SHORT COMMUNICATIONS

MOON CAMERA VALUES OF $\Delta T = ET - UT$*

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The ephemeris scale of time is based on the revolution of the Earth around the Sun. In 1956 the International Committee of Weights and Measures adopted a new definition of the second, the fundamental unit of time, in terms of ephemeris time. The second is the fraction 1/31556925·9747 of the tropical year for 1900 January 0 at 12 hours, ephemeris time.

An observation of the Sun's position identifies an instant on the scale of ephemeris time. In practice it is preferable to observe the position of the Moon. The right ascension (to $0^s{\cdot}001$) and the declination (to $0''{\cdot}01$) of the Moon are tabulated in the *Improved Lunar Ephemeris* (1952–59) as functions of ephemeris time. The ephemeris is entered with the observed position of the Moon to provide a value of ephemeris time (ET). Knowledge of the epoch of observation in universal time (UT) leads to the correction $\Delta T = ET - UT$ which must be applied to universal time to obtain ephemeris time.

Photography

Although the determination of the Moon's position by photographic means is difficult, a significant advance in technique has resulted from the development of the dual-rate Moon position camera (Markowitz 1954). During the International Geophysical Year, a Markowitz camera was offered to the Mount Stromlo Observatory by the United States Naval Observatory. The camera was attached to the Oddie telescope, a visual refractor of aperture 9 in. and focal length 140 in. The camera on the telescope can photograph a section of the sky 2·4 degrees square. Star images, although not free from coma, are measurable to a distance of 65 min of arc from the centre of the photographic plate.

A neutral filter, whose transmission coefficient is 0·001, is mounted at the centre of the camera field. Rays of light, which form the Moon's image on the photographic plate, pass through this filter. The light of the stars is filtered by a Schott GG-14A filter. Eastman Kodak 103-G (fast) plates are used at first and third quarters of the lunation; II-G (slow) plates are used when the Moon is full. The acceptance band of the photographic plate/star filter combination is approximately 700 Å wide in the green-yellow range of wavelengths. The narrow wavelength band provides compensation for the absence of full chromatic correction of the objective glass. All plates are developed in D19 developer at 68°F. It has been necessary to

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vary the developing time throughout the lunation from 5 min at first quarter to 2 min at full phase. The plates so obtained are clear enough to be measured by projection.

Epoch of Observation

During the operating cycle of the camera, the dark Moon filter tilts about its axis of support. The tilting action of the filter holds the Moon's image fixed relative to the star images. The instant during the exposure at which the Moon filter is parallel to the star filter is the epoch of observation (Markowitz 1959). This instant is determined in the system of universal time (UT).

A calibration of the camera is made prior to each lunation to relate the instant of parallelism to the instant at which a timing contact on the camera operates a chronograph. The instant of operation of the timing contact is read from the

TABLE 1
VALUES OF ΔT DURING THREE LUNATIONS

Date	ΔT (sec)	Date	ΔT (sec)	Date	ΔT (sec)
12.vii.59	35·34	13.viii.59	31·39	11.ix.59	30·91
14.vii.59	32·26	15.viii.59	30·85	15.ix.59	32·86
	31·86				
16.vii.59	32·20	16.viii.59	31·30	17.ix.59	28·05
					32·39
17.vii.59	32·30	17.viii.59	31·03	22.ix.59	31·00
18.vii.59	31·66				
25.vii.59	30·01				
Mean	31·72		31·14		31·79

chronograph tape against a sequence of seconds pulses. The pulses are derived from the standard clock. As soon as the error of the standard clock with respect to UT is determined, the epoch of the plate is known.

Results

An extensive program of lunar observations was included in the longitude and latitude program of the International Geophysical Year. Measuring machines were located at four measuring centres. The United States Naval Observatory measured and reduced the Mount Stromlo plates. Table 1 lists values of $\Delta T = ET - UT$ from observations at Mount Stromlo between July and September 1959. Each entry is based on two plates which were exposed in the direct and reversed positions of the camera.

The means do not include the values of ΔT for July 12 and September 17, 1959. No explanation can be offered for such widely divergent values. The star places used in the reductions of the plates were taken from the Yale Zone Catalogues.

Corrections for the irregularities of the Moon's limb and for the equinox have not been applied to date.

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References

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