



## Pluto's "P4" and the Search for Additional Rings and Moons

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We report on the discovery and subsequent analysis of "P4", Pluto's fourth known moon (officially designated S/2011 (134340) 1). P4 was discovered in Hubble Space Telescope images from June and July 2011, and recovered in follow-up observations during September 2011. Numerous pre-discovery detections have now been identified in the Hubble archive, spanning 2005-2011. These detections provide a long time baseline for determining the body's orbital elements. Based on a preliminary analysis of the 2011 data, the body has an orbital period of 32.1 days, placing it at a semimajor axis near 59,000 km, between the orbits of Nix and Hydra. It appears to fit the general trend of orbital elements in the Pluto system, with Nix near the 1:4 orbital resonance with Charon, P4 near the 1:5, and Hydra near the 1:6. All orbits are coplanar and nearly circular. This configuration suggests that the bodies formed in place rather than as captured objects. The diameter of P4 depends on the assumed geometric albedo: 14 km if its albedo  $\sim 0.35$ , comparable to that of Charon, or 40 km if it has a much darker albedo  $\sim 0.04$ , which would be more typical of other Trans-Neptunian Objects. We also report on the search for rings of Pluto. We can exclude any faint rings comparable in reflectivity to the Jovian ring, orbiting anywhere near or beyond the orbit of Charon.