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NEW EVIDENCE FOR RING—LIKE ARCS AROUND NEPTUNE

On the night of August 19, a team of observers comprising A. Brahic and B. Sicardy (Paris), C. Perrier (Lyon), and R. McLaren and B. Grundseth (CFHT) used the infrared photometer to observe the occultation by Neptune of an extremely red star (V=18.2, K=6.4). The observations were made in the K band (2.2 μm), where Neptune is very faint (~ mag 12) because of the methane absorption in its atmosphere. Because the occulted star was bright, both in absolute terms and relative to the planet, a very sensitive search for secondary occultations was possible. The infrared photometry software was specially modified for this observation to provide relative timing accurate to 1 ms and U.T. accurate to 10 ms.

At 19:28 local time, the star disappeared behind the planet and reappeared 73 minutes later; no central flash was seen. Thirteen minutes after the reappearance (6:53:49.3 UT) the starlight dimmed again by 15% for approximately 1.5 seconds. An identical secondary occultation was seen simultaneously at the NASA IRTF, confirming the reality of the event and indicating with virtual certainty the presence of material in orbit around Neptune. The duration of the event indicates that the size of the occulting object(s) is $\leq$ 17 km, with the principal uncertainty being the projected size of the star. If one assumes that the orbiting material lies in Neptune's equatorial plane, the distance from the center of the planet is 51,000 km or 2.1 Neptune radii. The IRTF (but not CFHT) observed the star in the corresponding region (assuming a nearby circular orbit) on the pre-immersion side, but no secondary events were seen. To explain this, it would appear necessary for the ring to be either fragmented or else very thin or very diffuse at certain points so that it does not produce a detectable occultation. Furthermore there have been about ten previous reports of secondary occultations involving Neptune, most of them in the optical. The great majority of these are unconfirmed, but if even a few are real, then it appears likely that there are several Neptunian rings.

It seems certain now that Neptune, like the other giant planets, possesses some form of ring system, but it is a strange one. Speculation at present centers around the existence of several fragmented and/or translucent rings at various distances from the planet. The possibility of rings around Neptune is of profound significance for the planning of the Voyager 2 encounter in August 1989. The NASA planning team hope to direct the spacecraft so that after observing the planet, it is deflected for a close approach to Triton, which possibly has methane glaciers and liquid-nitrogen oceans. But it now appears that such a trajectory may traverse the newly-discovered ring region, with the resulting risk of destruction by collision. A case can certainly be made for continuing observations of Neptune occultations.

R. McLaren