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NEW SATELLITE OF NEPTUNE: S/2004 N 1

M. R. Showalter, SETI Institute; I. de Pater, University of California, Berkeley; J. J. Lissauer, NASA Ames Research Center; and R. S. French, SETI Institute, report the discovery of a new satellite of Neptune. The object, provisionally designated S/2004 N 1, was detected in ten separate sets of images taken by the Hubble Space Telescope (HST) spanning 2004-2009. Each set of images comprises multiple long exposures obtained within a single 50-min observing window defined by one orbit of HST. Images within each orbit were co-added, while allowing for the small but predictable pixel shifts associated with circular, equatorial motion around Neptune. Observation times, measured offsets from Neptune, and S/N ratios are as follows:

Date UT	Offset	S/N
2004 Nov. 6.435	-4".73 E, -0".55 N	4.9
2004 Dec. 8.305	+4".60 E, +1".10 N	7.7
2004 Dec. 9.305	+4".19 E, +1".75 N	5.8
2004 Dec. 9.362	+3".12 E, +2".26 N	5.1
2005 Apr. 1.845	-4".09 E, -1".91 N	4.1
2005 May 6.961	-4".60 E, -1".53 N	5.1
2005 May 12.224	+4".23 E, +2".02 N	5.9
2005 May 17.021	+3".45 E, +2".42 N	3.6
2009 Aug. 19.609	-3".56 E, +0".26 N	4.4
2009 Aug. 19.673	-4".56 E, -0".79 N	8.2

The instruments used were ACS/HRC, except for WFC3/UVIS in 2009. The initial astrometry is consistent with a body traveling on a near-circular, uninclined orbit. The inferred mean motion (n) is 378.907 +/- 0.001 degrees/day (P = 0.95 days). The projected radial distance from the planet's center is 105300 +/- 500 km, placing the satellite between the orbits of Neptune VII (Larissa) and VIII (Proteus). The orbital radius is consistent with a semimajor axis of 105283 km, as derived from n. The satellite's V magnitude is 26.5 +/- 0.3. If the satellite has an albedo of 0.1, comparable to that of the other nearby satellites, then it has a radius of 8-10 km; this makes it much smaller than any of Neptune's previously known satellites, and below the detection threshold of the Voyager cameras.

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