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FIRST BELGRADE VIDEOGRAPHIC OBSERVATION OF A LUNAR OCCULTATION

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SUMMARY: A VHS-C camcorder was used to record an occultation of Antares by the Moon. In repeated visual reobservations of the phenomenon with a tenfold "extension" of the time-scale a good internal accuracy has been achieved.

1. INTRODUCTION

Simple video technic can be used in some astronomical observations in order to improve accuracy and reliability of the observational data. The lunar, and other, occultations need only accurate timings of the phenomenon. These are suitable for the videographic observations.

Besides an objective document of the observed astronomical event, the simple videographic and visually analysed record offers: a) delayed (off-line) and slow-motion measurements, b) many times repeated measurements of the same phenomenon, and c) possible independent warning signals during the visual time-analysis of the records. Of course, an obvious drawback of such a video system is the limited time-accuracy afforded by its inherent time-resolution of 0.02 sec.

Another, more elaborate, version of videographic observation can based on an impersonal approach by digitalization of the video-signal and its computer processing. However, this may become as complicated as an astronomical CCD system proper but not as effective.

2. THE OBSERVATION

A VHS-C CCD camcorder GR-AlE produced by JVS was mounted behind the focal plane of the 65-cm Zeiss refractor ($L = 1^h22^m3\overset{s}{.}31$; $\varphi = 44°48'12\overset{''}{.}4$; h = 260 m) of Belgrade Observatory in the way shown in Figure 1. The camcorder was used in its extreme macro mode. It was focused on a field lens, F, just in front of the camcorder objective ring. At the same time the field lens was in the refractor focal plane. The optical arrangement worked as a focal length compressor with a factor about two, resulting in the lunar image diameter of about 5 cm on the 13 mm CCD receiver. Just beside the field lens, still within the camcorder field of view, were two LEDs, L_1 and L_2, flashing in two-second rhytm governed by the Observatory's main quartz clock.

Disparition and reapparition of Antares occulted by the Moon were observed on April 4th, 1991.

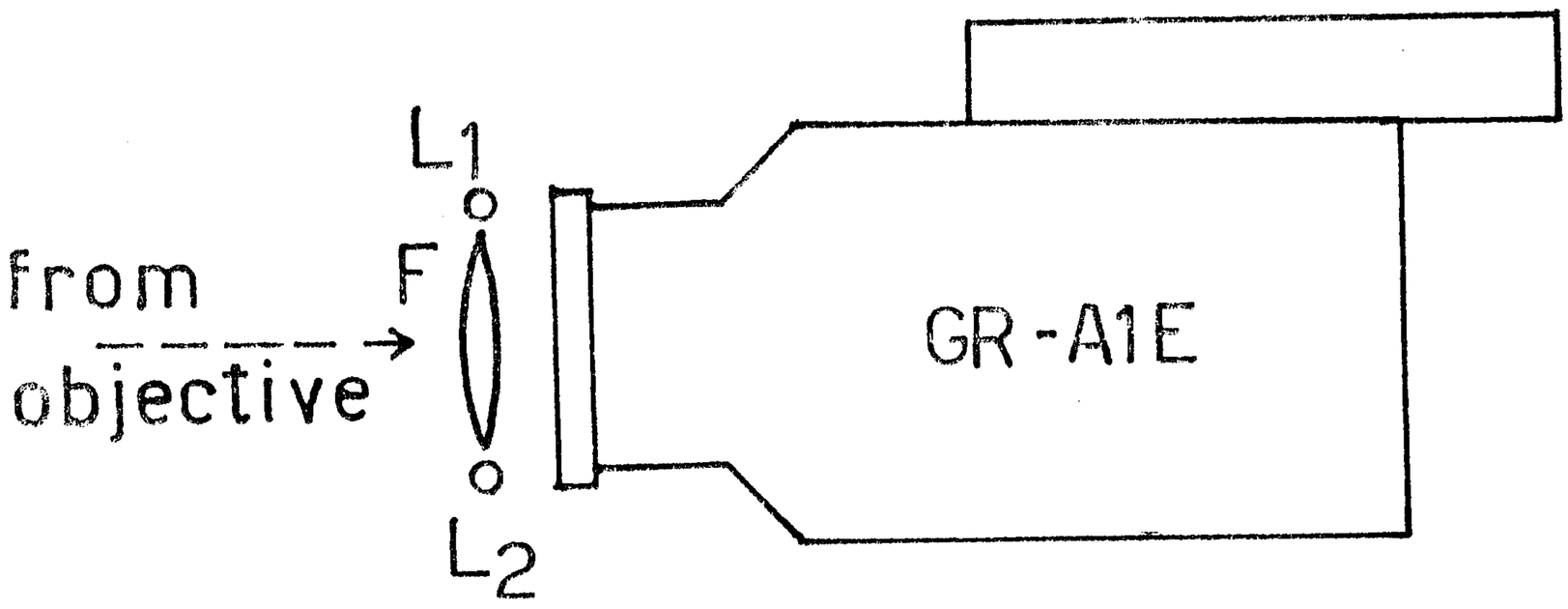

Fig. 1. The Belgrade videographic optical arrangement. GR-AlE = the JVC VHS-C CCD camcorder. F = field lens in the focal plane of the 65-cm refractor. L_1 and L_2 = light emitting diodes activated by two-second time-signals.

The recorded phenomenon has been repeatedly replayed and the occultation times recorder by a stop-watch. Two more important procedures were applied: 1) the video tape was played in the SLOW mode with the tenfold slower speed than during the recording, and 2) the special time-marks previously recorded on a tape recorder were used as a kind of audio warning to increase the observer's alertness immediately before the time of the video-signals that had to be measured by the stop-watch. Both of these procedures were meant to decrease the observer's personal error down to the order of 10^{-2} sec.

In this way a series of two-second signals and an occultation phase were measured around the disparition and around the reapparition in an "extended (tenfold) time-scale". These measurements were easilt converted into the normal time-scale. The accuracy of the factor 10 has been checked too.

Thus, the instrumental UT times of $2^h39^m 3^s.063 \pm 0^s.011$ and $3^h44^m17^s.625 \pm 0^s.009$ for the disparition and the reapparition respectively have been obtained. The cited errors represent the r.m.s. error of the arithmetic mean for 8 and 9 measurements respectively.

The driving line between the quartz clock and the LEDs in the camcorder field of view contained a relay. Its effect was independently measured with an oscilloscope and it amounted to -0.115 sec. It was also known that the correction of the quartz clock itself was -2.054 sec.

Applying both of these corrections to occultation the instrumental times, one could finally obtain:

$2^h39^m00^s.894$ for the disparition and

3^hhh$^m15^s.456$ for the reapparition.

3. CONCLUDING DISCUSSION

The final disparition and reapparition times can be readily compared with the ephemeris: $2^h39^m 00^s$ and $3^h44^m13^s$ respectively. Generally, such an O-C difference is not imposible.

On the other hand it was found that the present videographic disparition was by 0.96 sec earlier and the reapparition by 6.79 sec later than the visual observation of the same phenomenon made with the Zeiss astrograph of Belgrade Observatory (Protić-Benišek, 1991). This disparition difference can be explained at least qualitatively, by the geographic effects. Namely, it can be estimated that the disparition Moon's shadow, taken as circular, advanced from the 65-cm refractor toward South-East (approximate azimuth of the astrograph) at about 470 ms^{-1}. However, though the sense of the reapparition difference is corect, on the basis of geographic considerations it had to be much smaller. A slight motion of the refractor with respect to the Moon had been noticed at the time of the reapparition. But, as the star reappeared well inside the field of view (not on its edge!) this effect was also excluded as a possible cause of the reapparition difference. It has no acceptable explanation yet.

It is to be expected that such observations in Belgrade will be performed with a proper CCD technic in near future.

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ПРВО БЕОГРАДСКО ВИДЕОГРАФСКО ПОСМАТРАЊЕ ЈЕДНЕ ОКУЛТАЦИЈЕ МЕСЕЦОМ

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Стручни чланак

VHS-C камкордер коришћен је за снимање једне окултације Антареса Месецом. Поновљеним визуалним посматрањем снимљене појаве, уз десетоструко спорију репродукцију, постигнута је добра интерна тачност мерења времена диспариције и реапариције.