

OCCULTATION DETECTION OF A NEPTUNE RING SEGMENT; W. B. Hubbard¹, A. Brahic², P. Bouchet³, L.-R. Elicer⁴, R. Haefner⁵, J. Manfroid⁶, F. Roques², B. Sicardy², and F. Vilas^{1,*}

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We observed the appulse of SAO 186001 to Neptune on 22 July 1984 (1) from two telescopes at the European Southern Observatory (ESO) (2,3) and from a single telescope at Cerro Tololo Inter-American Observatory (CTIO) (4). All three experiments recorded a single interruption of the starlight at approximately 5h 40m 09s UTC. The event was nearly simultaneous at the ESO stations, and occurred approximately 200 milliseconds later at CTIO. The event had a duration of about 0.8 seconds (full width at half depth), and the stellar intensity declined by about 35%. These parameters were virtually identical for all three observations.

The ESO observations were obtained on the 1.0 and 0.5 m telescopes. The effective wavelength of the single-channel observations at the two telescopes was 0.8 microns and 2.2 microns respectively. These two telescopes are separated by 250 m. Observations at CTIO were made using the 0.91 m telescope with a 3-channel photometer (effective wavelengths were 0.9 microns, 0.44 microns, and approximately full light). This telescope had a projected distance of 100 km from the ESO telescopes on the sky plane.

The apparent path of the star through the Neptune system was such that the star passed north of the planetary limb, and there was no planetary occultation. Thus we have no direct determination of the exact location of the occultation point with respect to the center of Neptune. However, calculations from positional measurements (5) can be used to determine that the occultation event occurred at a radial distance of approximately 75000 km, if it is in the equatorial plane. The occulting object is most plausibly a ring segment, because its apparent width along the star path could not have exceeded about 10 km, and it has a nearly identical cross-section over a length of 100 km. The position angle of the ring segment can be accurately determined, and it appears to be consistent with that of a segment of a circular, equatorial ring, taking into account existing uncertainties in the Neptune ephemeris and pole position.

The bulk of previous occultation searches for Neptune rings have concentrated on the region within the Roche limit, but a number of scans of the 3 Neptune-radii region are available, and most of these have not revealed any material at present (6,7). Moreover, no corresponding second ring crossing is evident in the 22 July 1984 data. A confirmed occultation event was observed on 24 May 1981 (8) but again showed no second crossing and was interpreted as an unknown satellite. This event may be related to the 22 July 1984 feature. The obscuring material at about 3 Neptune radii cannot form a continuous opaque ring analogous to the 9 known Uranian rings.

It is evident that as many stellar appulses to Neptune as possible should be observed prior to the planned 1989 Voyager spacecraft encounter, in order to improve our knowledge of the location and density of the ring arcs.

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References:

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