THE OCCULTATION OF MKE 31 BY NEPTUNE ON SEPTEMBER 12, 1983

(Letter to the Editor)

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Abstract. The predicted occultation of the star No. 31 (Mink *et al.*, 1981) by Neptune on September 12, 1983 was observed photoelectrically. Four secondary occultations were recorded before the immersion event.

Guinan *et al.* (1982) reported a ring system, extending from 4755 to 11 080 km above Neptune, from a re-analysis of their observations of the occultation of the star BD $-17°4388(+7^m.8)$ by Neptune on April 7, 1968. While they observed an occultation of the star 23 (Klemola *et al.*, 1978) by Neptune on August 21, 1980, Nicholson and Jones (1980) established a possible secondary occultation of duration 1.5^s and depth of 0.7 at a projected equatorial radius of $1.5R_N$. From the observations of two stellar occultation events, on May 10, 1981 and May 24, 1981, no ring occultation events were identified by Elliot *et al.* (1981) and a limit, of 0.07 on the optical depth of any equatorial rings of Neptune with widths > 5 km and radii $> 32\,400$ km, was placed by them. From the observations of May 24, 1981 occultation event, Reitsema *et al.* (1982) reported that they might have detected a third satellite of Neptune with an orbital radius of $3R_N$. Kerr (1983) has discussed that chances of catching a lone satellite in front of a star were slim, perhaps 1000 to 1 and the speculations are that there are many more small inner satellites. From the occultation of the star No. 30 (Mink *et al.*, 1981) by Neptune on June 15, 1983 Elliot (1983) reported that there is no evidence of rings around Neptune. However, the possibility of detecting a ring system or number of small inner satellites has not been ruled out completely (Kerr, 1983).

The predicted occultation of an uncatalogued star (star No. 31, Mink *et al.*, 1981) by Neptune on September 12, 1983 was observed with the 104-cm reflector of the Observatory using a filter combination (Corning 2-58 and 7-62) and EMI 9658 photomultiplier, thermoelectrically cooled to $-20\,°C$. The peak response of the system was at $\lambda 7500$ Å. The photometer output was recorded on a strip chart recorder. The response time of the system was $\simeq 0.6$ s for a full scale change in the deflection. The image of Neptune and the star were kept near the centre of a 45 arcsec aperture. The star contributed about 7.5% of the total signal. Continuous observations were made from 15^h30^m to 16^h50^m UT. Immersion event was recorded at $16^h37^m.0$ UT.

Four secondary occultation spikes having amplitude greater than 3σ and durations 1.5 to 3.0 s were recorded before the immersion event. These spikes were considered signifi-

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TABLE I

Mid-time (UT)	Duration (FWHM)	Fractional depth	Amplitude (σ)
$16^h04^m26^s.0$	$1^s.5$	0.9	3.7
16 56 43.0	3.0	0.9	3.6
15 52 44.0	1.5	1.0	3.7
15 38 54.5	1.5	1.0	3.3

cant on the basis of their amplitudes being significantly higher than the statistical probabilities in a normal gaussian distribution.

The midtimes (UT), durations (FWHM), fractional depths and amplitudes of these secondary occultations are listed in Table I. The fractional depths of these spikes have been determined directly from the recorder tracing. The amplitudes of all these spikes in Table I are also given in units of the standard deviation obtained from the recorded noise in the adjacent portions of the spikes.

The sky plane velocity for the present event was 2.0 km s^{-1}, which is slower by nearly a factor of 10 as compared to the other occultations by Neptune. The minimum width of 2.6 km, for secondary occultations, for the present event, is set by Fresnel diffraction for a wavelength $\lambda = 7500$ Å. The geometry of the occultation obtained from the predicted data supplied by Joseph E. Caroll of I.O.T.A. for Naini Tal (private communi-

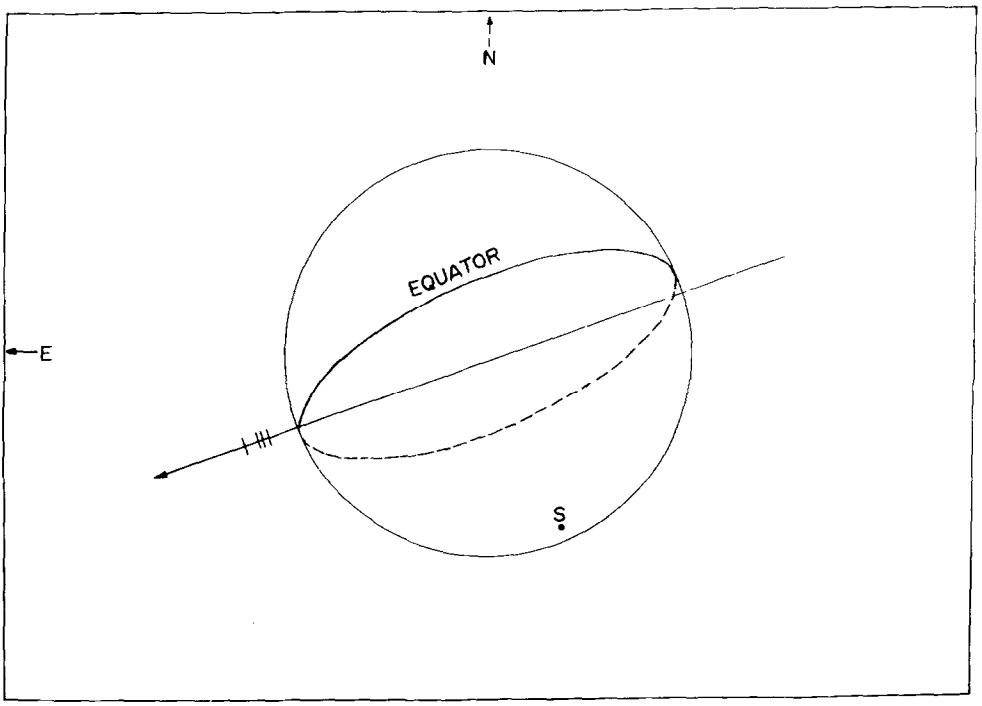

Fig. 1. Geometry of the occultation as projected on the sky plane. The locations of the secondary occultations are shown by vertical lines on the predicted apparent path of the star.

cation) is shown in Figure 1. The predicted circumstances for this event suggest that the secondary occultations occured at a distance of 1.16, 1.20, 1.22, and $1.28R_N$ from the centre of the planet, in the equatorial plane. The direction of the north pole is taken from the Astronomical Almanac, 1983 (E5).

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