

ASTRONOMICAL OBSERVATIONS MADE DURING THE JAPANESE OCCUPATION OF INDONESIA, 1942–1945

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Abstract: The Japanese arrival in Indonesia in early 1942 has always been associated with WWII. Major astronomical changes took place in what had been the Dutch East Indies. Bosscha Observatory, which had been a centre of Southern Hemisphere astronomical research and the headquarters of the *Nederlandsch-Indisch Sterrenkundige Vereeniging*, underwent a major reorganisation: its name was changed to the Lembang Astronomy Office, and a Japanese soldier, Masashi Miyaji, became the Director.

In this paper we study the astronomical activities that were carried out in Indonesia during the Japanese occupation era, mainly as outlined in Miyaji's account of conditions at the time. He and a former Dutch staff member, Dr. Joan Voûte, continued the original Bosscha Observatory double star research program, while the promotion of a lunar eclipse and a partial solar eclipse in newspapers and a magazine allowed a continuation of public involvement in astronomy. In addition, the Japanese authorities supported efforts by Islamic clerics to carry out lunar observations in order to determine the beginning of the fasting month.

Keywords: Indonesia; WWII Japanese occupation; Bosscha Observatory; Lembang Astronomy Office; Masashi Miyaji; eclipses; Islamic lunar sightings.

1 INTRODUCTION

The Japanese occupation of Indonesia in the first half of 1942 led to major changes in many areas of government, including the office that was responsible for astronomy in what was originally known as the Dutch East Indies.¹

In this paper we outline the major changes that took place at that time, after first providing a chronological background to the pre-WWII evolution of Indonesian astronomy in Section 2. Research for this project was challenging given the paucity of relevant archival records or published research papers, but data were drawn from local newspapers and an account written by Masashi Miyaji (1975), the Japanese officer who was responsible for Bosscha Observatory during the occupation of Indonesia. Records of wartime double star observations also were found in the Observatory archives, and these were also referred to in post-war publications.

2 THE DEVELOPMENT OF ASTRONOMY IN THE INDONESIAN REGION PRIOR TO WORLD WAR II

Astronomy had a long history of development in the region (Hidayat, 2011), beginning when rice-growing farmers from mainland Southeast

Asia came with pigs and pottery and settled throughout Java and other islands in the archipelago. In the process, they replaced and interbred with the original hunter-gatherer populations (e.g. see Orchiston, 2017, for a pan-island SE Asian overview).

The farmers also came with a 'new astronomy', one specifically geared to sedentary life and the cultivation of rice (Orchiston and Orchiston, 2018), and with the passage of time this evolved into the elaborate *pranotomongso* system documented by Daldjeoni and Hidayat (1987) in Central Java.

From around the ninth century CE Hindu religion, with temples that involved complex cosmological beliefs and practices (Shylaja, 2016), began arriving in what is now Indonesia. Those temples were particularly common in Java (see Orchiston et al., 2021a: 66, Figure 2.25) and some became favourite targets for staff and graduate students from the Department of Astronomy at the Institut Teknologi Bandung (e.g. see Khairunnisa, et al., 2021; Rodhiyah and Hidayat, 2019).

In the thirteenth and fourteenth centuries another religion, Islam, quickly spread throughout the Indonesian archipelago. As

... in other parts of island Southeast Asia we sometimes find that pre-Islamic astronomical beliefs and practices are incorporated into Islamic lore and come to the fore during certain astronomical events ... (Orchiston et al., 2021a: 67).

A good example is during solar and lunar eclipses (see Fatima et al., 2021).

The final phase in the pre-WWII astronomical history of Indonesia was marked by colonialism, beginning with the Portuguese in 1512 as they established trading stations in a bid to exploit the cinnamon, cloves, nutmeg and pepper of the famous 'Spice Islands'. In 1602 they were replaced by the Dutch East India Company (VOC), which progressively spread its control throughout the archipelago until the company went bankrupt in 1795. From that date the Dutch continued to administer their colony, apart from some years of conflict with the British. The Dutch were firmly in control when WWII intervened (for details of the colonial period see Ricklefs, 2008; Vickers, 2013).

Initially astronomy hardly flourished under the Dutch. However, the Southern skies did attract the attention of Frederick de Houtman (1571–1627) on a voyage to Bantam (now Banten, in West Java). The following year he made a second voyage to island SE Asia and during 26 months as a prisoner of Sultan Alauddin Ri'ayat Syah Sayyid al-Mukammal of Aceh (Sumatra) he made more observations of Southern constellations. He published these in 1603, following his release in 1601 and return to the Netherlands (Dekker, 1987; Verbunt and van Gent, 2011). There is some controversy surrounding de Houtman's observations, and recently these were discussed by de Grijs (2023).

More than a century later amateur astronomy emerged in the colony when Pastor Johan Mauritz Mohr (1716–1775) constructed an impressive-looking observatory in the capital, Batavia. Mohr observed the 1761 and 1769 transits of Venus (van Gent, 2005: 68), and was a member of the club of the arts and sciences in Batavia. Zuidervaat and van Gent (2004) provide an interesting account of this 'founding father' of Indonesian amateur astronomy, located as he was on "A bare outpost of learned European culture on the edge of the jungles of Java."

There was then another time gap before astronomy appeared once more in the colony, but this time it was a professional astronomer, Jean Abraham Crétien Oudemans (1827–1906), and his initial task was to conduct a trigonometrical survey of Java and other islands in the archipelago. Oudemans and his wife arrived in Batavia in 1857, and he spent nearly

20 years as 'Head Engineer of the Geographical Service of the Dutch East Indies' before returning to Holland and a Chair in Astronomy in 1875 (Orchiston et al., 2021b). While in the East Indies he found time to carry out a range of non-meridian astronomical work (*ibid.*), and observe total solar eclipses in 1868 and 1871 (*ibid.*; Mumpuni et al., 2017). Thus, Dr. Oudemans was

... able to successfully exploit the parameters of his official position in Java so that he could continue to indulge his passion for astronomy. In the process he was the only nineteenth-century Indonesian-based astronomer to build an international reputation ... (Orchiston et al., 2021b: 311).

These solar eclipses were followed by another one that was visible from the Dutch East Indies, on 16 May 1901. A Lick Observatory expedition set up their eclipse camp on the racecourse in Padang, and successful observations of the eclipse were carried out. Pearson and Orchiston (2017: 387) conclude that unlike Oudemans' eclipses,

... it was the 1901 eclipse that made a significant international contribution to coronal science. This eclipse therefore has an important place in the history of Indonesian astronomy.

While Oudemans was busy with his solar eclipses and trigonometrical surveying, staff at the Royal Magnetic and Meteorological Observatory in Batavia were providing the colony with meteorological and geomagnetic data, and a time service (Hidayat et al., 2017).² During the nineteenth century, this was a common pattern at colonial observatories across SE and East Asia (e.g. see Alvarez, 2023; Kinns, 2021; Orchiston, 2025; Phong, 2023; Zhu, 2023), where there was a special interest in typhoons given their potential to cripple national economies.

The 'astronomical landscape' in Java changed markedly with the arrival of Joan George Erardus Gijsbertus Voûte (1879–1963; Figure 1) in the Dutch East Indies. Voûte was widely known as an astronomer who was dedicated to helping the professional astronomical community there through the Nederlandsch-Indisch Sterrenkundige Vereeniging (henceforth NISV; The Association of Dutch Indies Astronomers). The NISV received substantial support from Karel Adolf Rudolf Bosscha (1865–1928; Figure 2), a Lembang tea company tycoon and philanthropist who had a special sympathy for and obsession with astronomy. He was the son of the Dutch physicist Johannes Bosscha, Jr.

(1831–1911) (Pyenson 1989, 56). K.A.R. Bosscha graduated from a technical engineering school that was led by his father, and he funded the establishment of Bosscha Observatory (Figure 3) in Lembang at a site with a latitude of $6^{\circ} 49' 28''$ S, longitude of $107^{\circ} 37'$ E, and an altitude of 1300 metres (van der Hucht, 2025). The Observatory was supplied with an impressive array of instruments (Voûte, 1933), which allowed the astronomers to conduct research at an international level (van den Heuvel, 2025).

With its inauguration on 1 January 1923 the Observatory became one of the mainstays of Southern Hemisphere astronomy. This was because the majority of observatories were located in the Northern Hemisphere. Therefore, making astronomical observations of the Southern skies from a site near the Equator was seen as both fascinating and exotic.

With the Japanese military occupation of the Dutch East Indies all astronomical observations immediately stopped and the Observatory was abandoned. In this paper we will trace how attempts were made to revive some of the pre-war astronomical research conducted at the Observatory, and how the Japanese authorities publicised solar and lunar eclipses that occurred during their occupation, and allowed Muslim clerics to conduct lunar observations that were critical for their religion.

3 DUTCH EAST INDIES ASTRONOMY DURING THE JAPANESE OCCUPATION

3.1 Introduction

All Dutch East Indies research and education institutions were affected during the massive reorganisation that occurred under the Japanese Occupation Government. Most management heads or top leaders were Dutch or Indo-European, and they were replaced by Japanese or Indonesians. But even with these chosen Indonesians, in fact the actual power was in the hands of the Japanese. However, the Japanese realised Indonesians were often best placed to supervise the work of the majority of Indonesians.

3.2 The Fate of Bosscha Observatory

Before the Japanese occupation, Bosscha Observatory had been directed by Dutch astronomer Dr. Aernout de Sitter (1905–1944; Figure 4; Oort, 1946) since 1940. With the occupation de Sitter³ lost his job, the Observatory was renamed the Kantor Perbintangan Lembang (Lembang Astronomy Office) or the Boshua Tenmondai, and a young military officer Masashi Miyaji (宮地政司; 1902–1986; Figure

5)⁴ became the new Director. He held this position from 1943 to 1945 (Hidayat, 2000: 53).

Miyaji's background is interesting. In Japan he trained under Professor Hisashi Kimura (1870–1943; Fukushima, 2014), the founding Director of the International Latitude Observatory at Mizusawa, Japan. Actually, long before



Figure 1: A cropped ca. 1908 photograph of Joan George Erardus Gijsbertus Voûte (https://en.wikipedia.org/wiki/Joan_Vo%C3%BBte#/media/File:JVoute.jpg)



Figure 2: An undated photograph of K.A.R. Bosscha (https://upload.wikimedia.org/wikipedia/commons/0/01/COLLECTIE_TROPENMUSEUM_Studioportret_van_de_heer_K.A.R._Bosscha_TMnr_10018605.jpg)

the outbreak of WWII in Asia and the Pacific a group of Kimura's astronomers planned to go to Java to carry out latitude observations. But they were delayed, and war broke out. Miyaji (1975) then gained the military rank of second lieutenant and entered the Air Force Division. Initially he was bound for New Guinea, but was reassigned

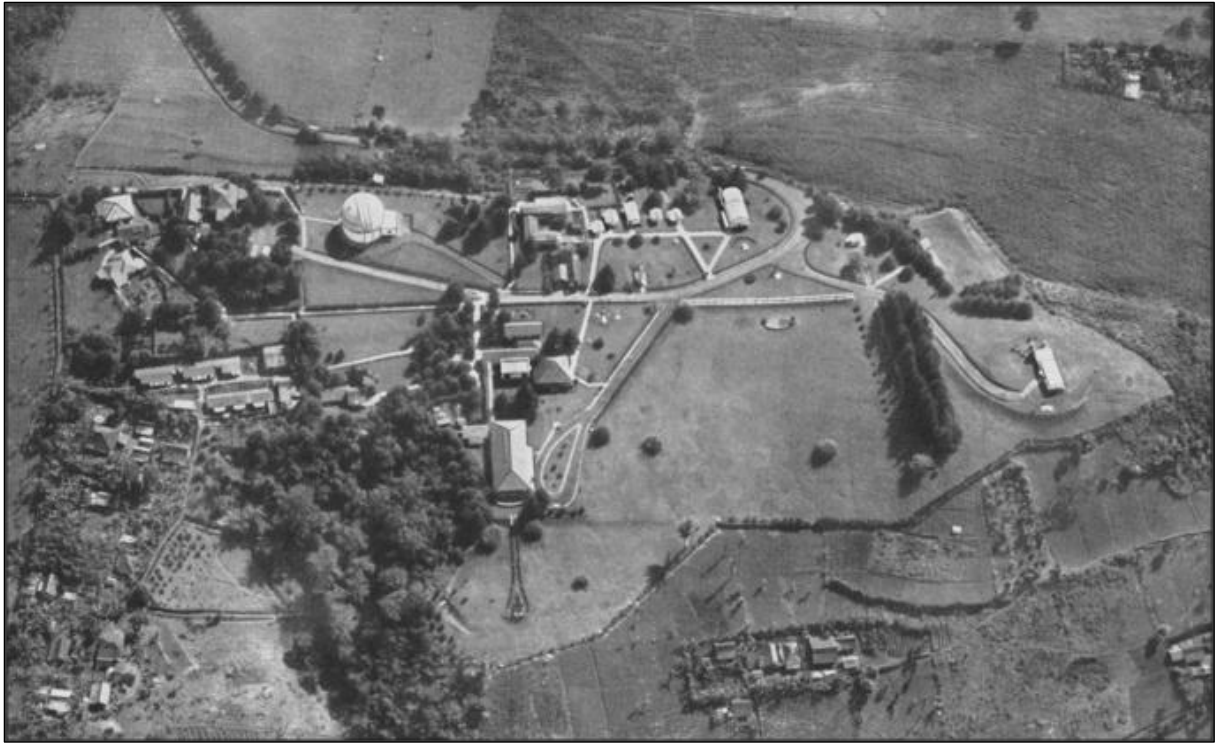


Figure 3: An aerial view of Bosscha Observatory soon after its founding (after Voûte 1933: Plate III).



Figure 4: A. de Sitter (after Oort, 1946).

ed to Java and ended up at an abandoned observatory at Cililitan in Jakarta.⁵ However, this was so run down and poorly equipped that Miyaji was relocated to the Lembang Astronomy Office, aka Bosscha Observatory (*ibid.*).

Japanese and Indonesian astronomers then worked in the Lembang Astronomy Office, and following Miyaji's intervention 65-year old Joan Voûte was released from a prisoner-of-war camp and allowed by the Japanese Government to also work at the Lembang Astronomy Office (Pyenson, 1989: 46). At the time, Voûte was white-haired and walked with the aid of a



Figure 5: Hisashi Miyaji (after Miyaji, 1975).

cane (Miyaji, 1975), a far cry from when he was founding Director of Bosscha Observatory (between 1923 to 1940). Thanks to Miyaji's support, Voûte was able to continue his pre-war research on double stars.

This was in stark contrast to his Dutch East Indies astronomy colleagues Aernout de Sitter, Willem Christian Martin (1910–1945),⁶ and Antonius Johannes Witlox (1900–1945).⁷ During the war all three were mobilised as soldiers, captured, and interned in prisoner-of-war camps where they subsequently died—some more quickly than others (see Oort, 1946).⁸

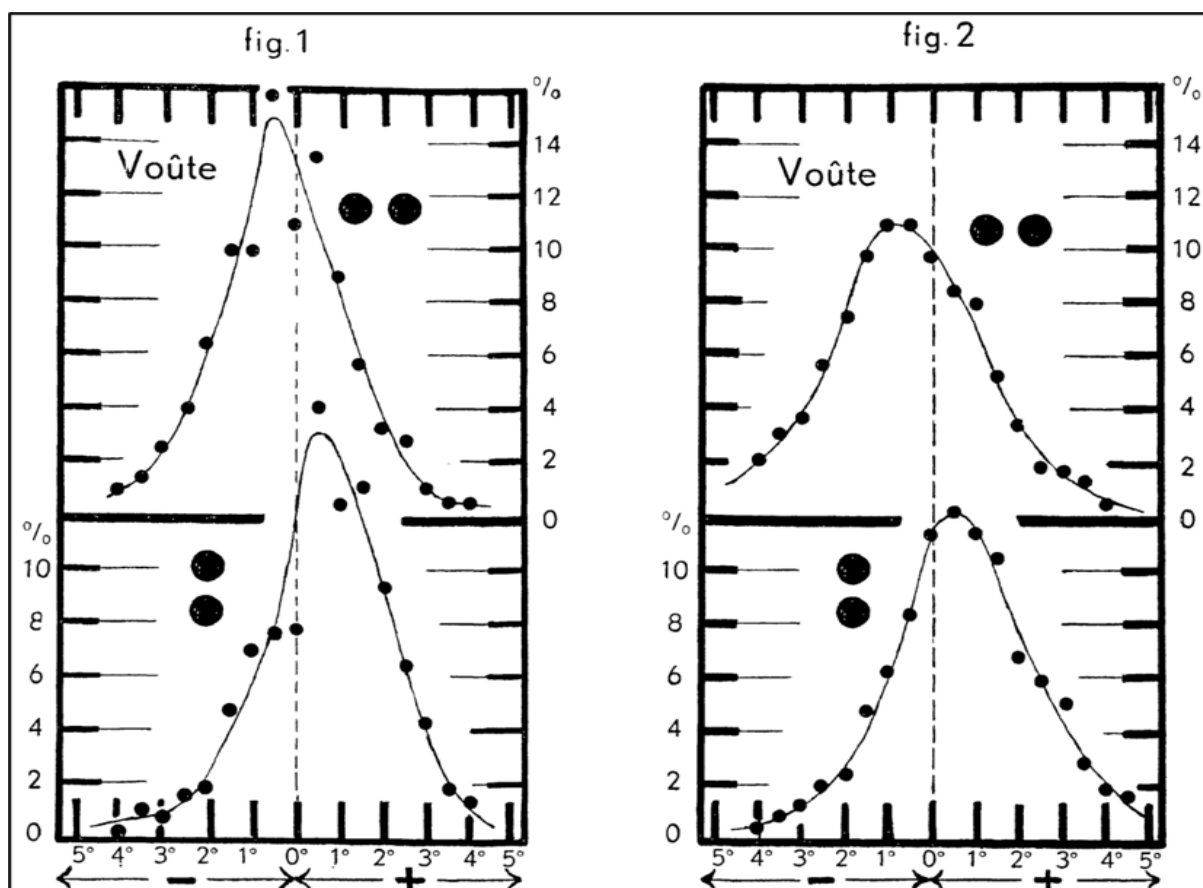


Figure 6: Voûte's observations of double stars using the reversing prism with the Zeiss 60-cm double refractor at Bosscha Observatory (after Voûte, 1954: 113).

While Miyaji could not save Voûte's colleagues he was able to save Indonesian astronomy and Bosscha Observatory during the Japanese occupation—even though the facility suffered damage during the hostilities and conditions were reported as awful (Miyaji, 1975).

Miyaji (1975: 319) revealed that only six Japanese, one Dutchman, and ten Indonesians worked at Lembang at this time. Voûte was the Dutchman, while the six Japanese astronomers were Kirita Masami, Uemae Shigemi, Kimura Tadataka, Nishikawa Toshio, Kawai Yagorō and himself. Kirita, Uemae and Kimura came from the Latitude Observatories at Tokyo or Mizusawa, while Nishikawa and Kawai were from the Faculty of Science at the University of Kyoto. The Indonesian staff relished the chance to gain experience in research, and particularly in observational astronomy.

Those at Lembang worked at the request of the military to determine latitudes; provide time calibrations; overcome transmission problems with the time-receiving signal; and prepare an azimuthal star chart. All of these were essential for the Japanese war effort (Miyaji, 1975: 320). But the astronomers went further: they monitor-

ed the Islamic calendar, and also carried out binary star observations (*ibid.*). The Islamic observations were essential for the well-being of Indonesia's Muslim population and to gain their support and sympathy.

Binary star observations were Voûte's speciality and one of the Observatory's primary research interests in the pre-War years. It is hard to see what specific benefit the Japanese military would derive from double star observations, and we can only conclude that this was Miyaji's private agenda, decided in consultation with Voûte. Nevertheless, the Japanese military apparently was happy to support this project, although they placed a ban on publishing any of the results during the war.

That Voûte did indeed systematically photograph double stars at this time is documented not only by Miyaji (1975) but also by papers that Voûte published later. For example, in his paper about the use of the reversing prism for measuring the position angle of double stars, Voûte (1954) explained that in mid-1943 he experimented with using and not using the reversing prism and concluded that each technique had different characteristics and margins of error (e.g. see Figure 6).

Table 1: Observable lunar eclipses visible from Bosscha Observatory between 8 March 1942 and 14 August 1945 (after Stellarium 1.2).

Type	Date	P1	U1	Max.	U2	P1
Partial	16 August 1943	23:58:25	00:58:41	02:28:18	03:57:53	04:58:11
Penumbra	29 December 1944	---	19:33:42	21:49:07	00.04.26	---
Partial	25 June 1945	19:25:40	20:37:10	22:13:52	23:50:40	01:02:12

Table 2: Observable solar eclipses visible from Bosscha Observatory between 8 March 1942 and 14 August 1945 (after Stellarium 1.2).

Type	Date	First Contact	Peak	Last Contact
Partial	1 August 1943	09:15:49	10:46:10	12.23.50
Partial-Annular	20 July 1944	12:15:35	13:51:25	15:10:51

In the Bosscha Observatory report that was written in 1947 and/or 1948, after Indonesian Independence, Voûte (1948: 5) explained that

... the following catalogue of photographically measured double stars was already written some years ago but has remained at the observatory when I had to leave it suddenly on the first of October 1945.

Since the original papers are not at my disposal, I give the following particulars from memory.

Voûte lists 233 double stars that were observed. However, if we examine the introduction he wrote, we see that he mentions some of the individuals who helped him with the analyses. Several were astronomers from outside of Lembang, including Kaj Aage Gunnar Strand (1907–2000), Willem Hendrik van den Bos (1896–1974), and Åke Anders Edvard Wallenquist (1904–1994). It is very likely that some of these analyses were carried before WWII, but only published after the war.

In 1955 Voûte published a 525-page catalogue of Bosscha Observatory observations of 37 different double stars, each of which had typically been photographed three times (Voûte, 1955). Clearly, most—if not all—of these observations were made during the Japanese occupation since Voûte left the Observatory soon after the war ended.

Finally, after the war the new Director of the Lembaga Astronomi Bosscha Sterrenwacht; (the name assigned to Bosscha Observatory after Independence) released the annual report for 1949/1950, where he stated that this would be a continuation of the *Annalen van de Bosscha Sterrenwacht* that was abandoned during the war. He also advised that the results of Voûte's double stars observations from 1943–1945 would be published in the ninth volume (Albada, 1951: 13–14).

It is quite possible that photographic plates exposed by Voûte during 1943–1945 are still there at Bosscha Observatory. After visiting the

Observatory in April 2025 Denny Mandey reported that most of the surviving photographic plates were unlabelled, scattered, and undigitized, due to the lack of staff responsible for archiving the plate collection. It can only be hoped that this situation will change in the future.

3.3 The Fate of the Royal Magnetic and Meteorological Observatory in Batavia

Meanwhile, during the Japanese occupation the Jakarta Weather Bureau also was known as the Kantor Angin Djakarta or the Jakaruta Kisho Kyoku, and sometimes referred to as the Djawa Kisho Kyoku or Jawa Kishō Kyoku in the *Asia Raya* newspaper. The Weather Bureau was able to employ Indonesians, and staff carried out astronomical and meteorological observations, and recorded earthquakes (Anonymous, 1943f). But their direct involvement in astronomy was at a lower level than those based in Lembang, because they had access to far more modest instruments.

4 THE TWO ECLIPSES OBSERVED FROM INDONESIA DURING WWII

Weather permitting, a total of five lunar eclipses and two solar eclipses could be observed from Indonesia between 8 March 1942 (Kalijati Ratification) and 15 August 1945 (The Defeat of Japan by the Allied Forces). The solar eclipses on 1 August 1943 and 20 July 1944 were the only solar eclipses that could be observed in Indonesia. Meanwhile, lunar eclipses on 15 August 1943, 4 August 1944, 29 December 1944 and 25 June 1945 were also visible from Indonesia. The lunar eclipse of 4 August could only be seen from the Sumatra region when the Moon rose. However, only the partial lunar eclipse of 15 August 1943 and the annular solar eclipse of 20 July 1944 received any publicity through the newspapers and a magazine.

According to the calculation from Stellarium Astronomical Calculator in Tables 1 and 2, the duration of the 1944 solar eclipse was 2 hours 55 minutes 35 seconds, while the duration of the 1943 lunar eclipse was 4 hours 59 minutes

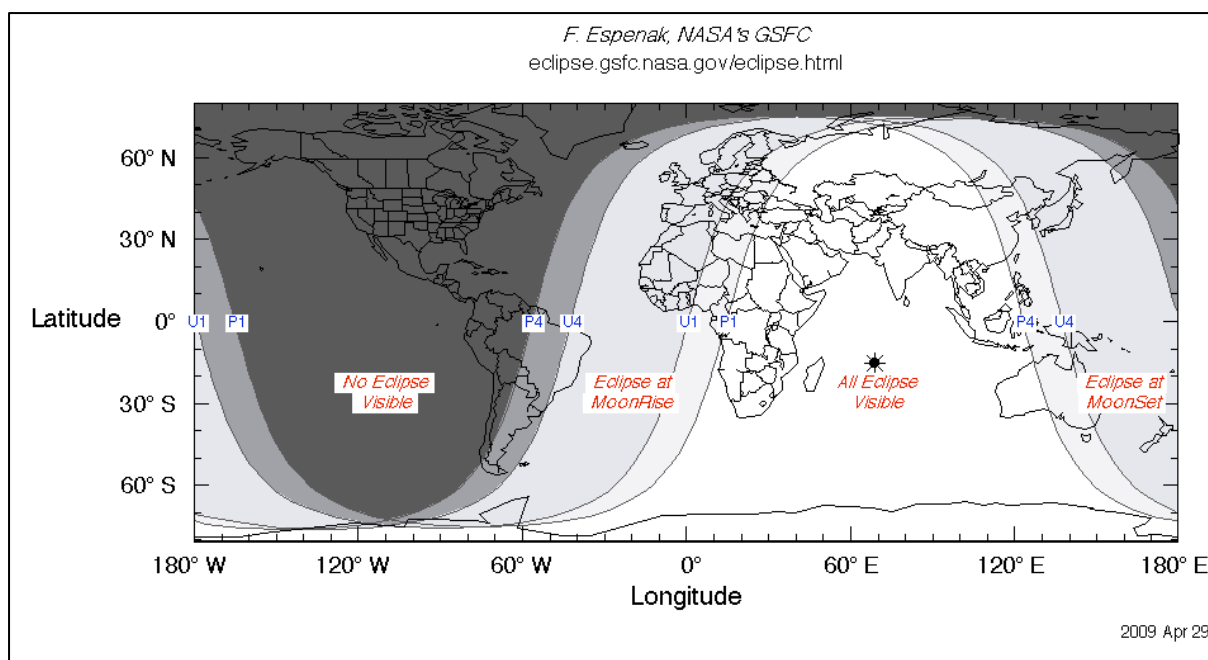


Figure 6: Visibility map for the lunar eclipse of 15 August 1943. Note that the eclipse was total over most of the Dutch East Indies (after [Espenak, 2009](#)).

46 seconds.

Although solar and lunar eclipses were popular with amateur astronomers and the general public, there is no mention of either event in [Miyaji's \(1975\)](#) account of astronomy during the Japanese occupation.

4.1 The Partial Lunar Eclipse of 15 August 1943

The lunar eclipse on 15 August 1943 was a partial event, with the Saros number of 137. The penumbral duration was 4 hours 56 minutes 44 seconds, and the umbral duration was 2 hours 56 minutes 23 seconds. As [Figure 6](#) indicates, only those living in Sumatra, Java, Borneo, and the Nusa Tenggara Islands, would have been able to see the entire eclipse, while those in the Celebes, Maluku and Papua, were not able to see the penumbral contact ([Espenak, 2009](#)).

News of the eclipse was reported in Banjarmasin's *Borneo Simboen* newspaper two days after the event. Here is an English translation:

Last Monday night. Approximately at 1 o'clock in this city the moon became dark which is commonly mentioned by the people as a lunar eclipse. Around 4 o'clock, the moon was only about 80 percent, from its normal size. Then at 6 o'clock the moon was back to its normal state and shone its light as it used to be, and the lunar eclipse had ended. ([Anonymous, 1943a](#)).

This lunar eclipse would have been clearly vis-

ible in rural areas where electric lighting was rare. Without doubt, the marked change in the appearance of the Moon would have been obvious to most observers.

4.2 The Annular Solar Eclipse of 20 July 1944

No total solar eclipses were visible from Indonesia during the Japanese occupation, but an annular eclipse, with the Saros number of 135, occurred on 20 July 1944. The eclipse path is shown in [Figure 7](#). Almost every region in Indonesia could see the solar eclipse, but visibility ranging between 35% and 80%. On Java the visibility only ranged between 35% and 40%, yet the eclipse was successfully observed from both Jakarta and Lembang.

Solar eclipses bring the risk of blindness if observers do not have suitable equipment and appropriate knowledge of how to observe safely. Thus, the Japanese Government forewarned people of the eclipse through an article in the *Asia Raya* newspaper on 19 July. Here is an English translation of the account:

The solar eclipse will happen on 20 July and could be seen in the Southern region, according to the statement of the responsible office, it can be seen partially in Jakarta, which will start at 2.10.56 at noon and the peak at 3.48.50 (39%).

The sun will come back to its initial state as it used to be at 5.9.41. By using the black-glasses people can observe this phenomenon. ([Anonymous, 1944a](#)).

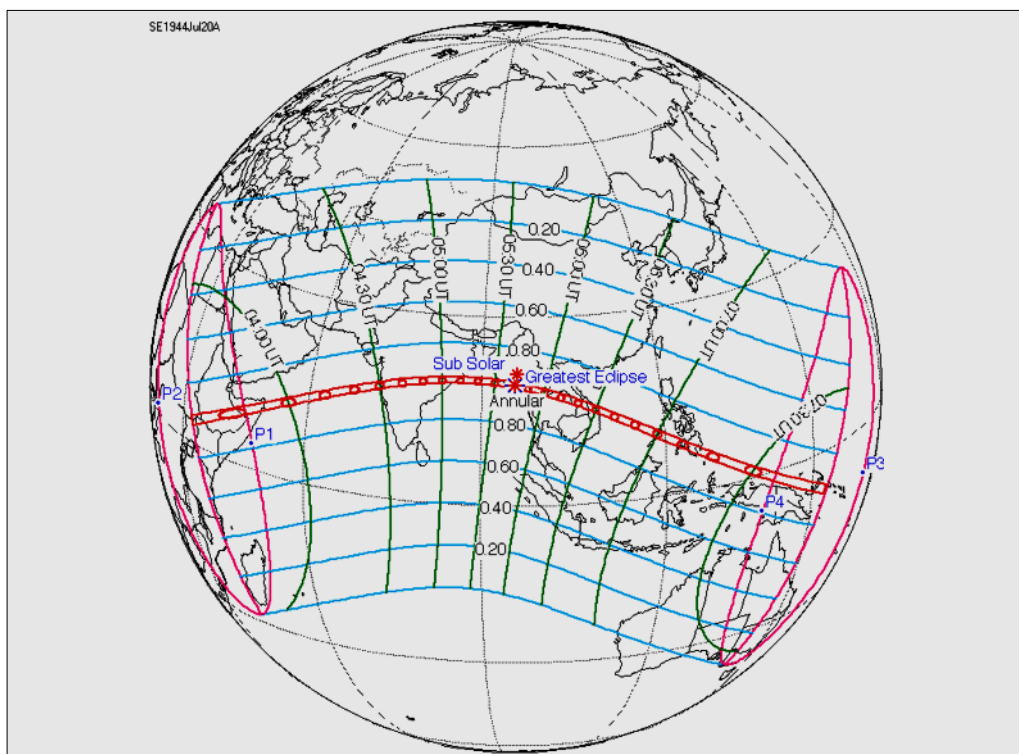


Figure 7: Map of the path of the 20 July 1944 annular solar eclipse, which was a partial eclipse as viewed from throughout Indonesia (after [Esenak, 2004](#)).

Maximum visibility in Jakarta would be 39%. Note that the *Asia Raya* article ended by recommending (but not insisting) that people use black glasses when observing the eclipse.

On the day when the eclipse occurred there were no newspaper reports of observations, and the first eclipse report appeared on 21 July

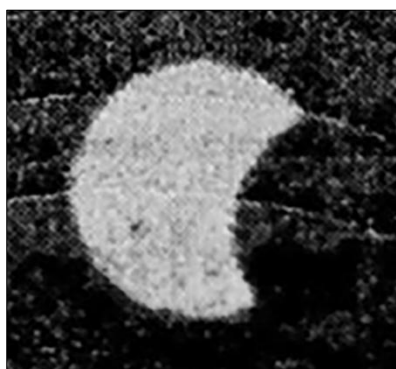


Figure 8: A photograph of the maximum phase of the 20 July 1944 partial solar eclipse (after [Anonymous, 1944b](#)).

1944 in the *Asia Raya* newspaper, which included a photograph a picture of the event eclipse ([Figure 8](#)) clear enough ([Anonymous, 1944b](#)). Thus, it could be concluded that there was clear weather at the time of observation.

The next article about the eclipse appeared in the *Djawa Baroe* magazine on 1 August 1944.

This magazine, also included photographs taken in Jakarta and Lembang. Both the Jakarta Weather Bureau and the Lembang Astronomy Office contributed observations. Those living in *kampongs* (villages) also observed it while holding a thin layer of black film in front of their eyes ([Anonymous, 1944b](#)).

This magazine also included two full pages of photographs of observations made by the professional astronomers and common people. One of the photographs showed a staff member from the Lembang Astronomy Office observing the eclipse ([Figure 9](#)). If we compare [Figure 9](#) with [Figure 10](#) and the Bosscha Observatory description that was published by [Voûte \(1933: A26\)](#) eleven years earlier, we can confirm that the telescope used for the eclipse observation was the Zeiss 13-cm.

In the capital, staff at the Jakarta Weather Bureau observed the eclipse with a small telescope. Although the Weather Bureau is located in the middle of a large city, there was no information about whether the observation was open to the public or not (see [Anonymous, 1944c](#)).

[Figure 11](#) shows two different staff members from the Jakarta Weather Bureau observing the eclipse. The left-hand image was taken from the *Asia Raya* newspaper, which contained plenty of other news, so the eclipse photograph was small and not very clear. By contrast, the

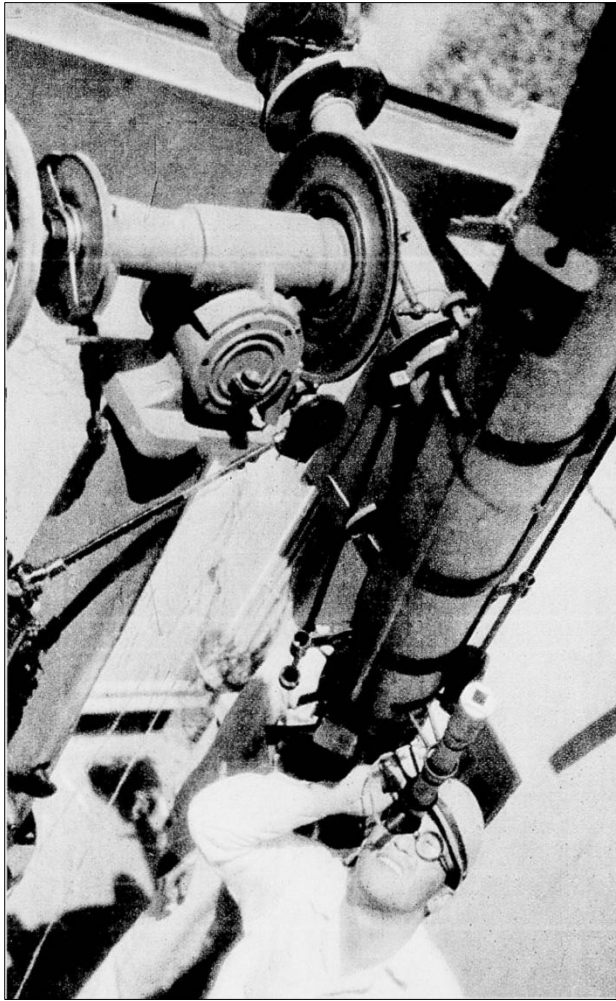


Figure 9 (above left): Observation of 20 July 1944 annular solar eclipse at the Lembang Astronomy Office (Bosscha Observatory) (after [Anonymous, 1944c](#)).

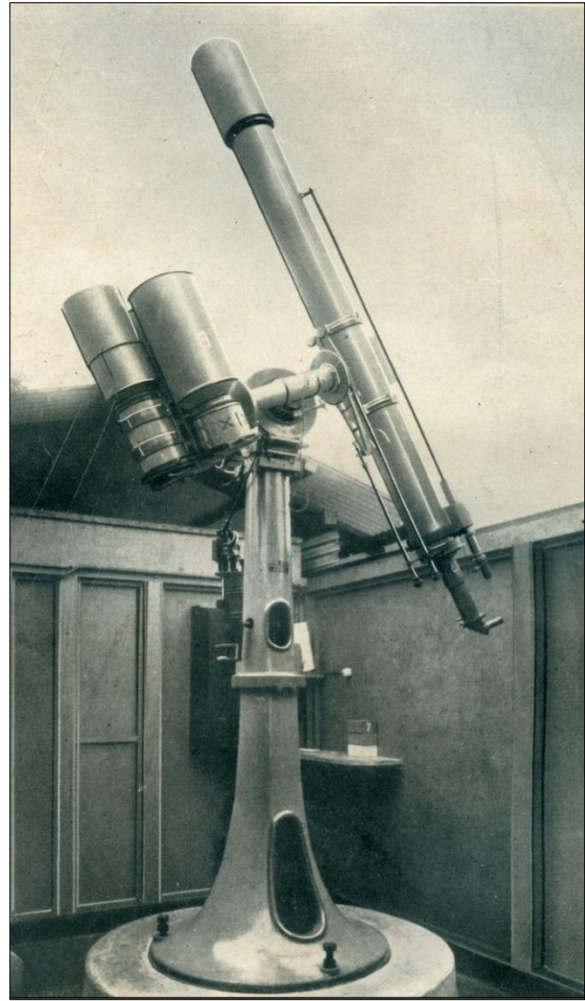


Figure 10 (above right): The Zeiss 13-cm refractor and two astrocamera on the same equatorial mounting at Bosscha Observatory (after [Voûte, 1933: Plate XI](#)).



Figure 11 (right): Observations of the 20 July 1944 partial solar eclipse from the Jakarta Weather Bureau (after [Anonymous, 1944b](#)).

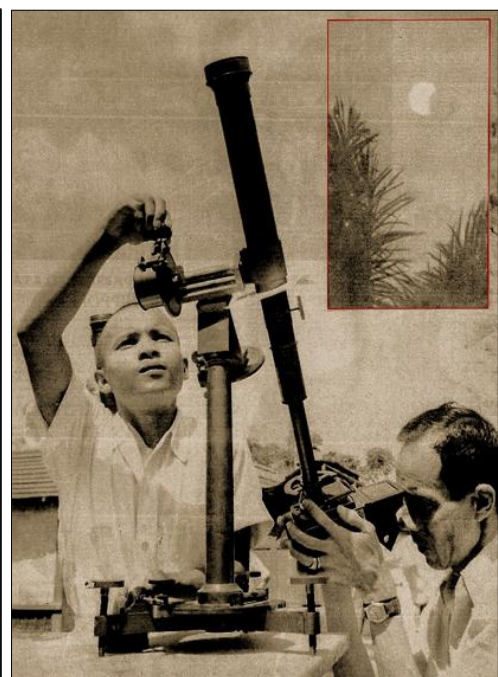




Figure 12: Observing a projected image of the 20 July 1944 partial solar eclipse from the Jakarta Weather Bureau (after Anonymous, 1944c).



Figure 13 (above, right): Safely observing the partial solar eclipse of 20 July 1944 from a village (after Anonymous, 1944c).

right-hand image shows some detail. The telescope is much clearer, and is a small equatorially mounted refractor. In one corner of the photograph there is an insert showing the solar eclipse at or near its maximal phase.

The staff from the Jakarta Weather Bureau not only looked through the telescope but they also observed using the projection technique (see Figure 12). The advantage of this technique was that the solar image could be viewed safely by many people simultaneously.

Observations of the eclipse also were made from the villages, as shown in Figure 13 and explained in the *Djawa Baroe* magazine:

Also in the kampong [village] people gazed at the sky, observed the solar eclipse by using the black lens which they made it themselves. (Anonymous, 1944c; our English translation).

Finally, it is not surprising that the astronomers at the Lembaga Astronomy Office did not produce any academic publications based on their observations of the 1943 and 1944 eclipses, since their observations did not contribute in any useful way to astronomical research. These eclipses, at best, were mere public spectacles.

5 RUKYAT: THE OBSERVATION OF THE MOON TO DETERMINE THE BEGINNING OF THE ISLAMIC CALENDAR

Rukyatul Hilal (or *rukya*t) is the observation of the crescent Moon at the end of the Islamic calendar, or Hijri. The purpose of this observation is to determine the beginning of next month (Bashori, 2015: 193–194). *Rukya*t is crucial for this observance, particularly since there are many holy months in Islam. There are three

important *rukya*t months, namely Ramadan, Syawal, and Zulhijjah (Bashori, 2015: 17). Each of these is an important event, for the following reasons. First, Ramadan is the month when Muslims fast; second, on 1 Syawal is the day of Eid Mubarak; and the last, Zulhijjah is the month for the Hajj and the day of Eid Adha on 10 Zulhijjah.

*Rukya*t also involved the affirmation of the hisab calculation. The data taken from hisab are used to predict the Moon's condition, such as *ijtima'* (conjunction), elongation, and *hilal* altitude. If the *hilal* was unable to be seen, due to the obstruction of weather or was impossible to be seen because the Moon was below the horizon, then *istikmal* would be applied. *Istikmal* is the fulfilment of the Hijri month from 29 days to 30 days.

During the Japanese occupation *rukya*t was also conducted, and as in the previous era was in the hands of the Office of Religion (*Dinas Agama*), a public organisation. The *hilal* observation tends to be used for religious matters rather than for science. These observations would later supplement the calculations that were made to determine the accuracy of the hisab by the many Islamic organisations during the Japanese occupation period.

Figure 14 is a photograph from the *Asia Raya* that shows *hilal* observations by Islamic clerics (*oelamas*) using a simple instrument (Anonymous, 1943c). Note the small size of the instrument, which was not a telescope but rather a simple viewfinder that could be used to make an altitude measurement. The 2 September 1943 issue of the *Asia Raya* provides this brief description:

The [Islam] clerics on Tuesday, night of Wednesday, on 31 August deployed by



Figure 14: A *Hilal* observation conducted by Islamic clerics (after [Anonymous, 1943d](#)).

the Commission of Fasting Months, were busy observing the Moon in the direction where the Sun set, in order to determine the beginning of the Fasting months. ([Anonymous, 1943d](#)).

Meanwhile, we could not find any other photographs showing *hilal* observers using a more complex instruments to observe the *hilal*.

According to [Miyaji \(1975\)](#) astronomers at the Lembang Astronomy Office also observed the *hilal* to complete the *hilal* data. The Office of Religion (*Kantor Agama*) in Jakarta would receive the reports on the *rukyat* result from different regions and would then determine the beginning of the new month in the Islamic calendar. And as mentioned earlier, they also reported in the newspapers. An issue of the *Borneo Simboen* newspaper also reported the results of a one month calculation for the year 1944, or 2604 in the Japanese year (Sumera) and 1363 Hijri in the Islamic calendar ([Anonymous, 1944e](#)).

The main newspaper in Java, Jakarta's *Asia Raya*, reported the *imsakiyah* schedule during the Japanese occupation as well. This schedule contained prayer times, which were crucial for Muslims. As a rough approximation, Islamic prayer times could be determined by a sundial.

For example, Dzuhur should be held when the Sun is at its highest culmination (or at the zenith) and moving towards the West; Ashar when the Sun's altitude is approximately 45° ; and Maghrib when the Sun sets in the West. The *imsakiyah* schedule appeared in the *Asia Raya* newspaper on 28 August 1943 and 23 August 1944 for Ramadan ([Anonymous, 1943c](#); [Djoen-aedi, 1944](#)). Based on the prayer times shown in the *Asia Raya*, the time zone used was the Tokyo time zone (UTC+9). Those *imsakiyah* schedules also appeared when *rukyat* had been held, and the fasting month had already been decided by the Government.

Hilal visibility is affected by many factors, including the weather and the Moon's altitude. Weather is one of the unavoidable factors, particularly because Indonesia is a tropical country with wet and dry seasons. If the *rukyat* is held during the rainy season, then the probability of the *hilal* being invisible due to rain becomes high. Then it should be determined by the *hisab*, or calculation of the position of the Moon below the horizon, or in other words, setting before the Sun, when it is impossible to see the *hilal*.

Of the four *rukyat* of Ramadan held in the period of the Japanese occupation, which are shown in [Table 3](#) below, there was a high prob-

Table 3: *Roe'jah* or *Hilal* observations to determine the Fasting Month 1942–1945 (after Stellarium and Al-Habib).

Gregorian Date	Hijri Date	Moon Altitude	Visibility	Moon's Position	Result
11 September 1942	29 Sya'ban 1361	+7°	Probably	Above the Horizon	New Month
31 August 1943	29 Sya'ban 1362	+5°	Probably	Above the Horizon	New Month
19 August 1944	29 Sya'ban 1363	+5°	Confirmed	Above the Horizon	New Month
8 August 1945	29 Sya'ban 1364	+5°	Probably	Above the Horizon	New Month

Table 4: *Roe'jah* or *Hilal* observations to determine Eid Mubarak in 1942–1945 (after Stellarium and Al-Habib).

Gregorian Date	Hijri Date	Moon Altitude	Visibility	Moon's Position	Result
10 October 1942	29 Ramadan 1361	+2°	Probably	Above the Horizon	New Month
29 September 1943	29 Ramadan 1362	−0° 29'	None	Set before the Sun	Istikmal
17 September 1944	29 Ramadan 1363	−0° 46'	None	Set before the Sun	Istikmal
6 September 1945	29 Ramadan 1364	−1°	None	Set before the Sun	Istikmal

ability that the *hilal* of all of them would be seen. The lowest *hilal* altitude was 5°, and the highest was 7° above the western horizon. So it was likely that the *hilal* could be seen.

One of the reports that supported Table 3 appeared in the *Asia Raya* on 19 August, and advised that a *hilal* observation would be made in Tomang and Rawa Buaya in Jakarta in the evening (Anonymous, 1944g). The 1 September issue of the very same newspaper printed 1 Ramadan 1362 on the top-right corner of those pages opposite the Sumera Calendar.

According to Table 4, only the *rukyat* of Syawal on 30 Ramadan 1361, equivalent to 10 October 1942, had a probability of the Moon being visible. Three *rukyat* observations between 1943 and 1945 were impossible to see due to the low altitude of the Moon and being below the Sun. Additionally, the Moon had already set when Maghrib or when the Sun was on the western horizon. If the *hilal* was seen on 10 October 1942, then on Maghrib on the same day the Syawal month began and it was possible to hold takbiran. Then the next day, people would celebrate Lebaran or Ied Mubarak.

A report in the *Asia Raya* on 27 September 1943 confirmed that *hilal* was not seen and that hisab was mainly preferred (Anonymous, 1943e). *Rukyat* was planned to be held on the night of Thursday or Wednesday, 29 September 1943, but the *hilal* was impossible to see. In the meeting of Islamic clerics meeting on 26 September 1943, it was decided that the *hilal* would be impossible to see because its altitude was only approximately 1°. Hence, at that meeting, they decided that Ramadan was completed with istikmal, thus the beginning of Syawal started on Friday 1 October 1943 (*ibid.*). From the report description it is clear that the clerics at that meeting stated a decision using the hisab method without waiting for confirmation from *rukyat*. Data delivered at that meeting also

differed from the simulation data listed in Table 4, which states that from the Stellarium simulation the *hilal* altitude was approximately −0° 46'. In other words, there is a difference of at least 1.5° between the data presented at the meeting of the clerics on 26 September 1943 and the Stellarium simulation.

Rukyat was not the only tool to determine when the fasting month began. On 20 August 1943 the *Asia Raya* reported that the meeting of Islamic clerics decided that Ramadan would begin on 1 September 1943 (Anonymous, 1943b). Despite that decision, which fits the condition when *rukyat* should be held, without a doubt the news indicating that the use of hisab was prioritised.

Problems with setting the date of the fasting month also occurs in Indonesia these days. Because of the numerous Islamic organisations with different criteria, it is possible that the beginning of the fasting month differs in each organisation. During the Japanese occupation, the same thing happened as well, in Bogor Residency or Bogor Shuu. On 17 August 1944 the *Asia Raya* reported the new law on the *rukyat* or determination of the fasting month in several regencies in Bogor Residency. Regencies or Ken that were mentioned by the newspaper included Bogor, Sukabumi, and Cianjur. Those three regencies had to report to the residency if they saw *hilal* during *rukyat*. The determination would then be decided by that residency. When the new law was announced the Japanese Government expected that the beginning of the fasting month would be simultaneous in every region (Anonymous, 1944f).

Rukyat was held in several regions, then the observational results were reported to Jakarta. On 19 August 1944 the *Asia Raya* suggested that people should not sound the beduk before the official announcement from the Government. Also, in the same report, *rukyat* in Jakarta was held by the Committee of Ramadan and Shu-

Table 5: Roe'jah and Hilal observational news on the Fasting Month reported by the *Soeara Asia* and *Asia Raya* in 1942–1945.

Gregorian Date	Hijri Date	Moon Position	Result	Confirmed By
11 September 1942	29 Sya'ban 1361	Above the Horizon	New Month	<i>Soeara Asia</i> , 11 September 2602
31 August 1943	29 Sya'ban 1362	Above the Horizon	New Month	<i>Asia Raya</i> , 20 August 2603
19 August 1944	29 Sya'ban 1363	Above the Horizon	New Month	<i>Asia Raya</i> , 20 August 2604
8 August 1945	29 Sya'ban 1364	Above the Horizon	New Month	<i>Asia Raya</i> , 9 August 2605

Table 6: Roe'jah and Hilal observational news on Eid Mubarak reported by the *Soeara Asia* and *Asia Raya* in 1942–1945.

Gregorian Date	Hijri Date	Moon Position	Result	Confirmed By
10 October 1942	29 Ramadan 1361	Above the Horizon	New Month	<i>Soeara Asia</i> , 10 October 2602
29 September 1943	29 Ramadan 1362	Set before the Sun	Istikmal	<i>Asia Raya</i> , 26 September 2603
17 September 1944	29 Ramadan 1363	Set before the Sun	Istikmal	<i>Asia Raya</i> , 18 September 2604
6 September 1945	29 Ramadan 1364	Set before the Sun	Istikmal	<i>Asia Raya</i> , 7 September 2605

umuka in Tomang and Rawa Buaya. After the Government in Jakarta received all of the *rukyat* reports from various regions the result for the beginning of the fasting months was then announced by radio at 10 pm (Anonymous, 1944g).

From the *hilal* of Ramadan a decision was issued by the Government (Table 5). From 1942 to 1945 when each of the *hilal* observations was conducted, the Moon was located above the western horizon, making the *hilal* visible. While the *hilal* of Syawal (Table 6) only had a chance of being visible, the remainder were completed to 30 days.

The Government's stance had been reported a week before in the same newspaper, the *Asia Raya*. In the rubric *Tanja-Djawab Pemerintah-Sanyo* (Question-Answer Government-Sanyo) with the special theme of *Menjongsong Boelan Poeasa* (Welcome the Fasting Month), there was one sub-rubric with the title of Roekjat dan Hisab. The Japanese occupation Government tended to make decisions based on the visibility of the *hilal*, even though several parties were only using the hisab criteria. Despite the regulated use of the *rukyat* method, the Government still allowed the people to choose as part of religious freedom (Anonymous, 1944d).

Nowadays, *hilal* observations in Indonesia are conducted by many parties, including the Government, the Ministry of Religion (*Kementerian Agama*; *Kemenag*) and the Office for Meteorology, Climatology, and Geophysics (*Badan Meteorologi, Klimatologi dan Geofisika*; *BMKG*). There are other professional parties

that also make observations, such as the Office of National Research and Innovation (*Badan Riset dan Inovasi Nasional*; *BRIN*) and Bosscha Observatory. Meanwhile, amateur and non-professional groups, such as Islamic boarding schools and local astronomy clubs (including the Surabaya Astronomy Club), also make *hilal* observations.

6 AFTER THE END OF THE WAR

The defeat of the Japanese military on 15 August and the Proclamation of Independence of the Republic of Indonesia on 17 August weakened the Japanese domination at Bosscha Observatory, which by this time was a total mess.

Miyaji left the Observatory on the day of the Japanese defeat after immediately telling Voûte the war had ended, but apparently Voûte had already heard of the surrender of the Japanese military to the Allied Forces. Miyaji (1975) later mentioned that Voûte brought his grandchildren to the Observatory to say farewell.

There are three different versions of when Voûte left the Observatory. In the introduction of *Annalen van de Bosscha Sterrenwacht*, he wrote that he left the Observatory on 1 October 1945 (Voûte, 1948), while in one of his post-war double star papers he stated that he was "... forced to leave the Bosscha Observatory in September 1945." (Voûte, 1955: 109). But Pyenson (1989: 81) has a different version in his book: "The native Javanese expelled Voûte from the observatory grounds on 8 October 1945." Pyenson used a letter sent by Hendrik

van Gent (1899–1947) to Ejnar Hertzsprung (1873–1967) to arrive at this date. There are three different dates, but we can safely say that Voûte left the Observatory in early October 1945.

After the war Miyaji and Voûte kept in touch. Several years later Voûte was working at Strasbourg Observatory, and he sent Miyaji a letter about his wish to observe double stars with the 65-cm equatorial telescope at Tokyo Astronomical Observatory (Miyaji, 1975), where Miyaji was the Director. Meanwhile, in one of his letters Miyaji mentioned Aernout de Sitter, and he asked Voûte to find information about him.

When Miyaji and Voûte left, Bosscha Observatory was in a deplorable state, probably a combination of action by the Japanese military and then the local Indonesian paramilitary units that could enter the Observatory at will. Therefore, when Elsa van Dien arrived in Indonesia in late 1948 tasked with returning Bosscha Observatory to working condition she faced a challenge. According to her accounts some of the damage was done by the Japanese military, but the occupying Dutch and British Armies also were responsible for maintaining chaos in Indonesia (and at the Observatory).

Under the guidance of Coert Hendrik Hins (1891–1951), Elsa and Gale Bruno van Albada (her future husband), restored the Observatory buildings, replaced a lost lens on one of the telescopes, erecting a new telescope funded by UNESCO, and brought the Observatory back to its initial function as an international astronomical research centre (see van den Heuvel, 2025, and research papers published by staff since 1940).

7 CONCLUDING REMARKS

The Lembang Astronomy Office (the new name of Bosscha Observatory) functioned as an astronomy research centre during the Japanese occupation of Indonesia in WWII, somewhat like its initial function during the Dutch colonial era. Three staff members of Bosscha Observatory were interned and died in prisoner-of-war camps during WWII. Of the eleven people who worked at the Observatory during the Japanese occupation only one was Indo-Dutch, and he was former Director Joan Voûte. With the help of Miyaji Masashi, the Director of the Observatory at the time, Voûte was released from a prisoner-of-war camp and returned to the Observatory. Once there, he was able to continue his research on double stars, although it was not possible to publish any of the results until after the war.

Apart from Voûte's successfully visual and

photographic observations of double stars, staff at the Lembang Astronomy Office were involved in other work in collaboration with the military, such as providing a time service and making the *hilar* observations necessary to determine the beginning of the month in the Islamic calendar. However, most of the *hilar* observations were carried out by Islamic clerics, and although decisions were made following the clerics' meetings, the final decision was always made by the occupying Government. Note that hisab calculations were always carried out before any *hilar* observations were attempted.

During the Japanese occupation of Indonesia not all the astronomical observations were carried out in Lembang. Those at the Weather Bureau in Jakarta also made observations, but these were at a low level because of the modest telescopes at their disposal.

Only two different eclipses were publicised and observed by astronomers and the public while the Japanese occupied India during WWII. One was the partial lunar eclipse of 15 August 1943 and the other the annular solar eclipse of 20 July 1944—which was seen as a partial eclipse throughout much of Indonesia. The solar eclipse gained more press coverage than the lunar eclipse, but the professional astronomers treated both events as mere 'astronomical spectacles', since they were not seen to have any scientific value.

8 NOTES

1. The 'Dutch East Indies' or 'Dutch Indies' referred to the region ruled by the Colonial Government of Dutch Indies from 1816 to 1942, while the term 'Indonesia' refers to the period of Japanese occupation in the formerly Dutch East Indies region. In this paper the terms 'Indonesian region' and 'Indonesian archipelago' have no political or chronological connotations and merely refer to the geographical region of island SE Asia that is now occupied by the nation of Indonesia.
2. The Royal Magnetic and Meteorological Observatory of Batavia was located in Engelsche Kerking Street (now Jalan Arief Rachman Hakim), beside the Anglican Church. Just like Mohr's Observatory, currently there are no traces left of this building. Several sources mentioned its name, or more specifically its location. During the Japanese occupation period the name was changed to the Jakarta Weather Bureau.
3. Several sources state that Aernout de Sitter died while in a prisoner-of-war camp. There is a grave-stone in the Heroes Cemetery (Eereveld) Pandu in Bandung which

- states that he was registered as a member of the Dutch Indies Colonial Army (KNIL). According to the prisoner-of-war report card, he was captured on 7 July 1943, fell ill with thiamine deficiency (i.e. *beriberi*) on 26 August 1944, and died on 15 September 1944 in the Hospital of Malay Prisoner of War Second Branch in Palembang, Sumatra.
4. Masashi Miyaji's name is sometimes given as Masasi Miyadi. As an anonymous referee of this paper noted, this "... is not a misspelling. The Japanese used ... Miyadi in publications generally before WWII, but after the 1950s they tended to prefer ... Miyaji. This is because the spelling of Miyaji is considered to be closer to the natural pronunciation in Japanese."
 5. In December 1942 the Japanese occupying forces renamed Batavia Jakarta in their attempt to remove evidence of Dutch colonialism. The new name was retained after WWII when Indonesia gained independence. Jakarta is a corrupted version of the original Javanese name Jayakarta.
 6. Willem Christian Martin was mobilised as a KNIL soldier in the artillery forces and was captured by the Japanese on 8 March 1942. He entered the prisoner-of-war camp in Cilicap on 15 August 1942, then moved to a camp in Bandung, and on 7 November 1943 was transferred to the camp in Palembang. He then suffered from chronic colitis from 28 August 1944 through to his death on 29 June 1945.
 8. Antonius Johannes Witlox was mobilised with the KNIL and captured by the Japanese in Bandung on 8 March 1942. At the time he was registered as an astronomer, but also had an infantry soldier rank. He was immediately sent to the Java Prisoner of War First Branch in Bandung, but on 14 September 1944 was transferred to the Malay Prisoner of War First Branch in Pekanbaru. He fell ill with acute enteritis on 28 March 1945 and died on 7 April 1945.
 9. The documentation that currently exists does not fully explain the mobilisation of Dutch Indies astronomers during the war, in the cases of De Sitter, Witlox and Martin. Note the simultaneous capture of Witlox and Martin on 8 March 1942, when the Colonial Government of the Dutch Indies surrendered to the Japanese Army with the ratification of the Kalijati Agreement in Subang. Subang is located north of Bandung and Lembang, and it is very likely that Witlox and Martin were captured in Bandung when the KNIL soldiers were defeated by the Japanese army.

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Over the past two decades Wayne has supervised more than 35 Master of Astronomy and PhD history of astronomy research projects through three different Australian universities.

Wayne has wide-ranging research interests and more than 500 publications, mainly about historic transits of Venus; historic solar eclipses; historic telescopes and observatories; the emergence of astrophysics; the history of cometary and meteor astronomy; the astronomy of James Cook's three voyages to the Pacific; amateur astronomy and the amateur–professional interface; the history of meteoritics; Indian, Southeast Asian and Māori ethnoastronomy; and the history of radio astronomy in Australia, France, India, Japan, New Zealand and the USA. He has published various papers on aspects of Indonesian and island SE Asian history of astronomy and ethnoastronomy.

Recent books by Wayne include *Exploring the History of New Zealand Astronomy ...* (2016, Springer); *John Tebbutt: Rebuilding and Strengthening the Foundations of Australian Astronomy* (2017, Springer); *The Emergence of Astrophysics in Asia ...* (2017, Springer, co-edited by Tsuko Nakamura); *Exploring the History of Southeast Asian Astronomy ...* (2021, Springer, co-edited by Mayank Vahia); *Golden Years of Australian Radio Astronomy: An Illustrated History* (2021, Springer, co-authored by Peter Robertson and Woody Sullivan), and *Histoire de la Radioastronomie Française* (2025, EDP Sciences, co-authored by James Lequeux). He has also edited or co-edited a succession of conference proceedings.

Since 1985 Wayne has been a member of the IAU, and he is a former President of Commission C3 (History of Astronomy). In 2003 he founded the IAU's Historical Radio Astronomy Working Group, and is the current Radio Astronomy Subject Editor for the Third Edition of Springer's *Biographical Encyclopedia of Astronomers*. He also founded the IAU Working Group on Historic Transits of Venus, and is the founding Director of the Historical Section of the Royal Astronomical Society of New Zealand.

In 1998 Wayne co-founded the *Journal of Astronomical History and Heritage*, and was the Managing Editor until 31 July 2022 when he passed ownership of the journal to the University of Science and Technology of China. In 2013 the IAU named minor planet 48471 'Orchiston', and in 2019 he and Dr Stella Cottam were co-recipients of the American Astronomical Society's Donald E. Osterbrock Book Prize for their 2015 Springer book, *Eclipses, Transits and Comets of the Nineteenth Century: How America's Perception of the Skies Changed*. In 2023 Wayne was elected an Honorary Member of the Royal Astronomical Society of New Zealand, and Springer published the following Festschrift: Gullberg, S., and Robertson, P. (eds), *Essays in Astronomical History and Heritage: A Tribute to Wayne Orchiston on His 80th Birthday*. In January 2024 Wayne and Darunee Lingling Orchiston attended the Winter Meeting of the American Astronomical Society in New Orleans, where he was presented with the 2024 Le Roy E. Doggett Prize for History of Astronomy. In August 2026 they will go to Toowoomba, Australia, where Wayne will receive an Honorary DSc from the University of Southern Queensland.

Wayne and Darunee Lingling live in a quiet village near Chiang Mai in northern Thailand. When not involved in astronomy he enjoys following Australian and New Zealand athletics, and Formula 1 motor racing.