

LUNAR CALENDAR CONFERENCE OVERVIEW

Imad-ad-Dean Ahmad

In recent times the Islamic world has fallen into confusion every time the date of an 'Id festival or the fast must be set. This year Saudi Arabia began its fast before the commencement of the new moon, by any scientifically acceptable definition. In America different groups began their fast on different dates. Yet, although three different definitions of the new moon were used, all groups managed to end on the same date.

Much of the confusion is due to misunderstanding scientific terms or failing to appreciate the accuracy and precision of scientific models. For example, why should people who closely follow scientific calculations of solar positions and setting for the purpose of determining the daily prayers completely reject the scientific calculations of moonset—even to the point of accepting allegations of lunar sightings after the moonset time? The conference that we are holding today and tomorrow is primarily a meeting of astronomers, both Muslim and non-Muslim, who are dedicated to clarifying the issues involved with determining the Islamic lunar calendar by presenting the most up-to-date information on the matters of orbital calculation. Confusion that arises from disagreements over *fiqh* and the interpretation of the meanings of hadith are better left to a future joint conference of *fuqaha* and Muslim astronomers.

The first part of verse 189 of *Surat al Baqarah* has been translated by A. Yusuf Ali in the following manner: "They ask thee concerning the new moons. Say, they are but signs to mark fixed periods of time in (the affairs of) men, and for pilgrimage." Thus the new moon has no mystic significance—the moon's phases are only a clock. Similarly, the Prophet (peace be upon him) chastised those followers who said that the sun darkened because of the death of his infant son Ibrahim, with the admonition that the

sun and moon are signs of Allah and do not eclipse for the death of human beings.¹

The question that has caused so much confusion among Muslims is how to read this clock Allah has placed in the sky—especially as regards the beginning and end of Ramadan. By definition the astronomical new moon is when the moon lines up between the earth and sun (defined as the time when the celestial longitude of the moon and sun are the same). At that time the moon cannot be seen from earth because it is too close to the sun and is lost in the glare of the daylight scattered from the sun by the air. It is not until many hours later that the new moon can be seen.

It takes the moon 29 1/2 days to travel its orbit around the sun. Thus the month can be 29 or 30 days. (Many *ahadith* support this well-established fact.) The Prophet warned his companions that they were an unlettered people who could “neither write nor count,” and therefore they must prefer to sight the moon rather than calculate its position—although, if the day were cloudy, they could calculate it by waiting 30 days from the previous new moon.² Later, when Islamic civilization flourished and the Muslims could not only count and write but had invented spherical astronomy, the scholars were able to calculate the time when a new moon could be sighted. Today, we can calculate the time of new moon sighting to within a few hours (for most places on the earth), and the exact time of the astronomical new moon more accurately than watches are generally maintained.

BACKGROUND

One requirement which must be imposed not only on scientific models, but also on juristic decisions, is the requirement of logical consistency. While it is not for a scientific assembly to dictate to Muslims whether to use the time of calculated sighting (traditional definition of new moon) or the time of actual conjunction (astronomical definition of new moon) to set their calendars, Muslims must in any case use the same method to calculate the end of Ramadan as the beginning. Otherwise, the month may end up 28 or 31 days, or it may end up 29 when it should be 30, or 30 when it should be 29.

1. Imam Muslim, *Sahih*, vol 2, trans. Abdul Hamid Sadiqui (Lahore: Muhammad Ashraf, 1976), in Book 6 (Kitab al-Sawm), Chapter 406, hadith no. 2376, 526.

2. Imam Muslim, *Sahih*, vol 2, trans. Abdul Hamid Sadiqui (Lahore: Muhammad Ashraf, 1976), in Book 6 (Kitab al-Sawm), Chapter 406, hadith no. 2378, 527.

The first day of Ramadan of this year provided an opportunity for observers on the east coast of the United States to resolve a dispute as to when the first time of sightability is. By the "moonset lag criterion,"³ the new moon of Ramadan had a better than even chance of being seen from the American eastern seaboard on the evening of Tuesday, April 29. By contrast, Yallop argued that, on the basis of a generalization of "an ancient Babylonian rule," it was "impossible to make the observation at more easterly longitudes" than 86.25 degrees West.⁴ However, the new moon was observed from a suburb of Washington, D.C. some 9 degrees to the east,⁵ as well as from a number of other eastern locations.⁶

THE ZONE OF UNCERTAINTY

Among the many points that we hope this conference will clarify are the distinction between conjunction and sightability, the impossibility of sighting a moon that has set, and the difficulties of sighting a moon that sets soon after the sun. But if there is one point that I think has been most underappreciated by the astronomical community, it is the fact that calculation of sightability is a probabilistic endeavor. The algorithm which Yallop advocated has been shown to be overly conservative as a hard limit on earliest sightability.⁷ We must emphasize the fact that while a line can be drawn east of which sightability from the ground is impossible due to the Danjon effect and another line can be drawn west of which sightability is limited only by local weather conditions, between these lines is a wide region where many variables including the quality of the observer's eyes plays a role in detectability. Having accepted this fact, we may then proceed to try to model, as best as we can, the factors that determine observability within this zone.

3. Mohammad Ilyas, *A Modern Guide to Astronomical Calculations of Islamic Calendar, Times, and Qibla* (Kuala Lumpur: Berita, 1984).

4. B. D. Yallop, RGO Astron. Info. Sheet no. 50, 1987.

5. B. E. Schaefer, private communication, 1987.

6. L. E. Doggett, and P. K. Seidelman, abstract for IIIT Lunar Calendar Conference, 1987.

7. Yallop, RGO Astron. Info. Sheet no. 50.

THE EXAMPLE OF DHU AL HIJJAH 1407 (1987)

In the table below I give the moonset lag behind sunset in Makkah, Saudi Arabia, for days following astronomical new moon (conjunction) near the beginning of Dhu al Hijjah 1407 (1987) and an estimation of the probability of sighting under good conditions. The estimation of the probability is calculated assuming that Ilyas' stated errors are standard deviations.⁸ Notice that with the moonset lag calculation there is some uncertainty about the correct date in Makkah. On Sunday, July 26, 1987, the moon set approximately 41 minutes after the sun in Makkah. Sighting this moon would be very difficult, but not quite impossible. Thus Monday would be the earliest date for the first of Dhu al Hijjah. By coincidence, dating by means of conjunction gives us the same result. Conjunction took place at 12:37 a.m. standard time in the Saudi time zone on July 26. Thus, on the system based on conjunction, the first day of Dhu al Hijjah in Saudi Arabia was Monday, July 27 and the 'Id would then be on August 5. Neither system would permit the first of Dhu al Hijjah to begin on Sunday, July 26 or earlier, since the moon set before the sun on the previous evening.

Table 1

Date	Moonset Lag in Makkah	Probability of Sighting (Estimated)
July 25th	-----	impossible
July 26th	41 minutes	< 0.05
July 27th	111 minutes	certain

In the past it was held that each community must use calculations (or sightings) for its own area. Of course, a legitimate sighting in Makkah would imply that a legitimate sighting should be possible in Washington because sunset occurs 8 hours later there, although at very high latitudes the moon may not be sighted at all. Some are now claiming that the availability of high speed communication makes this restriction obsolete. We emphasize, however, that ANY SIGHTING GIVING AN 'ID EARLIER THAN AUGUST 5 IN SAUDI ARABIA DESERVES DISMISSAL OUT OF HAND. It would have been either incorrect or else a miracle. Neither a

8. Ilyas, *A Modern Guide to Astronomical Calculations of Islamic Calendar, Times, and Qibla*.

false sighting nor a miracle serves the clock purpose the Qur'an gives to the new moon.

August 5 would be the date of *'Id al Adha* in Makkah based on conjunction. If one requires sighting, then it is only the earliest possible date. Since Saudi Arabia falls in the zone of uncertainty, a decision by the *fuqaha* to rely on actual sightability from the ground would mean that an attempt to actually sight the moon is necessary to resolve the uncertainty.

We note that if it were allowed that an observation anywhere on earth before dawn in Saudi Arabia should set the date of the new month, then an August 5 *'Id* is a certainty, since even Yallop's conservative calculations⁹ predict observability over the Atlantic ocean at 20:48 UT that same evening (comfortably before the Saudi dawn).

EXPECTATIONS

The papers which shall be presented for the duration of the conference reflect the state of the art of calculations of the times of conjunction and of visibility and the errors associated with each. Among the topics addressed are uncertainties due to meteorological conditions, instrumental factors, altitude of observation, and visual acuity of the observer. We hope to achieve a scientific consensus on the algorithms for, and the accuracy of, methods for determining the date and time of the new moon, both from conjunction and from sighting by an ideal observer under arbitrary terrestrial conditions, as well as the errors associated with those determinations.

Our conference should provide scholars with the scientific facts needed to issue a *fatwa*. Within this scope we may issue a consensus-of-the-conference statement on any scientific question on which unanimous agreement may be found. The result should permit the calculation of an Islamic calendar corresponding to whatever criteria the religious scholars may choose to adopt for the definition of the new moon, be it birth (the astronomical conjunction), moonset after conjunction, or visibility under some set of prescribed conditions.

9. Yallop, RGO Astron. Info. Sheet no. 50.