be used and how they should be used in the context of moon sighting. The aim is to ensure that the practice of moon sighting remains in line with its original purpose, which is to observe the crescent moon in a way that

[20] Muhammad Manshur ibn Abdul Hamid ibn Muhammad, *Mizan al-I'tidal fi Takmilati Jawab as-Su'al fi Mas'alati Ikhtilafi al-Matali'i wa Ru'yat al-Hilal* (Jakarta: Penerbit Sayyid 'Ali ibn Abdillah Alaydrus, t.th), 34-35

[21] "*La Haraj min al-Isti'anah bi al-Ajhizah al-Haditsah li Ru'yat al-Hilal*" dalam laman al-Islam *Su'al wa al-Jawab*

enhances accuracy and precision, while maintaining the integrity of the practice according to certain fiqh perspectives.

In the context of using a telescope as an aid for moon sighting in Islamic jurisprudence, it is important to clarify that not all types of telescopes may meet the Sharia criteria. To meet the Sharia criteria, the telescope used for moon sighting must fulfill several conditions. Firstly, the telescope must be capable of directly observing the crescent moon without using reflection or additional light sources. This is crucial to ensure that the observation truly originates from the crescent moon itself, without interference from external factors. Secondly, the telescope does not have to be able to observe the crescent moon in various weather conditions, including when clouds cover the sky. This is important considering one of the indications in the hadith of Prophet Muhammad which commands to estimate or predict when the crescent moon is obscured by clouds.

Given these criteria, a radio telescope, or telescopes that utilize radio waves, not visual light, is a telescope that may be considered for moon sighting purposes. The operation of a radio telescope differs from that of an optical telescope used for visual observations. A radio telescope receives radio waves originating from astronomical objects (such as the moon) and converts them into electronic signals. This allows observers to observe astronomical objects even when visual light cannot reach them, such as when the crescent moon is very thin.

While the use of a radio telescope in moon sighting can provide highly accurate data about the moon's position, the difference lies in the fact that this is not the reflection of light but rather the detection of radio waves emitted by the moon. This is contrary to the principle of the view of scholars who allow moon sighting using technology because a radio telescope, although designed to assist observers in seeing the moon, produces a reflection of the moon's waves rather than a visual representation of the moon. The concept that the moon disk captured by a radio telescope does not always appear as a crescent moon raises the issue of whether the received radio waves are from the reflection of a new

crescent moon or even a reflection from an old crescent moon. Despite this, in the context of weather disturbances during moon sighting, the use of a radio telescope is not affected by weather conditions, including clouds that may cover the moon.

The existence of moon sighting (*rukyat*) within the jurisprudence of worship serves as the cause or rationale for the application of the command to fast. In this regard, the *taklifi* obligation lies in the command to fast. Moon sighting itself is considered to be *wadh'i* (causal), which means that it serves as a cause or reason for the application of *taklifi* law, in this case, the command to observe Ramadan fasting. The command to observe Ramadan fasting is the main goal or *ghāyah* in the context of this worship, while moon sighting, calculation (*hisab*), or other methods are considered as means or intermediaries to achieve that goal.[22]

Prophet Muhammad offered moon sighting (*rukyat*) as one of the ways to achieve the *ghāyah* (fasting or entering the month of Ramadan). However, it is important to remember that in the view of jurisprudence (*fiqh*), moon sighting is optional or one of the accepted methods. This means that if advancements in knowledge and science allow for the discovery of new ways to achieve the *ghāyah*, then these new methods also have the potential to be judged as causal (*waḍh'i*). In other words, jurisprudence acknowledges that throughout history, methods for achieving the *ghāyah* (fasting) may evolve in line with scientific progress without altering the essence of the worship command itself.

In the perspective of jurisprudence (*fiqh*), can the use of a radio telescope in determining the beginning of the Hijri month also be seen as a means (*wasīlah*)? In this view, the use of a radio telescope is indeed considered optional, which means its usage is not obligatory and can be an option as an assisting tool but not strictly necessary. If so, then the use of a radio telescope as a means for

[22] *Al-'amr bi al-Syai' amr bi wasailihi,* Abd al-Raḥmān bin Nāṣir al-Sa'dī, al-Qawāid al-Fiqhīyyah, (tt, al-Murāqabah al-Ṡaqāfah, 1428 H/2007M), 132.

determining the beginning of the Hijri month has the potential to be judged as causal (*wadh'i*). In this case, the use of a radio telescope can be a cause or factor influencing certain worship actions, especially when the start time of the month affects the implementation of worship such as fasting or Hajj.

The use of a radio telescope as a means for determining the beginning of the Hijri month in jurisprudence cannot be considered a means. This is because the operation technique of a radio telescope involves wave reflection, which is different from conventional telescopes used as an assisting tool for human eyes to see the visual crescent moon more clearly. Similarly, the wave capture of a radio telescope does not always appear as a crescent moon but always appears as a full disk.

Some aspects of Sharia do indeed provide limited flexibility to accommodate changes in society and technology. Scholars often debate how modern technology and science can interact with Islamic law that has been in existence for centuries. The advancement of science and technology can influence how individuals understand and practice Islamic teachings in certain situations. In many cases, scientific discoveries can result in fatwas that attempt to relate Sharia principles to modern realities. However, scientific discoveries will not fundamentally change Sharia in the sense of its core principles, which are considered religious decrees that cannot be replaced or altered by scientific or technological discoveries.

Science and technology have always played a significant role in the development of human civilization. In the context of Islam, science and technology can be used to facilitate the implementation of worship and enhance understanding of Sharia. It is important to remember that the development of science and technology should not be used to complicate the practice of worship for the faithful. Instead, the use of science and technology should aim to facilitate the implementation of worship and better understand the principles of religion.

The development of science and technology can be a useful tool in supporting the implementation of worship without changing the essence of Sharia itself.

D. Conclusion

The results of this research depict several important points. Firstly, the using of radio telescopes has been proven to provide highly accurate and objective astronomical data for monitoring the position of the moon, unaffected by weather conditions that may disrupt visual observations. This indicates that radio telescopes can offer reliability and high precision in determining the moon's position. In the context of fiqh, the use of radio telescopes cannot be accepted as an optional *wasīlah* that potentially has *wadh'i* law. This is due to the fundamental differences in operational techniques between radio telescopes and conventional telescopes. Radio telescopes involve the use of radio wave reflections, which are vastly different from the primary function of conventional telescopes designed as aids for human visual observation of the crescent moon to enhance clarity. Observations made with radio telescopes always show the moon in a full-disc phase, unlike visual observations that may capture the moon in a crescent or thin phase. However, radio telescopes still have the potential to serve as supportive tools to verify calculation results. This means that although radio telescopes are not recognized in fiqh as the primary method for determining the beginning of the Hijri month, they can function as auxiliary tools to help ensure consistency in determining the initial timing of the Hijri month, regardless of weather conditions.

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