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Syahadah Rukyatulhilal Using Astro Digital Imaging: From Subjectivity to Objectivity

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Abstract:

The process of determining the beginning of the lunar month based on *syahadah rukyatulhilal* often contains an element of subjectivity to witnesses which can only be confirmed by oath before a judge. Technological developments are expected to increase the objectivity of the process of *syahadah rukyatulhilal* by attaching the hilal image generated from Astro digital imaging. This study explains the importance of a new *rukyatulhilal* model based on digital data as witness reinforcement in the process of *syahadah rukyatulhilal*. By using a scientific and a fiqhiyah approach, research shows that developing a digital data-based rukyatulhilal model is significant in avoiding the subjectivity of the process and its results. This is following the spirit exemplified by the Prophet and the fuqaha' in accepting rukyatulhilal testimony by avoiding things that raise doubts. Using image evidence from astro digital imaging to corroborate rukyatulhilal's testimony does not violate fiqh, even the status of image as evidence is the same as witness status.

Keywords: astro digital imaging; image processing; syahadah rukyatulhilal.

Abstrak:

Proses penentuan awal bulan qamariah yang didasarkan *syahadah rukyatulhilal* sering kali mengandung unsur subjektifitas pada saksi yang hanya bisa dikonfirmasi dengan sumpah di depan hakim. Perkembangan teknologi diharapkan bisa meningkatkan objektifitas proses *syahadah* rukyatulhilal dengan lampiran citra hilal yang dihasilkan dari *astro digital imaging* (pencitraan digital pada objek astronomi). Penelitian ini memaparkan pentingnya model baru rukyatulhilal yang berbasis data digitalsebagai penguat saksi dalam proses *syahadah rukyatulhilal*. Dengan menggunakan pendekatan sains dan pendekatan *fiqhiyah,* penelitian menunjukkan bahwa pengembangan model *rukyatulhilal* yang berbasis data digital sangat penting dilakukan dalam rangka menepis subjektifitas proses dan hasilnya. Hal ini sesuai dengan semangat yang dicontohkan oleh Nabi dan *fuqaha'* dalam menerima kesaksian rukyatulhilal dengan menghindari hal-hal yang menimbulkan keraguan. Penggunaan bukti citra dari *astro digital imaging*untuk menguatkan kesaksian

rukyatulhilal tidak menyalahi fikih, bahkan status bukti citra itu sama dengan status saksi.

Kata Kunci: astro digital imaging; image processing; syahadah rukyatulhilal

Introduction

The process of determining the beginning of the lunar month (*qamariah*) in Indonesia cannot be separated from subjectivity. This can be seen from the understanding of the arguments[1] that have implications for parameters,[2] methods,[3] and criteria.[4] Subjectivity in the hisab method can be found in the application of various hisab models with varying degrees of accuracy. Each model has practitioners who believe in absolute accuracy in their model. In the *rukyat* method, subjectivity can be seen from the claims of the success of *rukyat* at a critical position of the *hilal* height or has not attained *imka>n rukyat*. The subjectivity can be seen from several criteria made by mass organizations, which tend to prioritize legitimacy contestation rather than consideration of the benefit of the people.[5]

The process of determining the beginning of Ramadan and Zulhijah 1442 Hijri is a few examples of the subjectivity of determining the beginning of the lunar month because of the height of the hilal, according to hisab, is still critical. The hilal position at the beginning of the month of Ramadan and Zulhijah in the hisab method is similar, with a range of elevation values from 2 to 3.5 degrees for various regions in Indonesia. Reports from various observation points scattered throughout Indonesia, as recorded in the NU hilal observation network "Hilal Record," in which the author is also involved in this activity, show that there is no area that has a maximum brightness level that can be used as an ideal parameter for observing the hilal. Professional circles in the field of observation (Bosscha Observatory, National Institute of Aeronautics & Space, and the Meteorology, Climatology, & Geophysics Agency) have not succeeded in detecting the hilal. Reports of success

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[1]Ali Imron, *"Pemaknaan Hadis-Hadis Hisab-Rukyat Muhammadiyah dan Kontroversi yang Melingkupinya," Jurnal Studi Ilmu-Ilmu Al-Qur'an Dan Hadis* 15, No. 1 (2014), 3-7. http://ejournal.uin-suka.ac.id/ushuluddin/alquran/article/view/1185.Muhammad Rezi, *"Pemahaman Hadis-Hadis Rukyat Hilal dan Relasinya dengan Realita Isbât Ramadhan di Indonesia," Al-Hurriyah: Jurnal Hukum Islam* 1, No. 1 (2016): 111–27.

[2]Judhistira Aria Utama and - Hilmansyah, "PENENTUAN PARAMETER FISIS HILAL SEBAGAI USULAN KRITERIA VISIBILITAS DI WILAYAH TROPIS," *Jurnal Fisika* 3, no. 2 (November 28, 2013), https://doi.org/10.15294/jf.v3i2.3821.M. Raharto and N. Sopwan, *"Umur Bulan Sebagai Parameter Visibilitas Hilal," Prosiding Seminar Nasional Fisika (SNF)* 3 (2019): 26–29.

[3]Ahmad Yunan Siregar, *"Metode Hisab dalam Rangka Menyelesaikan Perbedaan Puasa Arafah Antara Indonesia dengan Arab Saudi: Telaah Atas Pemikiran Profesor Syamsul Anwar," AT-TAFAHUM: Journal of Islamic Law* 1, No. 1 (May 22, 2017), http://jurnal.uinsu.ac.id/index.php/attafahum/article/view/665.

[4]Muh Ma'rufin Sudibyo, *"Observasi Hilāl di Indonesia dan Signifikansinya dalam Pembentukan Kriteria Visibilitas Hilāl," Al-Ahkam* 24, No. 1 (2016): 113–44; Mutoha Arkanudin and Ma'rufin Sudibyo, *"Kriteria Visibilitas Hilal Rukyatul Hilal Indonesia (RHI) (Konsep, Kriteria, dan Implementasi)," Jurnal Al-Marshad* 1, No. 1 (February 24, 2017), http://jurnal.umsu.ac.id/index.php/almarshad/article/view/737; Hendro Setyanto and Fahmi Fatwa Rosyadi Satria Hamdani, *"Kriteria 29: Cara Pandang Baru dalam Penyusunan Kalender Hijriyah," Al-Ahkam* 25, No. 2 (2015): 205–20.

[5]Ridwan Ridwan and Muhammad Fuad Zain, "Religious Symbol on Determining the Beginning and End of Ramadan in Indonesia," HTS Teologiese Studies / Theological Studies 77, No. 4 (August 5, 2021), https://www.ajol.info/index.php/hts/article/view/212044.

were actually obtained from non-professional circles with a naked eye observation model. Three of the several points that reported successful hilal observations were in East Java, namely Lamongan, Gresik, and Jember.[6] Reports on the success of observing the hilal from the three locations are applying naked eye method, and verification of the validity of the witness can only be done by oath before a judge.

This fact is so contradictory when professionals, armed with adequate knowledge and equipment, seem to lose to non-professionals who are full of limitations with the naked eye observation model.[7] The range of hilal height values between 2-4 degrees is in the critical category. For the record, no professional astronomer has been able to obtain observations more than this altitude value. As a reference for comparison of data, for example, the record for observing the hilal from professionals, members of the Islamic Crescent Observation Project and the International Astronomical Center network, is 7.6 degrees for the naked eye category and 5.0 degrees for the optical aid observation category.[8]

In the fiqh study, the oath before a panel of judges is considered sufficient to determine the beginning of the lunar month, as exemplified by the Prophet Muhammad and the next generation of the ulama. In terms of *isbat* at the beginning of the month, the Prophet did teach in a simple way, namely by taking an oath.[9] At first, what the Prophet taught was simple. However, when examined in-depth, taking an oath to a person who claims to have witnessed the hilal indicates that the Prophet wanted a truly objective witness. At that time, there was definitely no other way to measure the objectivity of testimony except by taking an oath, so the ulama in the next era set several criteria for witnesses; for example, the witnesses must be *adil* (fair)*, 'aqil* (knowledgable), and *baligh* (mature).[10]

In this era, verifying the results of the observation of the hilal must adapt to conditions supported by advanced technological developments. At the time of the Prophet, oaths were relied on to verify the truth of the observation. Nevertheless, this is undoubtedly imperfect at this time if there is no involvement of technology to support data verification. One technology that is relevant to help verify observational data is Astro digital imaging or digital imaging of astronomical objects, namely an observation model using a particular device to detect and record

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[6] *"PBNU: Ramadhan Mulai Selasa 13 April,"* nu.or.id, accessed October 26, 2021, https://nu.or.id/nasional/pbnu-ramadhan-mulai-selasa-13-april-NU0FR; Kompas Cyber Media, "PBNU: 1 Ramadhan 1442 H Jatuh pada 13 April 2021," KOMPAS.com, April 12, 2021, https://nasional.kompas.com/read/2021/04/12/19243321/pbnu-1-ramadhan-1442-h-jatuh-pada-13-april-2021.

[7] Muhammad Faishol Amin, *"Ketajaman Mata Dalam Kriteria Visibilitas Hilal," Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan* 3, num. 2 (December 30, 2017), https://doi.org/10.30596/jam.v3i2.1526.

[8] "International Astronomical Center (IAC)," accessed on October 26, 2021, https://www.astronomycenter.net/record.html?l=en.

[9] جَاءَ أعرَابِيٌ إِلَى النَّبِي صَلَّى اللهُ عَلَيهِ وَ سَلَّمَ فَقَالَ إِنِي رَأيتُ الهِلالَ قَالَ أَتَشهَدُ أَن لاَ إِلهَ إِلاَّ اللهُ؟ أَتَشهَدُ أنَّ مُحَمَّدًا رَسُولُ اللهِ ؟ قَالَ نَعَم قَالَ يَا بِلالُ ! أَذِّن فِي النَّاسِ أَن يَصُومُوا غَدًا

al- Tirmiz, *al-Jami' al-Sahih*, vol. 3 (Beirut: Dar al-Fikr, tt), 74; al- Nasai, *Sunan al-Nasai.*, vol. 4 (Beirut: Dar al-Fikr, tt), 172; Abu Dawud, *Sunan Abi Dawud*, vol. 1 (Beirut: Dar al-Fikr, tt), 715.

[10] Wahbah al-Zuhayli, *al-Fiqh al-Islami wa Adillatuh*, Cet. Ke 3, vol. 2 (Damaskus: Dar al-Fikr, 1989), 598–604; Muh}ammad Buh}ait al-Muti'i, *Irsyad Ahl al-Millah ila Is bat al-Ahillah* (Egypt: Kurdistan al-'Ilmiyah, 1329), 12–22.

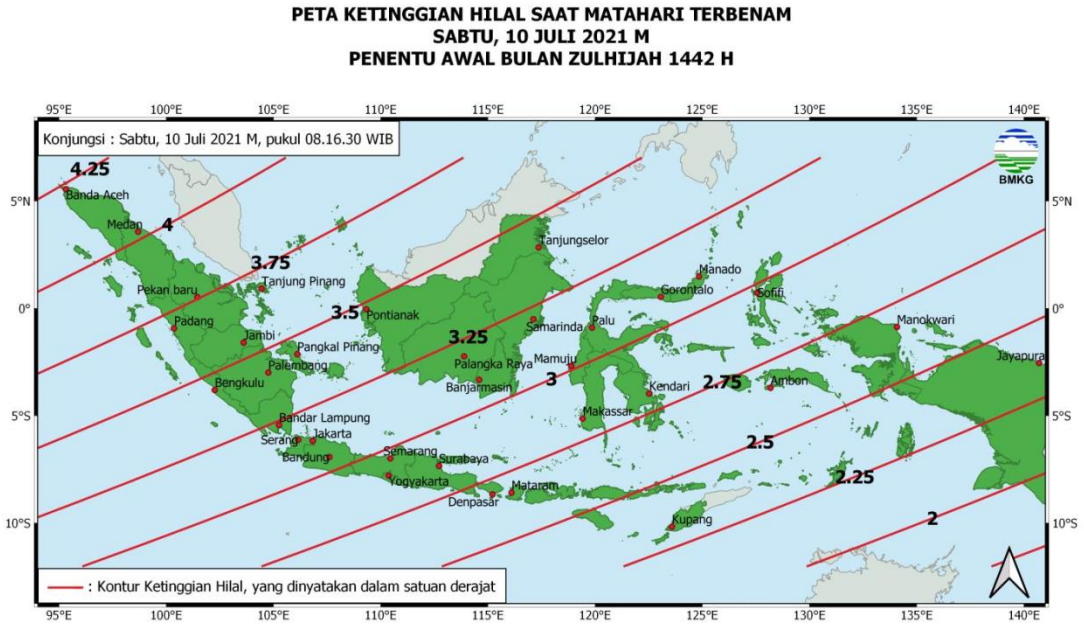
the hilal so that the resulting output is a hilal image that can be interpreted, analyzed objectively and transparently and avoid doubtful things.

This study describes the urgency of developing the *rukyatulhilal* model by applying the Astro digital imaging model to a more measurable *rukyatulhilal* to increase the objectivity and validity of the data, especially in the *syahadah* rukyatulhilal process, so that the results are legally valid and scientifically accountable. The approach used in this research is a combination of science and fiqhiah approaches. The author obtained Astro digital imaging technique data obtained by participatory observation methods during 2014-2019 with professionals in the field of astronomical observation, including Mr. Thierry Legaulth (A French Astronomer, a world record holder for observing the crescent moon during conjunction), Bosscha Observatory, BMKG (Meteorology, Climatology, and Geophysical Agency), LAPAN (National Aeronautics and Space Agency), and Imah Noong.

Results and Discussion

The Subjectivity of Rukyatulhilal in Indonesia and the Urgency of Astro Digital Imaging

The results of *rukyatulhilal* at the beginning of Ramadan and Zulhijah 1442 Hijri, which are the basis for *isbat* at the beginning of the month, are filled with subjectivity. This can be seen from *hisab* data, the condition of the western horizon during the implementation of *rukyat*, and the time of seeing the *hilal*. Based on an up-to-date *hisab* system, especially in the contemporary category, the height of the *hilal* before Ramadan 1442 Hijri for the Indonesian region is seen in 2.25–3.25 degrees and the height of the hilal before Zulhijah 1442 Hijri is in 2–4.25 degrees.



Source: BMKG (Meteorology, Climatology, and Geophysical Agency)

There has never been any data on the success of witnessing the *rukyatulhilal* in this altitude range that both domestic and foreign astronomers could scientifically verify. The hilal in the altitude range, as in the case above, is often reported by observers with an inadequate background in *ilm al-Falak* or astronomy, which of

course, raises doubts. Is it true that the object they observe is the hilal? As reported on the "Hilal Record" network, the condition of the western horizon during the implementation of *rukyatulhilal* in general in these two vital months is not perfectly bright. For example, in one of the places that reported seeing the hilal, and the western horizon was covered with thick clouds. This was reported just before sunset. This condition is clearly seen in the photo a few moments before *Maghrib* (dusk), which observers uploaded.

Source: Hilal Record

The photo depicts the condition of the western sky, which is very dense and covered with thick clouds when the *rukyat* is carried out. However, some observers state that they can see the *hilal* with their naked eyes sometime after sunset, even though the value of the hilal's illumination at that time was only 0.1%. Another unique thing happened to the process of observing the *hilal* in Ramadan 1442 Hijri, in which observers reported the success of witnessing *rukyat* at 5:40 PM (Western Indonesian Time) in Jember. The observation location in Jember faces a stretch of rice fields with western horizon conditions covered with trees and houses of residents, with a horizon barrier height of about one degree. The *hilal* in Jember sunset is at 5:42 PM (Western Indonesian Time) according to the *hisab* method, and every one-degree of *hilal* height equals four minutes (when converted into units of time). When the clock is at 5:40 PM (Western Indonesian Time) in Jember, that means two minutes before the *hilal* sets for the horizon height of zero degrees, and when the horizon height in Jember is one degree, then the *hilal* has set at 5:38 PM (Western Indonesian Time) according to the *hisab* method, but the rukyat observers reported that they succeeded in seeing the hilal at 5:40 PM (Western Indonesian Time), or two minutes after sunset according to astronomical calculations.[11] This is an example of the subjectivity of *rukyatulhilal* in Indonesia, which needs to be

[11] *"Tim Rukyat NU Jember, Gresik, Dan Lamongan Melihat Hilal | BANGSAONLINE.Com - Berita Terkini - Cepat, Lugas Dan Akurat,"* accessed on December 26, 2021, https://www.bangsaonline.com/berita/89473/tim-rukyat-nu-jember-gresik-dan-lamongan-melihat-hilal.

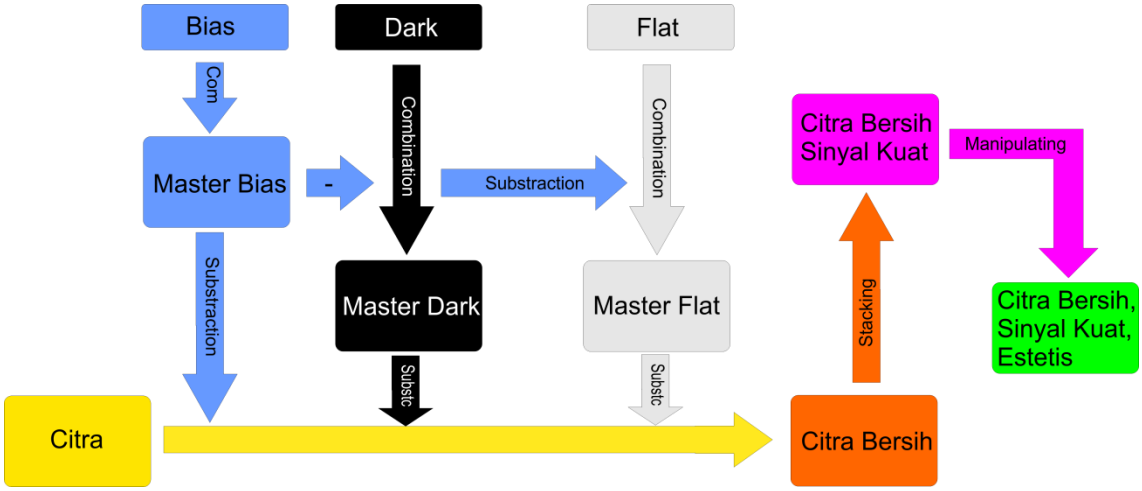
addressed with various tools and methods, and one of them is Astro digital imaging.

Digital Imaging is the process of imaging or recording particular objects using digital devices. The reference to the word "astro" indicates specialization to specific objects that are targeted, which in this case are astronomical objects, such as the *hilal*. By processing and managing the results using digital tools, the analysis of the results will be easier and more flexible so that the level of validity of the results is accountable. Astro digital imaging is a further process of astronomical observations using tools. Previously, optical technology was used to clarify objects, and then the digital imaging process continued with the recording process.

The assumption of the term digital is usually associated with accuracy and perfection, but in reality, there is a law of Physics that states that "perfection does not exist."[12] This also applies to the devices used in Astro digital imaging, which are also not free from shortcomings. Even the light captured by the most sophisticated sensors will not be free from flaws in the form of artifacts[13] caused by imperfections and limitations of the sensors and optics used in the imaging process. Each imaging device will always include artifacts that are also recorded in the raw image during the recording process. Following the law of Physics that there is no perfection in the real world, the digital image produced by the digital imaging process also needs to be further processed to get even more perfect results, and the process is called image processing. Image processing aims to reduce or eliminate defects or artifacts that always follow in every imaging process so that the processed image will be easier to be interpreted by computers or the human eye.[14] Several algorithms can be used to reduce or eliminate the inherent defects of an image generated by the camera sensor so that the image will be more scientifically accurate and aesthetically pleasing. The main principle in image processing is the signal-to-noise ratio.[15] Thus image processing can be referred to as an attempt to clean the image from unwanted effects, increase the signal, and at the same time, reducing the noise. However, the noise will also basically increase as the signal increases.

There are several stages of image processing to obtain an aesthetically accurate image with a solid and good signal. The flow and stages of processing are described in the following diagram:

[12]Thierry Legault, Astrophotography, 1st edition (Santa Barbara, CA: Rocky Nook, 2014), 43.
[13]An artifact is something that is observed in a scientific investigation or experiment that appears and does not occur naturally, as a result of a preparatory or investigative procedure.
[14]Chris Woodhouse, The Astrophotography Manual: A Practical and Scientific Approach to Deep Space Imaging (New York: Focal Press, 2016), 193.
[15] Noise is any disturbance that affects a signal and appears automatically. In digital photography, noise manifests as random dots or changes in color values in an image. Barbara A. Lynch-Johnt and Michelle Perkins, Illustrated Dictionary of Photography (Buffalo, NY: Amherst Media, 2008), 76.



First is Image Calibration, the process of correcting image data from systemic errors in the measurement system.[16] This process is essential to get the best results from an image. When a photographer does an image recording, the results are not only the desired data but also extraneous data that needs to be removed or deleted with specific techniques to reveal good data. Light is not the only signal element collected by a camera's sensor in the image-making process. Other elements permanently attached to every image can cause imperfections, such as thermal signals, signal bias, and uniformity defects. The process of correcting unwanted elements is vital, especially in the long exposure imaging process.[17] The image calibration process will produce a clean image, a light frame free from random and systematic error signals so that only the desired signal remains. This process can be done using three types of image frames, bias, dark, and flat, which are described by the following formula:[18]

$$\text{Clean Image} = \frac{\text{RAW(light) frame} - \text{dark frame}}{\text{Flat-field frame} - \text{bias frame}}$$

A light frame contains the actual image data of the object being photographed. Each pixel in the light frame contains the signal data of the observed object and all random and systematic error signals captured by the camera and lens sensors. The bias frame is the image frame used to remove the readout signal from the camera sensor. When a pixel has not received any signal, the camera still has a variety of other ways of reading data from a sensor. A flat frame is an image frame used to correct optical imperfections and correct for variations in sensitivity across pixels in the sensor. By using a flat frame, the uneven image due to variations in sensor sensitivity or noise attached to the sensor and optics will be flat and balanced, and this calibration process will produce a clean image.

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[16]Gerald R. Hubbell, Scientific Astrophotography: How Amateurs Can Generate and Use Professional Imaging Data, Patrick Moore's Practical Astronomy Series (New York: Springer, 2013), 176.

[17]Thermal signal is heat noise, also called hot pixel, caused by the activity of electrons in camera sensors or related amplifier circuits. Signal bias is noise that causes small random variations around the mean value. Uniformity Defects are the sensitivity variations of various pixels across the sensor. Legault, Astrophotography, 43.

[18]Legault, 49.

After obtaining a clean image, the next step is to amplify the clean image signal. Steps to amplify the signal are carried out by aligning or combining some clean image frames or calibrated images in one image frame or called stacking, and the main objective is producing a signal-to-noise ratio (to increase the signal-to-noise ratio). Mathematically, an object's signal-to-noise ratio is the brightness of the pixels divided by the brightness of the associated noise. For example, if an object has a count of 2,000 and the amount of noise is 10, then the signal-to-noise ratio is 200 (2,000/10). If applied to an image of a very dim object, it will be found that the number of pixels caused by the object will not be much greater than the noise, i.e., the variation in brightness of the dark parts of the image. An image with spots is a sign of a low signal to noise ratio, and an image with a bright target and a flat dark background indicates a high signal-to-noise ratio.

The working principle of stacking is that when multiple images of the same scene are combined, the noise component of one image tends to cancel out the noise of the other image, and the final image can be dramatically improved. In other words, the more the number of frames that are combined, the better the results will be. For example, if combining four images, noise can be decreased by a factor of two, merging twenty-five images, noise can be decreased by a factor of five, stacking a hundred images, the final image can reduce its noise by a factor of ten. Thus, the level of noise reduction achieved is the square root of the number of merged images.[19]

The previous two processing stages (image calibration and stacking) are referred to as pre-processing and processing. The result of both processes is a clean color image, or a set of monochrome ones, with a strong signal. These two processing steps can be considered sufficient because the final result is a clean image with a strong signal. However, these two stages of the process are considered insufficient for particular objects based on pursuing the aesthetic aspects of the recorded object. Therefore, it is necessary to add one more stage of the process, which is commonly known as image manipulation. Image manipulation (sometimes called post-processing) is a substantial activity to fulfill various aesthetic needs. Activities in post-processing include; enhancing the color of objects, correcting cosmetic defects and improving composition, sharpening and enhancing the structure, enhancing subtle details and increasing contrast, managing hue and color saturation, and so on.[20]

The whole processing series, both pre-processing, which consists of calibration, processing by combining images, and post-processing, are carried out with a software. Some software only provide pre-processing to processing menus, but some software provide complete menus ranging from pre-processing to post-processing. Image processing is actually not necessary in *rukyatulhilal*. Image processing is required according to the conditions surrounding the *hilal*, from the age of the *hilal* to other factors that affect the level of visibility. Based on experience in the field, detecting a *hilal* more than 24 hours old does not require image processing. However, image processing is still needed when the purpose of

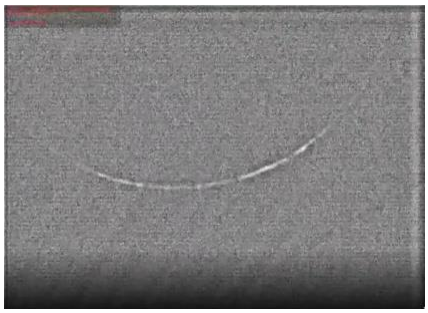
[19]Grant Privett, Creating and Enhancing Digital Astro Images, Patrick Moore's Practical Astronomy Series (London: Springer, 2007), 51–55.
[20]Woodhouse, The Astrophotography Manual, 193.

observation and recording is not only to detect the *hilal* but also to get a good and easily recognizable image.

Image processing is crucial in the *rukyatulhilal* process with critical *hilal* conditions, or when the *hilal* age is less than twenty hours because the light area is very thin and the light is very weak. In critical *hilal* conditions, image processing is necessary in detection process. Because in this condition, the hilal often cannot be detected directly by looking through a telescope and can only be detected after image processing has been carried out on the *hilal* recording. In general, image processing aims to improve the recorded image. In practice, there are several stages and levels according to Image processing with the expected goals and quality. For the critical *hilal* that cannot be detected directly with a telescope, complete image processing is essential, namely the image calibration process or image cleaning, image signal strengthening, and level adjustment or post-processing.

The stages in image processing will affect the sharpness of the object. For example, in the case of handling the critical *hilal* (young age and small elongation) at the beginning of Zulhijah 1438 Hijri (August 22, 2017), which was recorded and processed by the Bosscha Observatory team in Kupang, East Nusa Tenggara and the BMKG team in Waingapu, East Nusa Tenggara, on the same day and place with a good atmosphere. However, the results obtained with different instruments and processing are also quite different. With an astronomical camera, the Bosscha Observatory team carried out a complete processing (three stages). The BMKG team armed with a DSLR camera only carried out one processing stage, namely the manipulation process (post-processing). The difference in this processing model is indeed motivated by different goals. The Bosscha Observatory team targets a clear new moon image with a powerful signal, so there is no doubt about the interpretation of the image. In contrast, the BMKG team aims to maintain the natural nature of the hilal, which is not much different from the background color.

The Bosscha Observatory team detected the *hilal* in Kupang, East Nusa Tenggara, at 17:44 WITA (Central Indonesia Time), and the BMKG team in Waingapu, East Nusa Tenggara, at 17:58 WITA coincided with the start of sunset at the two observation locations.



Hilal Image by Bosscha Hilal Image by BMKG

Source: Bosscha Observatorium and BMKG

Astro digital imaging, with its processing series, is a measurable activity that produces an output in the form of an objective image so that the output of this series of processes is strong evidence of whether or not the hilal appears. These measurable activities and processes present objective data, in contrast to the naked eye observation, which is attached to subjective originating from the observer's

nerves of consciousness and other disturbances surrounding the hilal. Although Astro digital imaging with a series of processes is a measurable activity that produces objective and measurable outputs, this method is not the only determinant of the success of rukyatulhilal. Weather also plays a crucial role because Astro digital imaging works on light waves, which are naturally invisible when obstacles exist. The conclusion is that Astro digital imaging is not a process of showing the light that never exists but ensuring the presence or absence of light from a particular object.

Astro Digital Imaging in the *Syaha<dah* Rukyatulhilal

The visibility of the hilal is the primary goal of the rukyatulhilal implementation. The sight of the hilal is one of the guidelines for entering a new month in the Hijri calendar. In the Hijri calendar, the entry of a new month is the initial guideline for implementing worship so that a strong belief in the true results of rukyatulhilal is vital as the basis for guidance. The Prophet (Muhammad PBUH) once gave a technical example in determining the beginning of a new month, namely the beginning of the fasting month of Ramadan, with his acceptance of reports or testimonies of his companions about the sighting of the hilal. The report or testimony from his companion was used as the basis for the Prophet to determine the beginning of the worship (fasting of Ramadan). Historical records that explain this are:

عَنِ ابْنِ عُمَرَ قَالَ تَرَاءَى النَّاسُ الْهِلاَلَ فَأَخْبَرْتُ رَسُولَ اللَّهِ -صلى الله عليه وسلم- أَنِّى رَأَيْتُهُ فَصَامَهُ وَأَمَرَ النَّاسَ بِصِيَامِهِ[21]

Meaning: From Ibn 'Umar RA. he said: People have seen the hilal, then I told the Prophet Muhammad (PBUH). That I also saw it, then the Prophet fasted and ordered the people to fast.

عَنْ رِبْعِيِّ بْنِ حِرَاشٍ عَنْ رَجُلٍ مِنْ أَصْحَابِ النَّبِيِّ -صلى الله عليه وسلم- قَالَ اخْتَلَفَ النَّاسُ فِى آخِرِ يَوْمٍ مِنْ رَمَضَانَ فَقَدِمَ أَعْرَابِيَّانِ فَشَهِدَا عِنْدَ رَسُولِ اللَّهِ -صلى الله عليه وسلم- بِاللَّهِ لأَهَلاَّ الْهِلاَلَ أَمْسِ عَشِيَّةً فَأَمَرَ رَسُولُ اللَّهِ -صلى الله عليه وسلم- النَّاسَ أَنْ يُفْطِرُوا.[22]

From Rib'i bin Hirasy, from one of the companions of the Prophet (PBUH), he said: People have different opinions about the last day of Ramadan, so two Arabs came and testified in the name of Allah before the Prophet (PBUH), that they both saw the crescent moon yesterday afternoon. So, the Prophet (PBUH) ordered the people to do *iftar* (breaking the fast).

عَنْ عَبْدِ الرَّحْمَنِ بْنِ زَيْدِ بْنِ الْخَطَّابِأَنَّهُ خَطَبَ النَّاسَ فِي الْيَوْمِ الَّذِي يُشَكُّ فِيهِ فَقَالَ أَلَا إِنِّي جَالَسْتُ أَصْحَابَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ وَ سَأَلْتُهُمْ وَإِنَّهُمْ حَدَّثُونِي أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ

[21]Sulayman bin al-Asy'as al-Sijistani Abu Dawud, *Sunan Abi Dawud* (Riyad}: Maktabah al-Ma'arif, 1424), 411.
[22]Abu Dawud, 411.

عَلَيْهِ وَسَلَّمَ قَالَ صُومُوا لِرُؤْيَتِهِ وَأَفْطِرُوا لِرُؤْيَتِهِ وَانْسُكُوا لَهَا فَإِنْ غُمَّ عَلَيْكُمْ فَأَكْمِلُوا ثَلَاثِينَ فَإِنْ شَهِدَ شَاهِدَانِ فَصُومُوا وَأَفْطِرُوا[23]

From 'Abdurrahman bin Zaid bin Al Khaththab that he preached before people on a day that doubted to fast. Then he said; You should know that I once sat with the companions of the Messenger of Allah, and I asked them. They told me that the Messenger of Allah (PBUH) saying: Fast when you see it (*hilal*), break your fast when you see it (hilal) and slaughter the sacrifice because you see it (hilal). If it (hilal) is closed from your view, complete the count of months to thirty days; if there are two witnesses, fast and do your *ifthar*.

The example the Prophet gave in setting the beginning of the month is simple, by receiving a report directly or receiving a report under one condition, namely an oath. However, if studied in-depth, example of the Prophet actually contains a lesson that the Prophet really expects the objectivity of testimony. When the reporter was Ibn 'Umar, the Prophet immediately accepted the report because he already fully understood the capacity and credibility of Ibn' Umar. This is natural, so the Prophet (Muhammad PBUH) immediately accepted the report and certainly validated the truth of the report. However, when the reporters were people whom he did not know well (two Arabs), he had to ascertain the truth of the report by taking oath. In that era, taking an oath was certainly the only way to measure the truth and objectivity of a witness because, logically, there would be no companion who would dare to lie to the Prophet. However, in the name of the certainty and objectivity of the testimony, the Prophet needs to take the oath of the witnesses. Taking an oath is undoubtedly the most feasible way to know the truth and objectivity of a witness at that time.

In the next era, the ulama developed the advanced testimony technique (*syahadah)* in accepting the results of rukyatulhilal. According to the *Mazhab* (Islamic school of thought) of Hanafi, the testimony (*syahadah)* of the results of rukyatulhilal must meet several conditions, namely: rukyatulhilal is performed when the weather is sunny and the testimony (*syahadah)* must involve a large number of witnesses. According to this *mazhab*, the large number of witnesses is intended to bring a conviction and certainty to something that is conveyed. This *mazhab* does not accept individual testimony in clear sky conditions because, according to this *mazhab*, testimony that is contrary to public opinion in normal conditions will show the error of the testimony. While the weather is not sunny or cloudy, according to this *mazhab*, testimony can be done by one person who meets the criteria: Muslim, '*adil, 'aqil, baligh,* either a man or a woman. The nature of '*adil,* in this case, is the nature inherent in a Muslim man or woman, where his or her good qualities outweigh the bad. According to this *mazhab*, individual testimony must be done before a judge or imam, even if it does not use the use of the sentence

[23]Abu 'Abd al-Rahman bin Shu'ayb al-Nasai, *Kitab Al-Sunan al-Kubra*, vol. 2 (Beirut: Dar al-Kutub al-'Ilmiyah, 1991), 99.Ahmad bin Muhammad Ibnu Hanbal, *Musnad Al-Imam Ahmad Bin Hanbal*, vol. 31 (Beirut: Muassasah al-Risalah, 1417), 190.

"*asyhadu*". *Mazhab* Hanafi also allows a person to testify on the testimony of others.[24]

Mazhab Maliki divides *syahadah* rukyatulhilal into three kinds. First: *Syahadah* can be carried out by a large number of congregations, namely some people who are believed it to be impossible to agree to lie. In this case, they are not required to be '*adil* and independent as a whole. In addition, they are also not tied to a particular gender. Second: *Syahadah* can be done by two people or more who are *adil*. The *Syahadah* of two or more people *adil* applies to implementing of rukyatulhilal in clear or cloudy sky conditions. The definition of *adil,* according to *mazhab* Maliki, is a man who is unrestrained, mature, and sane, who does not commit major sins and does not get used to minor sins, and always maintains *muru>'ah*. This *mazhab* holds that the testimony of a man (*adil)* or a woman (*adilah)* will not be accepted, as will the testimony of two women (*adilah).* However, such testimony is still binding personally on the witness, even though this testimony is legally rejected (cannot be used as a basis for the public), the witness is obliged to start or end the fast before the general public. *Mazhab* Maliki also allows witnessing the testimony of others on the condition that the number of witnesses and the nature of the witnesses are in balance with the number and nature of the original witnesses. Such testimony does not have to use the sentence "asyhadu". Third, the *Syahadah* of one *adil* person. According to *mazhab* Maliki, a *Syahadah* like this should not be used as the basis for a decision that is applied to the public. This *Syahadah* only applies to the witness personally and to those who believe and are willing to accept his testimony.[25]

According to *mazhab* Syafi'i, the *syahadah* rukyatulhilal, used as a guide and applied to the public when starting the fast is written in *qawl qadim,* can come from one witness who meets the following criteria: Muslim male, *'adil, baligh,* '*aqil,* and independent. This statement is different from the explanation in *qawl jadid,* that the *syahadah* rukyatulhilal as the basis for determining the beginning and end of fasting must come from two witnesses who are *'adil*. The witness must use the word "*asyhhadu*" in his testimony. In the case of a witness whose testimony is not accepted by the judge because he does not meet the requirements as stated, the witness is still bound by what he witnessed. In other words, the testimony binds him personally even though it cannot be used as the basis for decisions that apply to the public.[26]

In the *mazhab* Hambali, there is a difference between *syahadah rukyatulhilal* as the basis for determining the beginning of fasting and the beginning of another month. The basis for determining *syahadah rukyatulhilal* for the beginning of fasting can be taken from a Muslim who is *adil* in body and mind, *mukallaf* both male and female, and a free person or an enslaved person. The testimony of a person determined by the judge must be followed and implemented. According to this

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[24]Muh}ammad Amin Ibnu 'Abidin, *Radd Al-Mukhtar 'ala al-Durr al-Mukhtar Syarh} Tanwir al-Absar*, vol. 3 (Riyad}: Dar 'Alam al-Kutub, 2003), 356.

[25]'Abd al-Karim bin Muhammad bin 'Abd al-Karim al-Rafi'i, *Al-Syarh al-Kabir*, vol. 3 (Beirut: Dar al-Kutub al-'Ilmiyyah, 1997), 173–78; al-Habib Ibnu Tahir, *Al-Fiqh al-Maliki Wa Adillatuh*, vol. 2 (Beirut: Dar Ibn Hazm, 1998), 100–105.

[26]Muhammad bin Idris al-Syafi'i, *al-Umm*, vol. 3 (al-Manṣūrah: Dar al-Wafa', 2001), 232; Bandingkan dengan Abu Ishaq al-Syirazi, *al-Muhazzab*, vol. 2 (Damaskus: Dar al-Qalam, 1992), 594–96.

mazhab, the testimony of someone who has met the requirements must be followed by someone who knows, even though the judge does not determine the testimony. The testimony of a large number of people still cannot be accepted if the witnesses do not meet the requirements. *Syahadah* rukyatulhilal for months other than Ramadan, according to this school of thought, is required to be taken from two *adil* witnesses by using the sentence *"asyhadu"* in their testimony.[27]

From the various opinions regarding the *syahadah* rukyatulhilal that the *fuqaha* have put forward, we can take a lesson that the spirit carried by the *fuqaha* is the spirit of prudence in receiving testimony. This spirit of prudence aims to ensure the truth and objectivity of rukyatulhilal as the basis for *isbat* at the beginning of the month, which includes worship obligations, such as obligatory fasting in Ramadan. The primary purpose of *rukyatulhilal* by applying conventional methods (naked eye) and modern devices is to capture the sighting of the hilal. At the same time, the difference between the two of them is in the results. Conventional rukyatulhilal (naked eye) produces subjective results, namely the results of the hilal from the subject's interpretation of the rukyat object stored in the brain's memory and cannot be read by other parties so that the truth and error of the interpretation results are challenging to be confirmed. *Rukyatullhilal* with Astro digital imaging technique produces an objective hilal in the form of an image stored in computer memory and brain so that it is easy to analyze and read by other parties.

The results of *rukyatulhilal* become one of the guidelines in determining the beginning of the month. Reports and confirmation of the truth of the conventional rukyatulhilal (naked eye) results are submitted in the form of testimony (*syahadah)* before the judge. The truth and falsity of a report can only be confirmed by oath, so the true value is only subjective. The *rukyatulhilal* report using the Astro digital imaging technique is submitted in the form of a witness (*syahadah)* which is accompanied by evidence of an image. The truth and falsity of the report can be quickly confirmed based on the attached evidence, which can be analyzed openly, so that truth and error can be viewed objectively. *Fuqaha'* has formulated the number and requirements of witnesses in the *syahadah* rukyatulhilal. The number and conditions of witnesses formulated by the *Fuqaha'* are the results of *istinbat* on several hadith narrations about rukyatulhilal. The hadith narrated from Ibn' Umar and Ibn' Abbas above tells of the spirit of prudence in accepting the *syahadah.* This prudence aims to ensure the truth and objectivity of the rukyatulhilal as a basis for isbat at the beginning of the month, which includes various worship activities. This caution also ensures that time-based worship is actually carried out on time, not based on speculation that leads to ambiguity. Time-based worship should not be carried out based on time speculation. This can be learned from the severe prohibition from the Prophet to his companions, who rushed to speculate on fasting Ramadan before it was clear that the month of Ramadan was coming. The severity of the prohibition can be understood from the hadith composition, which applies *fi'il nahi* accompanied by *nun tawkid*.

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[27]'Abd Allah bin Ahmad bin Muhammad Ibnu Qudamah, *Al-Kafi*, vol. 2 (Jizah: Hajar, 1998), 228; Mansur bin Yunus bin Idris al-Buhuti, *Syarh Muntaha Al-Iradat*, vol. 2 (al-Risalah, 2000), 343–46; Wahbah al-Zuhayli, *al-Fiqh al-Islami wa Adillatuh*, Cet. Ke 3, vol. 2 (Damascus: Dar al-Fikr, 1989), 598–604; Muti'i, *Irsyad Ahl al-Millah ila Isbat al-Ahillah*, 12–22.

لَا يَتقَدَّمَنَّ أحَدُكُم رمَضانَ بِصَومِ يَومٍ أَو يَومَينِ إلاَّ أَن يَكُونَ رَجُلٌ كَانَ يَصُومُ صَومَهُ فَليَصُم ذلِكَ اليَومِ[28]

Never let any of you advance the month of Ramadan by fasting a day or two before unless someone who always fasts every day then may fast on that day.

The spirit of avoiding speculation over time can be seen from the concept of *yawm al-syakk* (a day that is still doubtful): a day that is not clear whether that day has entered the beginning of Ramadan or is still at the end of Sha'ban. The majority of scholars forbid fasting on the *yawm al-syakk*.[29] When the ambiguity of the time can make the implementation of worship unlawful, the clarity or objectivity of the process in determining the initial time is a demand. An objective legal basis is undoubtedly more important than a subjective legal basis. As the rules of *fiqhiyah* expressed by Muhammad Rasyid Ridla in Tafsir al- al-Manar and quoted by Wahbah al-Zuhayli in Tafsir al-Munir:

العِلْمُ مُقَدَّمٌ عَلَى الظَّنِّ[30]

Knowledge is more important than prejudice.

When we can obtain objectivity easily, then subjectivity should be deserted. For example, for someone who can see the Kaaba clearly, then there is no need for him to do *ijtihad* to find the direction of *qibla*. Therefore, when subjectivity contradicts objectivity, objectivity becomes the primary choice, as stated in the *fiqhi>yah* rules:

لَا عِبْرَةَ بِالظَّنِّ البَيِّنِ خَطَؤُهُ[31]

Something whose value is subjective and clearly wrong will be set aside.

The attachment of the hilal image can support the objectivity of the witness. In conventional *rukyatulhilal hilal*, the objectivity of the witness can only be judged from the nature of the witness and the oath. This is a logical consequence of the methods that may have been adopted in the past. This method at that time was very commonly used to obtain objectivity. However, over time, the nature of *'ada>lah* was much more difficult to judge from a witness, so that it could be replaced with other instruments, such as attachments to evidence brought by witnesses. In principle, fiqh has anticipated this problem by formulating the status of evidence in testimony. There are two rules of *fiqhi>yah* has the basis for applying evidence in testimony:

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[28]Abu 'Abd Allah Muhammad bin Isma'il al-Bukhari, *Al-Jami' al-Sahi Li al-Bukhaari*, vol. 2 (Cairo: Maktabah al-Salafiyah, 1403), 34; al- Nawawi, *Sahih Muslim Bi Syarh Al-Nawawi*, vol. 7 (Cairo: al-Matba'ah al-Misriyah bi al-Azhar, 1929), 194.

[29]Muhammad al-Syarbini al-Khatib, *Al-Iqna' Fi Hilli Alfaz Abi Syuja'*, vol. 1 (Beirut: Dar al-Fikr, 1415), 239.

[30]Wahbah bin Mustafa al-Zuhayli, *Al-Tafsir al-Munir Fi al-'Aqidah Wa al-Syari'ah Wa al-Manhaj*, vol. 2 (Damascus: Dar al-Fikr al-Mu'asir, 1418), 148; al-Sayyid Muhammad Rasyid Rida, *Tafsir Al-Manar*, vol. 2 (Cairo: Dar al-Manar, 1937), 187.

[31]Ahmad bin Muhammad al-Zarqa, *Syarhal-Qawaid al-Fiqhiyah*, Cet. ke 4 (Damascus: Dar al-Qalam, 1996), 357.

الكِتَابُ كَالخِطَابِ[32]

The status of writing is like the status of a conversation or message.

The analogy of the above rules when we studied further, the status of the hilal image is: *al-surah ka al-syahid* (image status is the same as witness status). Thus, the evidence of the hilal's observation (image) is vital in supporting the rukyatulhilal testimony. There are even more explicit rules

الثَّابِتُ بِالبُرْهَانِ كَالثَّابِتِ بِالعِيَانِ[33]

Something that is established by evidence is like something that is established by direct observation.

From this presentation, it is clear that Astro digital imaging is vital to improving the quality of the *syahadah* rukyatulhilal process by increasing objectivity and eliminating subjectivity.

Conclusion

Fiqh considers witnessing based on an oath valid because this was exemplified by the Prophet Muhammad when he received rukyat testimony. In that era, the oath was a simple method to measure truth and objectivity. However, along with the development of human character and the development of technology, using technological tools to strengthen testimony has become more accessible and more measurable when compared to measuring *'adalah* from a witness. Therefore, the *rukyatulhilal* testimony needs to be supplemented with supporting evidence attachments by using digital *hilal* images because it is easier to be held accountable when compared to an oath from a witness. The application of Astro digital imaging in improving the quality of the *syahadah rukyatulhilal* does not violate the applicable fiqh rules and is following the dynamic nature of the law, whether or not there is an '*illat* that surrounds it.

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[32]al-Zarqa, 349.
[33]al-Zarqa, 367.

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