AGE AS A CRITERION OF MOON'S EARLIEST VISIBILITY

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First (earliest) visibility of the New Moon has been the basis of lunar calendars from earliest times and remains important for many communities. Scientists have, therefore, been interested in developing astronomical criteria of first visibility for advance prediction. Although some simple basis had existed as early as the Babylonian period, major developments took place only at the hands of Hindus (around the fifth century A.D.) and Early Muslims (eighth to eleventh century)[1]. Early in this century, some work was undertaken using observational data[2] to develop a criterion of visibility. However, it was only recently that a convergent (composite) criterion together with a comprehensive system for global calculations of earliest visibility could be developed[3]. Although use of the criterion in a calculation system provides accurate and detailed information on first visibility (for each conjunction, one needs to list just the longitudes (λ_0), as a function of latitude, where the minimum condition of visibility is just met; to the west of λ_0, the condition is increasingly met[3]), it is still desirable to find a simpler basis.

The Moon's age (from conjunction) is a rather simple and easily accessible quantity which has been often used as a rough indicator of the earliest visibility. So far, this has been done on the basis of rather limited random observations and experiences. The estimates of the age requirements have thus varied greatly. The development of the global visibility calculation system has allowed a systematic investigation into the Moon's age as a criterion of visibility.

The calculation system was extended to determine the age of the crescent at each earliest-visibility-longitude (λ_0) at the time of local sunset to which the visibility test referred. The data for several years were then plotted as a function of season (day number). The results for three latitudes (Fig. 1) exhibit a similar pattern at all latitudes showing a variation with time of year with a superimposed variability at a given time. The latter results in a band of values, the width of which varies with time of year from almost zero around Day Numbers 140 and 290 to a maximum around Day Number 230. The envelope around the data thus provides the upper and lower limits of age requirements. This amplitude of variation increases with latitude and at 60° is rather large. At the lower latitudes, especially in the equatorial belt, the data should be quite useful in making a first estimation.

The results clearly show why the observational estimates have varied so greatly, since latitudinal dependence had not been allowed for. These results are also consistent with the earlier[3] estimate of 22 (± 2) hours based on four LDL which obviously referred to the apex latitudes (around 20°). The lowest limit of about 16 hours (at 0°) is consistent with sighting records, and the rejection of the $14\frac{1}{2}$-hour sighting by Ashbrook[2] seems correct. Even at the higher latitudes, the data provide a sounder basis of estimation than the earlier general estimate of "more than 30 hours"[4].

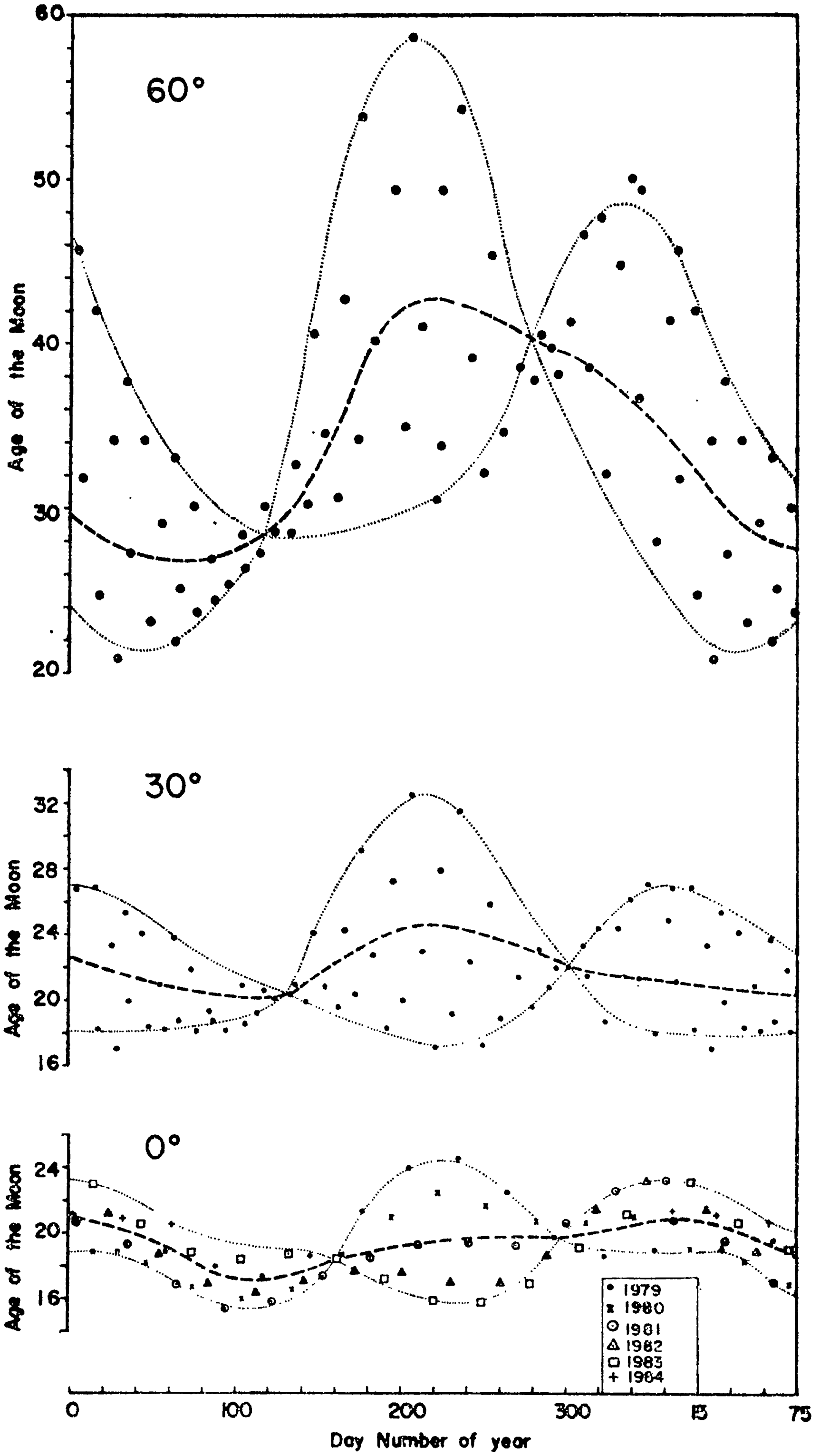

Fig. 1

Seasonal variability of the Moon's age requirement (hours) for earliest visibility in latitudes 0°, 30° and 60° North.

References

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A CALCULATION OF STELLAR CONTINUUM FLUXES WITH A PERSONAL COMPUTER

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The last five years or so have seen the popularization of a new type of calculator known as a personal computer or micro-computer. This instrument is very useful for teaching astronomy and for exhibitions in a science museum: we can now make numerical experiments in astronomy with ease. The continuum flux calculation shown here is one such example.

In order to clarify the understanding of the physical processes occurring in a stellar atmosphere, some approximations (plane-parallel, hydrogen-only

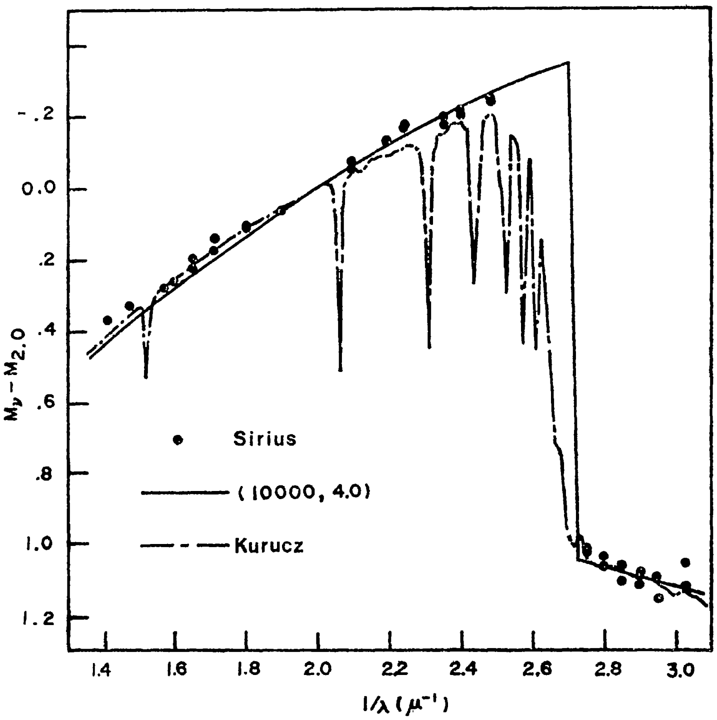

FIG. 1

Computed surface flux. Result by Kurucz[3] and scanner observations[4] of Sirius are also shown for comparison. The ordinate is in magnitudes normalized to zero at 5000 Å; the abscissa is in $1/\lambda$, where λ is the wavelength in μm.