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The Effect of Full Moon Light on the Brightness of the Sky in Lhokseumawe City

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Abstract: *The brightness level of the night sky is a crucial factor that significantly determines the success of astronomical observations. Various light sources, both anthropogenic such as residential and industrial lighting, and natural such as moonlight, can substantially reduce the visual quality of the sky. This study specifically aims to examine the contribution of the full moon to the brightness level of the night sky. The instrument used was a Sky Quality Meter (SQM), designed to measure sky brightness in units of magnitude per square arcsecond (mag/arcsec²). Observations were carried out for three consecutive nights, from December 16 to 18, 2024, coinciding with the full moon phase. Data were continuously recorded from 19:40 until 06:20 the following morning to obtain a temporal representation of sky conditions. The results showed an increase in sky brightness, with average values ranging between 16–20 mag/arcsec². On the first night, the sky appeared generally brighter, possibly due to atmospheric or local factors. On the second night, brightness peaked near 20 mag/arcsec² before gradually declining, while the third night remained relatively stable around 18–19 mag/arcsec². These findings confirm that full moonlight significantly contributes to increased night sky brightness and hold important implications for planning astronomical observations.*
Keywords: *Sky Brightness, Full Moon, Observation*

Abstrak: *Tingkat kecerlangan langit malam merupakan faktor penting yang sangat menentukan keberhasilan aktivitas observasi astronomi. Berbagai sumber pencahayaan, baik yang bersifat antropogenik seperti lampu pemukiman dan penerangan industri, maupun alami seperti cahaya bulan, dapat menurunkan kualitas visual langit secara signifikan. Penelitian ini secara khusus bertujuan mengkaji kontribusi cahaya bulan purnama terhadap tingkat terang-gelapnya langit malam. Instrumen yang digunakan adalah Sky Quality Meter (SQM), yakni alat yang dirancang untuk mengukur kecerahan langit dalam satuan magnitudo per detik busur kuadrat (mag/arcsec²). Observasi dilakukan selama tiga malam berturut-turut, pada 16–18 Desember 2024, bertepatan dengan fase bulan purnama. Data dicatat secara kontinu mulai pukul 19.40 hingga 06.20 pagi, sehingga diperoleh gambaran kondisi langit secara temporal. Hasil pengukuran menunjukkan adanya peningkatan kecerlangan langit dengan nilai rata-rata berkisar antara 16–20 mag/arcsec². Malam pertama menunjukkan langit lebih terang secara umum, malam kedua mencapai maksimum mendekati 20 mag/arcsec² sebelum menurun, sedangkan malam ketiga cenderung stabil di kisaran 18–19 mag/arcsec². Temuan ini menegaskan bahwa cahaya bulan purnama memberikan kontribusi signifikan terhadap peningkatan kecerlangan langit malam, serta memiliki implikasi penting dalam perencanaan pengamatan astronomi.*
Kata Kunci: *Kecerahan Langit, Bulan Purnama, Observasi*

A. Introduction

Light pollution is one of the common obstacles in astronomical observations, especially at night. The brightness level of the sky is measured in Bortle units The Bortle Scale is a tool to measure the level of brightness of the night sky due to light pollution. This scale consists of 9 levels, where the lower the number, the darker and ideal sky for stargazing[1]. Class 1 represents the darkest sky, usually in remote areas without light pollution which are usually mountainous

[1]Ziyan Yan and Minghong Tan, "Changes in Light Pollution in the Pan-Third Pole's Protected Areas from 1992 to 2021," AL - AFAQ : Journal of Astronomy and Astronomy 75, no. 1 (2023): 28–41.

areas, remote areas with minimal human settlements or even places where there are no human settlements at all[2].

In addition to astronomical observations, artificial light pollution or light pollution does not directly impact the astronomical determination of dawn time. This is because the time of dawn is determined based on the position of the sun which is about 18 degrees below the eastern horizon line, known as the dawn of shadiq. This timing is carried out through an astronomical calculation approach that is mathematical in nature and does not depend on the results of direct visual observations in the field[3]. However, in the practice of direct observation or rukyat, especially in environments dense with artificial light such as urban areas, light pollution can be a significant barrier. Light from street lights, buildings, vehicles, and other artificial sources can obscure or obscure the appearance of the true dawn, making it difficult for observers to distinguish between the dawn of kadzib (pseudo-dawn) and the dawn of shadiq that marks the dawn of dawn. As a result, visual observations of dawn can be delayed or even erroneous, if not done in places with absolutely minimal artificial lighting[4]. Therefore, in the context of dawn rukyat, the choice of a location that is far from light pollution is very important so that the natural light of dawn shadiq can be observed clearly and accurately[5]. This also shows that even though the determination of prayer times in general has used astronomical data, manual observation still requires favorable environmental conditions to maintain the accuracy of rukyat results.

In locations where light pollution is low and the number of stars is getting smaller, thousands of stars are clearly visible, and even galaxies like Andromeda can be seen with the naked eye. In contrast, Class 9 is the brightest sky, such as in the middle of a big city, where light pollution is very high. In this location, only a few bright objects such as the Moon and certain planets are visible[6]. The Bortle Scale helps amateur astronomers determine the best place to enjoy the night sky view, because the smaller the scale number, the more stunning the beauty of the stars and celestial bodies that can be observed.

Overall, the level of brightness and darkness of the night sky is influenced by various factors that come from anthropogenic activities and natural events. One of the main contributors to the increase in the intensity of sky brightness is the existence of residential areas with high population density. In areas like this, the level of use of artificial lighting such as street lighting,

[2]Abu Yazid Raisal et al., "Measurement of Sky Brightness in the Direction of Zenit in Medan and Serdang Bedagai Using Sky Quality Meter," JIPFRI (Journal of Innovation in Physics Education and Scientific Research) 5, no. 1 (2021).

[3]Era Zufialina, Muhammad Syahrul, and Nailul Alvi Hidayah, "Codification Historical Astronomy Pre-Islamic Ancient Civilizations and Their Contributions to Islamic Astronomy," AL - AFAQ : Journal of Astronomy and Astronomy 6, no. 1 (2024): 23–39.

[4]Marataon Ritonga, Arwin Juli Rakhmadi, and Abu Yazid Raisal, "Determination of Dawn Time Using All Sky Camera and Moving Average Method in Medan City," Court : Journal of Islamic Law Studies 8, no. 1 (2023): 13.

[5]M. Basthoni, Thomas Djamaluddin, and Ahmad Izzuddin, "Light Pollution Disturbance in Detecting Zodiacal Light and Twilight," AIP Conference Proceedings 2941, no. 1 (2023).

[6]Mustofa Ahyar, Yudhiakto Pramudya, and Okimustava Okimustava, "Implementation of Visual Basic-Based Sky Quality Meter Data Processing System for Analysis of Changes in Sky Brightness Levels," Journal of Physics Coils 3, no. 3 (2022).

household lighting, and lighting systems from commercial buildings tends to be very intensive and lasts all night. The accumulation of these artificial lighting sources triggers the phenomenon of light pollution, where light spreads into the atmosphere and reduces the natural contrast of the night sky. As a result, the sky becomes brighter than its natural state, which has a direct impact on the decline in the quality of astronomical observations, especially in the observation of celestial objects that have low light intensity[7]. Light from these various sources emits radiation that spreads into the atmosphere and causes the appearance of a phenomenon known as light pollution. In addition to artificial factors, natural elements also contribute to light pollution in the night sky. One of them is the rays from the Moon, especially when the Moon is in the full phase. This phase is one of the eight main stages in the Moon's synodic cycle, which is characterized by a geometric configuration in which the earth is halfway between the sun and the moon. In this position, the surface of the Moon facing the Earth receives complete illumination from the Sun's rays, so that the Moon appears intact with a perfectly round shape when observed from the Earth's surface. In this phase, too, the intensity of light reflected by the Moon's surface reaches its maximum value compared to other phases of the Moon, making it the moment with the most significant contribution of natural lighting to the brightness of the night sky. This condition often has a direct impact on the decline in the quality of astronomical observations, especially for celestial objects that are dim and require a completely dark sky background. The existence of full moon light is one of the natural sources of night sky illumination that is quite significant and often interferes with the quality of astronomical observation, especially for dim objects.

When the Moon is in a 100% light-filled phase, all surfaces facing the Earth receive the full illumination of the Sun's rays. This phenomenon makes the Moon appear intact, perfectly round, and very bright when observed in the night sky. The high level of light reflection that occurs in this phase causes the intensity of the moon's light to reach the maximum value compared to other phases of the moon, thus having a direct impact on increasing the brightness of the night sky. The high intensity of light reflected by the Moon in certain phases, especially during the full moon, causes a significant increase in the brightness of the night sky. The impact of this condition can be felt really, even in areas that are geographically and ecologically classified as having low levels of light pollution, such as rural areas with minimal artificial lighting sources, or dark sky conservation areas that are specifically designated to support astronomical observation activities. In such a situation, even though there is no contribution of light from a large amount of human activity, moonlight remains the dominant factor that interferes with the natural darkness of the night sky, thus reducing the effectiveness of observations of dim or low-magnitude celestial objects.

In such a situation, the influence of the light of the full moon can still be felt in real terms. This condition risks reducing visual quality in astronomical observation activities, especially for celestial objects that have a very low level of brightness. Some examples of such objects include faint galaxies that are located far away, poorly lit star clusters, and nebulae that emit

[7]M. Basthoni and Hendro Setyanto, "Typology of Dawn Light Curves in High and Low Light Pollution Areas," AIP Conference Proceedings 2391, no. March (2022).

faint light. All of these objects can generally only be observed optimally when the night sky is in a very dark state and completely free from external light interference, both from natural and artificial sources. Thus, the presence of additional lighting, such as full moonlight or artificial light pollution, can significantly hinder the visibility and accuracy in the observation of such objects[8]. The problem of full moon light is an interesting issue to discuss because this phase must be experienced by all regions, both urban and rural areas that tend to have minimal light pollution. Thus, understanding the impact of full Moon light on astronomical observations is important to support efforts to optimize observation activities, especially at night.

Instrument SQM is a measuring tool that is widely used in various scientific studies, especially in research that focuses on the quality of the night sky and light pollution problems. This instrument is designed to detect the level of light or dark sky with a high level of accuracy, and has a measurement angle coverage of 20 degrees. With this coverage, SQM is able to record the specific light intensity of the targeted area of the sky, making it very useful in conducting spatial analysis of the distribution of light at night. The precision level of this tool is quite high, with a margin of error of only about 3%, making it reliable in generating accurate quantitative data regarding fluctuations in the brightness of the sky over time. Another advantage is its ability to record data periodically and automatically with excellent temporal resolution, which is up to one recording per second.

The information obtained from the Sky Quality Meter (SQM) is not solely limited to the measurement of the level of brightness of the night sky expressed in the form of a unit of magnitude per second of the arc ku, adrat (mag/arcsec^2). The instrument also provides additional data that are complementary and important in supporting the analysis, such as the time and date of data collection (both in local and universal time formats), the ambient temperature of the instrument, the frequency of recording, and the total number of measurements that have been taken during the observation period. Thus, the SQM not only serves as a sky brightness measuring tool, but also as a device capable of recording supporting parameters simultaneously to produce more comprehensive and reliable observational data, but also includes other supporting parameters, such as time and date information of observation (both in local and universal time formats), the ambient temperature of the instrument, the total number of measurements taken, and the frequency of recording. With all these features, SQM is one of the main devices that is highly recommended in collecting objective data on the conditions of night sky lighting at various observation locations, both for scientific, environmental, and educational purposes.

The influence of light pollution, both from human activities and natural factors, has a huge impact on astronomical observation. One of the impacts can be seen in the observation of the dawn of shadiq, which marks the entry of dawn. In areas with high levels of light pollution, the appearance of dawn shadiq tends to be slower to be detected. In contrast, in areas with low levels of light pollution, dawn shadiq can be observed more quickly. This suggests that light

[8]Annisa Nurussaadah, M. Ihtirozun Niam, and Sudirman L, "The Accuracy of Approximate Solar Coordinates US Naval Observatory in Prayer Time Calculations," AL - AFAQ : Journal of Astronomy and Astronomy 6, no. 2 (2024).

pollution can affect the determination of dawn time by up to 77%. [9] In addition to human activities, the full moon phase is also one of the contributing factors to light pollution which greatly affects the brightness of the sky. In this phase, the moonlight reaches its brightest peak and has a significant impact on the time of dawn. In theory, the early determination of dawn time is determined by the ministry of religion when the height of the sun is at a position of 20° below the horizon. However, during the full moon phase, observations showed a time difference of about 16 minutes compared to the official schedule of the Ministry of Religion. Meanwhile, in phases other than the full moon, the difference in the appearance of dawn shadiq is only about 2 minutes[10].

B. Methods

This research was carried out by applying an observational method that aims to monitor and analyze the level of brightness of the night sky over a certain period of time. In the data collection process, the Sky Quality Meter (SQM) device is used as the main tool, used as a way to accurately and continuously record the brightness value of the sky. This tool was chosen for its ability to provide precise measurement results, so it greatly supports research needs that require quantitative data on variations in light intensity in the night sky. To protect the tool from the risk of damage due to rain and other extreme weather conditions, the SQM is housed in a special protective tube (housing) designed to maintain the stability of the tool's function during observation. However, it should be noted that the use of this shield may have a slight effect on the measurement results, so there may be a small deviation in the values displayed. The observations were made for three consecutive nights to coincide with the full moon phase, which took place in Lhokseumawe City. The observation location is located at the Malikussaleh Observatory, which was chosen because of its strategic position for data collection. This series of observations began on December 16 and ended on December 18, covering three nights of continuous observations.

C. Results and Discussion

1. The main factors that affect the brightness of the langgit

The brightness of the night sky is influenced by various factors that come from natural and artificial sources. These factors can increase the level of sky illumination thereby reducing the quality of darkness in the night sky, which directly results in difficulties in observing dim sky objects. Here are the main factors that affect the brightness of the sky[11]:

a. Moonlight

Moonlight, especially during the full moon, is one of the largest sources of natural lighting at night. The Moon's surface that fully reflects sunlight can significantly increase the brightness

[9]M Basthoni, "The Effect of Light Pollution on the Early Determination of Dawn Time in Indonesia," Postgraduate University Islam of the State of Walisongo, 2022, 7.

[10]Adi Nugroho, THE EFFECT OF MOONLIGHT ON THE APPEARANCE OF DAWN SIDIQ (ANALYSIS OF CURVE TURNING POINTS IN DETERMINING THE BEGINNING OF DAWN TIME USING SKY QUALITY METER), Block Caving – A Viable Alternative?, vol. 21, 2020.

[11]Hariyadi Putraga, Arwin Juli Rakhmadi, and Muhammad Dimas Firdaus, "Measurement of Night Sky Brightness and Light Pollution in North Sumatra Province," SNFA (National Seminar on Physics and Its Applications), 2022, 26–34.

level of the night sky. This light intensity can even rival artificial lighting in rural areas or relatively dark observation locations[12]. Therefore, the phases of the moon are an important consideration in the planning of astronomical activities.

b. Artificial Lighting

Artificial lighting is one of the main factors that has a significant impact on increasing the brightness of the night sky, especially in urban areas such as Lhokseumawe City. Various light sources from human activities such as street lights, building lights, digital billboards, industrial areas, and densely populated settlements emit light in all directions, including the sky. Most of this lighting is not well directed and ends up being scattered into the atmosphere. The light is then reflected back to the Earth's surface by dust particles, water vapor, and clouds in the atmosphere, creating a phenomenon known as skyglow[13].

At night, especially when there is no moon or when the moon is not very bright, this artificial light becomes the dominant source of brightness in the sky. This reduces the contrast between the sky and celestial bodies, making dim stars difficult or even invisible[14]. This artificial lighting effect is amplified by certain atmospheric conditions, such as high humidity or the presence of thin clouds, which make it easier for light to be reflected and scattered throughout the sky.

In the context of this study, it is important to understand that artificial lighting is not only a source of light in itself, but can also affect how much the light of the full moon affects the brightness of the sky. In areas with high artificial lighting, the moonlight effect may appear smaller because artificial light already dominates the night sky enough. On the other hand, in darker and poorly lit areas, the effect of moonlight on increased sky brightness will be more pronounced. Therefore, artificial lighting must be considered as an important variable in the analysis of the brightness of the night sky in Lhokseumawe City.

c. Atmospheric conditions

Atmospheric elements such as dust, water vapor, and clouds have a significant contribution to the reflection and scattering process of light sourced from various types of lighting, both natural such as moonlight and starlight, and artificial ones such as street lighting and light from buildings. Particles such as dust and aerosols scattered in the atmosphere play an important role in the process of light scattering. Most of these particles come from anthropogenic activities, including the burning of fossil fuels, industrial processes, and motor vehicle pollution. The presence of these particles causes light from both natural and artificial sources to be scattered in various directions randomly through a physical process known as scattering or scattering of light. This scattering mechanism has a direct impact on increasing the brightness of the night sky, because light no longer moves in focus, but instead spreads widely and disrupts the clarity of the sky needed in astronomical observation.

This process contributes significantly to the increase in light pollution intensity, especially in urban areas that have a high concentration of artificial lighting sources. In addition,

[12]AL Afaq et al., "Dynamics of Changes from the Abajadun Numbers to the Ghubari System" 7, no. 1 (2025): 48–56.

[13]Francisco Rokirianto Olin et al., "Design and Construction of a Sky Brightness Measurement System Using Tsl237S-Lf and Nodemcu Esp8266 Light Sensors," Journal of Physics: Physics Science and Its Applications 9, no. 2 (2024): 48–56.

[14]Muhammad Dimas Firdaus et al., "Analysis of the Impact of Artificial Light Pollution on Night Sky Brightness Using Sky Quality Meter," Elfalaky 6, no. 2 (2022): 197–206.

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high air humidity can exacerbate this condition[15]. Water vapor floating in the atmosphere can form a reflective layer that reflects light back to the earth's surface, so that the night sky appears much brighter than normal conditions." Clouds and fog also play a role in amplifying this effect. Although clouds are supposed to block light from space, in large cities full of artificial light, clouds instead serve as large reflectors that scatter light in all directions, significantly increasing the brightness of the night sky. Even in light cloudy conditions, the night sky can appear several times brighter than when the sky is clear. Atmospheric transparency, or the clarity of the sky, is also an important factor in determining how much light from celestial objects can reach observers on earth.

At an interval of 3 days, the process of observing the brightness of the sky in the condition of cloud cover at that time was 14%, this is a good condition for observing the brightness of the sky[16] :

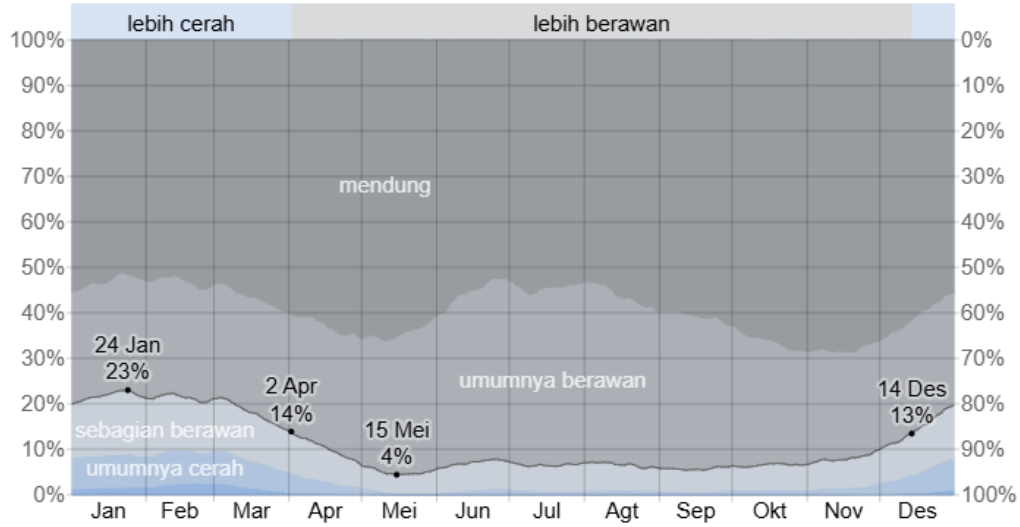

Figure 1 cloud thickness level

In addition, the air humidity condition at the time of observation is predicted to be around 6 km/h and the humidity is 94% - 95% in the Banda Aceh area, the data obtained is not much different from that in the Lhokseumawe area which experienced the same thing[17].

d. Geographical location and topography

The observation location has an important role in determining the quality of the night sky observed. Highland regions generally offer darker and clearer sky conditions compared to lowlands. This condition occurs because it is influenced by a number of factors, one of which is the vertical distance that is farther from artificial lighting sources which are generally concentrated in urban areas or densely populated areas in lowlands. At altitude, the atmosphere also tends to be thinner and drier, which means fewer particles and moisture can spread artificial light, so the night sky appears darker and celestial objects are easier to observe. Therefore, the

[15]Muhammad Zafanka Gazalba, Arino Bemi Sado, and Muhammad Saleh Sofyan, "The Effect of Atmospheric Humidity on the Visibility of the Hilal on Loang Baloq Beach," AL - AFAQ : Journal of Astronomy and Astronomy 5, no. 2 (2023): 211–22.

[16]"Climate, Weather by Moon, Average Temperature Lhokseumawe / Malikussaleh (Indonesia) - Weather Spark," accessed August 28, 2025, https://id.weatherspark.com/y/149052/Cuaca-Rata-rata-pada-bulan-at-Lhokseumawe-Malikussaleh-Indonesia-Sepanjang-Tahun.

[17]"RRI.Co.Id - Weather Prediction for Banda Aceh City Monday 16 December 2024," accessed August 28, 2025, https://rri.co.id/daerah/1193335/prediksi-cuaca-kota-banda-aceh-senin-16-desember-2024.

highlands are a very ideal location for the construction of astronomical observatories[18], both for scientific research purposes and for the development of night-sky educational tourism.

In addition to the altitude factor, topographic elements also affect the level of darkness in the sky. Locations surrounded by hills or mountains can naturally block the spread of artificial light from nearby cities. This geographical contour acts as a light shielding, which is able to minimize light trespass or light interference to the observation area. Thus, areas protected by natural formations such as valleys or mountain basins often have excellent quality of the night sky for astronomical observation[19]. Not only for scientists and researchers, places like this also have great potential as astrophotography or stargazing tourist destinations which are currently increasingly in demand by the wider community. Therefore, the selection of observation locations based on geographical characteristics and the level of artificial lighting around is a crucial strategic step in supporting optimal night sky observation activities.

e. Phases and positions of celestial objects

The phase of the moon is one of the astronomical factors that has a significant influence on the brightness of the night sky. The moon undergoes eight major phases during a single synodic cycle (about 29.5 days), starting from the new moon, the early crescent, the first quarter, the early convex moon, the full moon, the late convex moon, the last quarter, to the final crescent. Among these phases, the full moon phase is the one that has maximum brightness since the part of the moon that faces the earth fully reflects the sun's light. When this phase occurs, the intensity of the moonlight reaches its maximum and contributes greatly to the increase in the brightness of the night sky, especially in areas with minimal artificial lighting. In contrast, in the dead moon phase, the brightness of the night sky tends to be lower because there is almost no visible moonlight from the earth. In Lhokseumawe City, this influence can be felt directly, especially by skywatchers or amateur astronomers, as the bright light from the full moon can obscure the light of other celestial objects such as stars, faint planets, or galaxies. Therefore, understanding the moon's phase changes is important in analyzing natural light pollution and in determining the right time to make optimal astronomical observations.

f. Effects of Eclipse Events

Solar eclipses are one of the rare and temporary astronomical phenomena, but they have a considerable influence on changes in lighting conditions in the Earth's atmosphere. At the time of this event, especially when it enters the total phase or reaches its peak, the intensity of the Sun's light that usually shines on the Earth's surface decreases drastically in a very short time. As a result, the sky that was initially bright like daylight slowly turned darker, resembling the atmosphere of twilight or even the conditions of the night sky. The decrease in sky brightness that occurred during this eclipse was quite noticeable and can be observed and measured quantitatively using instruments such as the Sky Quality Meter (SQM), which is able to detect changes in light intensity in real-time. This phenomenon is one of the real examples of how astronomical events can significantly affect the visual perception of the sky.

[18]Muhammad Maulana Iqbal, Muhammad Akmal Habib, and Fajri Zulia Ramdhani, "Evaluating the Feasibility of Yanbu ' Ul Qur ' an Observatory in Menawan Kudus for Lunar Crescent Observation" 7, no. 1 (2025): 117–32, https://doi.org/10.21580/al-hilal.2025.7.1.27090.

[19]Delta Rosiana and Yudhiakto Pramudya, "Assessment of Night Sky Quality in Ganten Village, Kerjo District, Karanganyar: A Prospective Evaluation for the Establishment of the Falak Observatory," Al-Marshad: Journal of Islamic Astronomy and Related Sciences 9, no. 1 (2023): 30–40, https://doi.org/10.30596/jam.v9i1.13545.

This decrease in brightness is abrupt and extreme, providing a unique opportunity for researchers to study the response of the atmosphere to changes in the intensity of natural light. Some observations suggest that during the peak of the eclipse, air temperatures can drop, humidity can increase, and the sky light becomes dark enough to allow for the appearance of bright stars or planets during the day[20]. These fluctuations are evidence that eclipses can be a natural indicator of atmospheric sensitivity to changes in lighting.

In addition, the eclipse event is also the right moment to observe the extent to which artificial light affects the environment. When sunlight decreases during an eclipse, artificial lighting sources become more dominant and can be clearly seen contributing to the brightness of the sky. This provides a real picture of how light pollution works in natural low-light conditions, similar to nighttime conditions. In the context of research on sky brightness, such as in the observation of the moon or the measurement of the quality of the night sky in urban and sub-urban areas, understanding the influence of eclipses can provide additional insights into light dynamics in a short time scale. This event can be used as a comparative reference to analyze how much influence natural and artificial light has on the sky under various astronomical conditions.

2. Factor Full Moon Phase

One of the elements that consistently affects the brightness of the night sky is the moon phase, especially when the moon is in the full phase. In this phase, the moon is located opposite the sun when viewed from the earth, so that the part of its surface facing the earth receives full illumination from the sun's rays and reflects it optimally. As a result, moonlight reaches its highest intensity in a single lunar cycle, making it the brightest source of natural light at night after sun. This phenomenon occurs periodically every month, and contributes significantly to increasing the brightness of the night sky, especially in areas with minimal artificial lighting. In the context of astronomy and sky observation, the full moon phase is often considered a disturbance because its glare can reduce the contrast of the night sky, making dim celestial objects such as nebulae, galaxies, or small stars difficult to observe. Even in the condition of the sky free from light pollution, the light of the full moon is still able to illuminate the earth's surface brightly, which significantly reduces the quality of the night sky for the needs of visual observation and astrophotography, the influence of this full moon phase also has an impact on determining the time of dawn prayer, the appearance of dawn shadiq which is a marker of dawn time if observed in the full moon phase will cause the duration of its appearance to be 16 minutes Slower than the criteria of the Ministry of Religion, namely when the sun is at 20 degrees below the horizon, then when the observation is carried out outside the full moon phase, the duration of the appearance of the dawn of Shadiq is only 2 minutes different from the criteria of the Ministry of Religion, this shows a significant impact on the appearance of the dawn time marker which is influenced by the full[21] moon phase, based on research on the impact of light pollution at dawn in Indonesia, it was found that the data is as follows, data taken on April 21, 2021:

[20]Adi Jufriansah et al., "Dynamics of Sky Brightness during a Hybrid Solar Eclipse Using SQM" 11, no. 1 (2025): 63–78.

[21]Nugroho, THE EFFECT OF MOONLIGHT ON THE APPEARANCE OF DAWN SIDIQ (ANALYSIS OF CURVE TURNING POINTS IN DETERMINING THE BEGINNING OF DAWN TIME USING SKY QUALITY METER).

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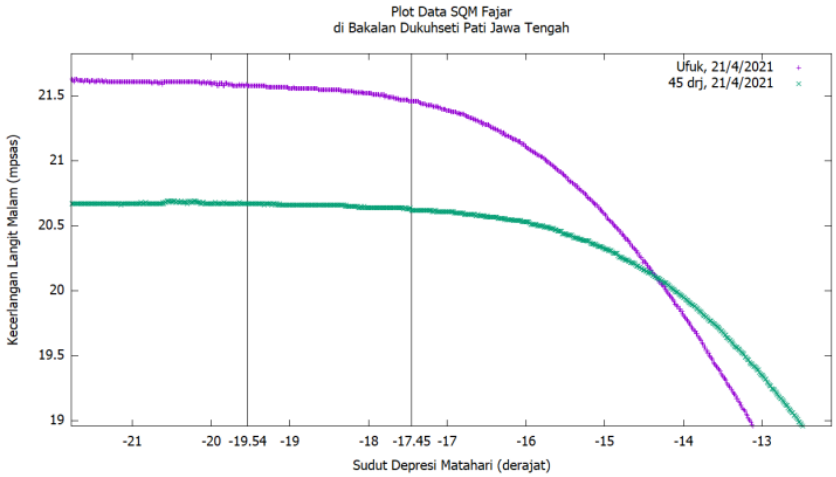

Figure 2 sky brightness data during true dawn (Fajr al-Sadiq)

And the observation in Bayuwangi on July 25, 2020:

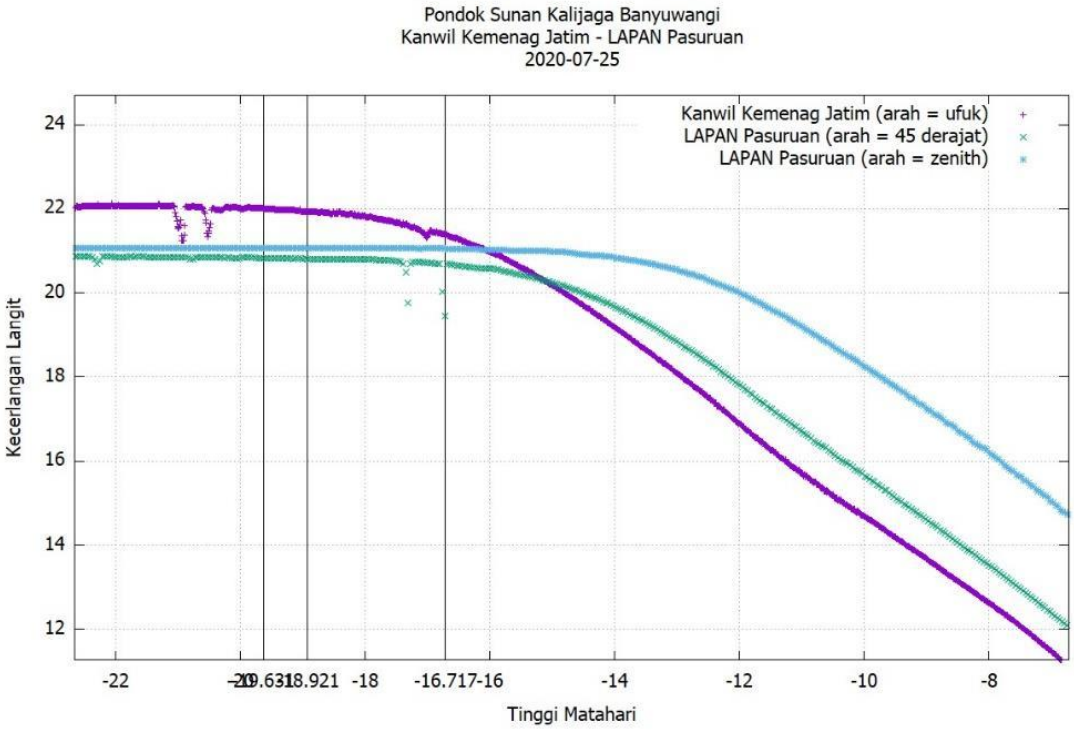

Figure 3 sky brightness data during true dawn (Fajr al-Sadiq)

Therefore, an understanding of the lunar cycle, especially the full phase, is very important in planning astronomical observation activities, including determining the best time for the observation of the moon, dawn time, stars, and other celestial phenomena.

In this study, data was collected from December 16 to December 18 with a span of three days, data was taken when the moon was in the full phase with the location coinciding with the Malikussaleh Lhokseumawe observatory, the observation time began after Isha at 19:40 to 06:00 in the morning for three consecutive days.

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The initial step in the data collection procedure begins with a connection between the Sky Quality Meter (SQM) device and a computer, both PC and laptop, using a USB cable connection. This connection aims to ensure stable data communication between the instrument and the data processing software, so that the initial setting and recording process of the sky brightness value can be carried out automatically and efficiently through a computerized system. This connection allows direct communication between the tool and the software used, so that the data from the sky brightness measurement can be transferred, monitored, and recorded automatically through a computerized system. After that, initial arrangements are made which include adjusting the time and date, determining location coordinates, and setting the time interval between data recordings. After the configuration stage is completed, the SQM is placed inside the protective capsule to avoid damage due to exposure to rain or dew during the night. The instrument is then directed vertically to the zenith point without any obstruction in front of the sensor, so that the measurement of the intensity of the sky light can take place optimally[22]. Sky brightness measurements are carried out using the Unihedron Device Manager (UDM) application, where data is recorded automatically every one minute, starting from 7:40 p.m. to 6:00 a.m. After all the data has been successfully recorded, the next step is to process it using the moving average technique available in Microsoft Excel software. This method is applied to facilitate the process of analyzing the pattern of changes in the brightness of the sky throughout the night.

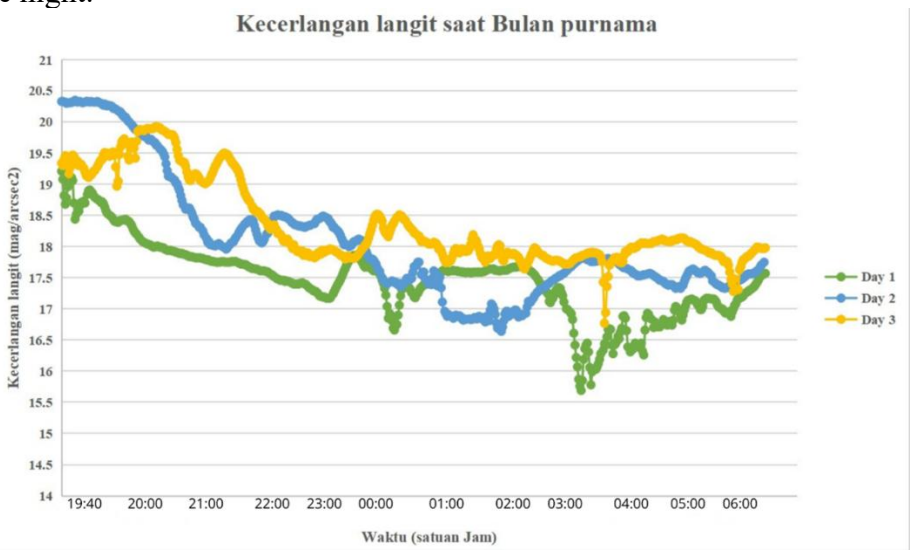

Figure 4 sky brightness data during the full moon

From the table above, it can be observed that the influence of the light of the full moon greatly affects the brightness of the three days of observation with an average of 17.46 Mag/arcsec^2 on the first day, then on the second day 18.06 Mag/arcsec^2 and on the last day, the third day with an average of 18.35 Mag/arcsec^2.

[22] Raisal et al., "Measurement of Sky Brightness in the Zenit Direction in Medan and Serdang Bedagai Using Sky Quality Meter."

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Table 1. Brightness of the Sky

Yes	Day	Mag/arcsec²	
		MIN	MAX
1	December 16	15,9	19,21
2	December 17	16,9	20,33
3	December 18	17,9	19,34

From the data obtained, it can be understood that the influence of full moon light has a great effect on the brightness of the moon, in this case the full moon event is one of the factors that causes an increase in light pollution that will be experienced in every region, both urban and rural areas, which are not the case with a small [23]population, but whether other phases of the moon also affect the brightness of the crescent moon along with the data on the brightness of the crescent moon.

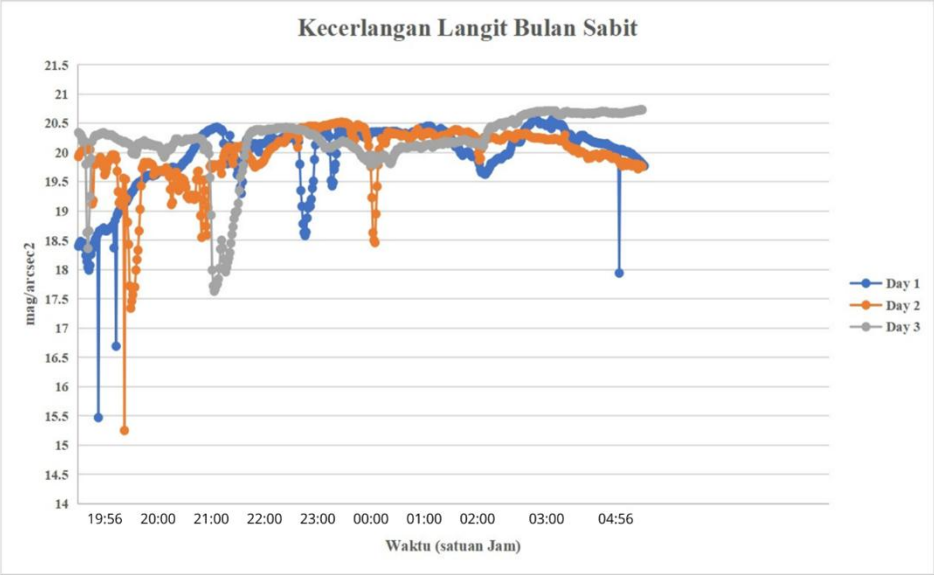

Figure 5 sky brightness data during the new moon phase

Based on the information listed in the previous table, it can be concluded that the crescent moon phase produces a relatively lower level of light pollution compared to the full moon phase.[24]. This shows that the crescent moon phase provides more favorable conditions for night sky observation activities. Taking into account the findings, the author suggests that night sky observation activities should not be carried out when the moon is in the full phase. This is because this phase produces a fairly high level of light pollution, which can ultimately reduce the quality of observation of celestial objects. To obtain optimal observation results, it is highly recommended to make observations in locations with minimal artificial lighting. The most ideal location for night sky observation is an area located far from the city center or residential areas

[23]Arwin Juli Rakhmadi, Hasrian Rudi Setiawan, and Abu Yazid Raisal, "Measurement of Light Pollution Level and Early Dawn Time at OIF UMSU Using Sky Quality Meter," Titian Ilmu: Multi Sciences Scientific Journal 12, no. 2 (2023): 58–65.

[24] Devina Kharida Alhan, "Analysis of the Brightness Level of the Night Sky on Hilal Visibility Using a Sky Quality Meter at the Malikussaleh Lhokseumawe Observatory" 4, no. 1 (2023): 25–39.

with high density. Alternatively, rural areas that have low levels of artificial lighting, or mountainous areas that generally have darker skies, may be a suitable option. In addition to the location aspect, the selection of the timing of observation is also a crucial factor that affects the success of observation activities. The time that is considered the most optimal and highly recommended to carry out night sky observation activities is when the Moon is in the new moon phase in this astronomical configuration, the Moon is in an aligned position between the Earth and the Sun, along with the side of the part of the Moon that leads to the Earth0 does not get direct illumination0 from the Sun's rays. As a result, the part of Earth's satellite that should be visible from Earth is in total darkness because no light reflection reaches the observer's eye, which makes the Moon appear to "disappear" from the night sky during this phase.

This condition causes the Moon not to reflect any light towards observers on the Earth's surface. As a result of the absence of moonlight, the night sky reaches its maximum level of darkness naturally, without interference from other natural light sources. This situation strongly supports the observation of celestial objects that have a faint light intensity, because the dark background of the sky allows visual contrast to be clearer and sharper. Therefore, the new moon phase is a very important moment to be used in astronomical observation activities, both professionally and educationally. This situation is particularly advantageous because it minimizes light interference from the Moon, which is often one of the main sources of increased brightness in the night sky. In these dark sky conditions, dim astronomical objects, such as star clusters, nebulae, and galaxies, can be observed more clearly and in detail. Therefore, by carefully considering the observation time factor as well as the selection of locations far from artificial lighting sources, the quality of night sky observation can be significantly improved. This allows observation activities to take place without interference from moonlight or light pollution produced by human activities in the surrounding environment[25].

D. Conclusion

Observations of the distribution of light pollution in the night sky were carried out using the Sky Quality Meter (SQM) device for three consecutive nights, namely from December 16 to 18, 2024, at the Malikussaleh Observatory, Lhokseumawe City. The measurement results showed that on the first night, the brightness of the sky was recorded at 17.46 mag/arcsec². This value experienced a slight increase on the second night, reaching 18.06 mag/arcsec², and continued to increase on the third night with an average brightness of 18.35 mag/arcsec².

These findings suggest that the light reflected by the moon in the full moon phase exerts a considerable influence on the increase in the brightness of the night sky. The high intensity of moonlight in this phase can interfere with the astronomical observation process, especially for dim celestial objects Therefore, the implementation of astronomical observations should not be carried out when the moon is in the full phase, considering that the intensity of moonlight in that phase is quite high and can interfere with the quality of observation. On the other hand, the

[25]A. Sánchez de Miguel et al., "Sky Quality Meter Measurements in a Colour-Changing World," Monthly Notices of the Royal Astronomical Society 467, no. 3 (2021): 2966–79.

most recommended period to carry out optimal night sky observations is when the Moon is in the crescent moon phase or the new moon phase (which is often also called a dead moon).

In both phases, the intensity of light reflected by the Moon's surface towards the Earth is very low, even in the new moon phase there is hardly any visible light from the Moon's surface due to its position between the Sun and the Earth. This condition results in a much darker night sky background, with minimal interference from moonlight, thus creating a very ideal situation for observing celestial objects that have a low magnitude. When the sky is free of light interference, the visual contrast of stars, planets, nebulae, and other dim sky objects is significantly increased, allowing for sharper, clearer, and deeper observation results.

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