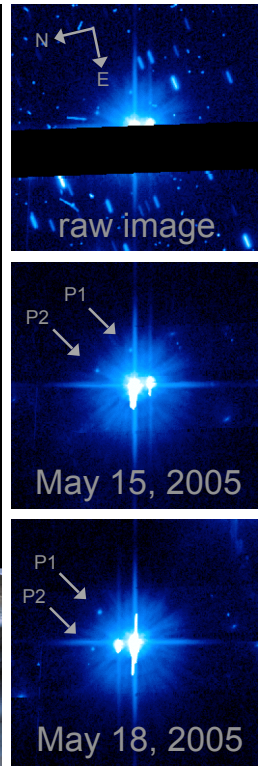
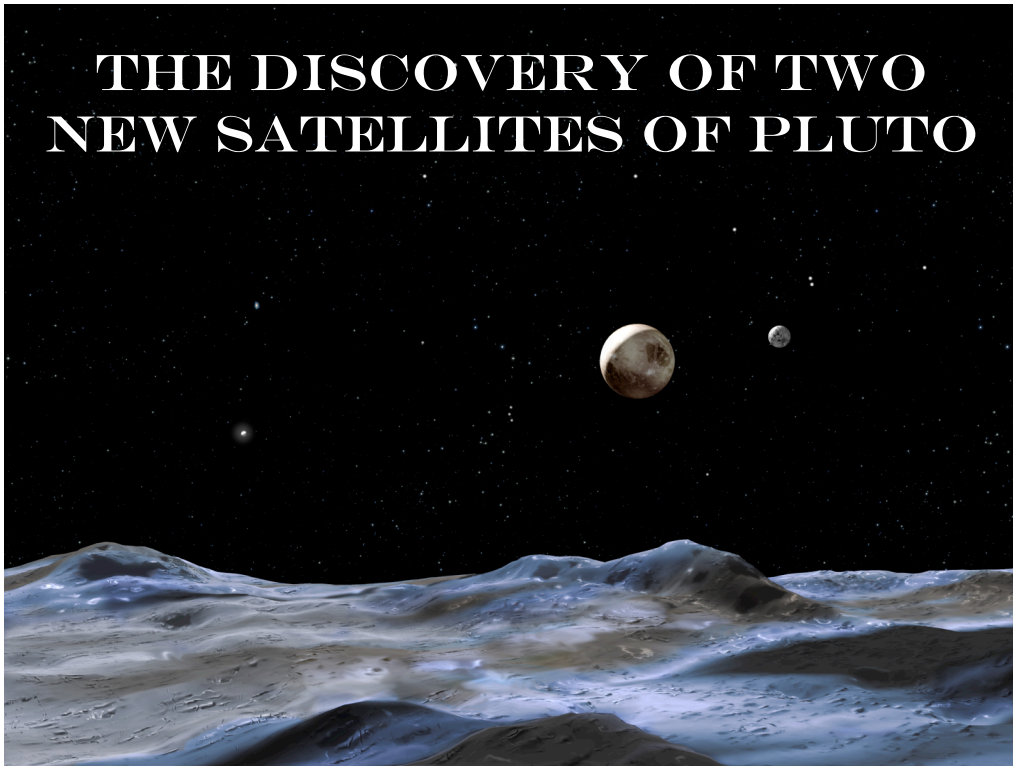




**Launch:  
January 2006 !**



**Max Mutchler (STScI), Andrew Steffl (SwRI), Hal Weaver (JHU/APL), S. Alan Stern (SwRI), Marc Buie (Lowell Obs.), William J. Merline, John Spencer, Eliot Young, Leslie Young (SwRI)**

**Figure 1:** Single "raw" WFC image (top) exhibiting artifacts which are mostly rejected in the "clean" combined images (below), where P1 and P2 are evident.

The planet **Pluto** was discovered in 1930, and is roughly 70% the size of the Earth's moon. Its satellite **Charon**, about half the size of Pluto, was discovered in 1978. On October 31, 2005, we announced the discovery of two additional satellites of Pluto (Weaver et al., 2005), provisionally designated **S/2005 P 1** and **S/2005 P 2** (hereafter "P1" and "P2"). Here we present our observations and preliminary attempts to characterize these new satellites (Stern et al., 2006). These observations were conducted with the *Hubble Space Telescope* on May 15 and May 18, 2005, in support of the *New Horizons* mission. This discovery comes at a pivotal moment in the study of the Pluto system, with *New Horizons* scheduled to launch in January, 2006.

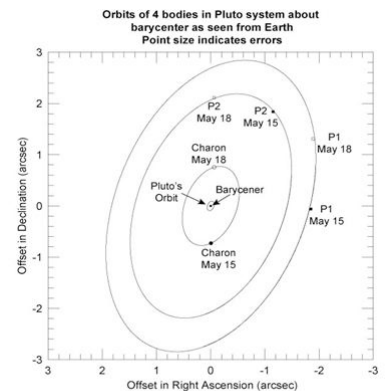
These new satellites were independently **discovered** by team members first on June 15, 2005, and again in August 2005, in 6 of 8 long exposures (475 seconds each) with the broad V-band (F606W) filter of the **Advanced Camera for Surveys (ACS)** Wide Field Channel (WFC). The "clean" distortion-corrected and median-combined images displayed above show some residuals from the incomplete rejection of the **artifacts** evident in the individual "raw" images (Figure 1): star trails, cosmic rays, diffraction spikes, saturation and bleeding of overexposed Pluto and Charon, and the WFC interchip gap (where the new satellites were hidden in 2 of the 4 dithered images on May 15). Despite these potentially obscuring artifacts, the new satellites are well-detected (S/N ~35) in both the raw and combined images, and exhibit the expected point spread functions of real objects.

P1 and P2 have visual (V-band) **magnitudes** of 22.93 +/- 0.12 and 23.38 +/- 0.17, respectively, which imply **diameters** roughly 3-14% that of Charon, or 100 km +/- 60 km, depending on their albedos. With these data, definitive orbits cannot be calculated for P1 and P2, but their positions in both epochs are consistent with objects located in Charon's orbital plane with little or no eccentricity (Figure 2).

Assuming such nearly-circular and co-planar orbits, we estimate that P1 and P2 are orbiting at barycentric **radii** of 64,700 km and 49,400 km, respectively -- or 3.7 and 2.8 times the orbital radius of Charon. We calculate orbital **periods** of 38.2 and 25.5 days for P1 and P2, respectively, which suggest possible 6:1 and 4:1 mean motion orbital **resonances** with Charon (period ~6.4 days). Since our data show no evidence for satellites beyond P1 (Steffl et al., 2006), to a limiting magnitude of  $V = 27.1$  (90% confidence), this makes for a surprisingly compact "**quadruple planet**", which occupies only the innermost 3% of Pluto's orbital stability zone.

Our team also found evidence that these satellites were marginally detected in earlier ACS High Resolution Channel (HRC) images obtained in 2002, near the locations predicted by our best orbital solutions, which provides some independent support for this discovery. We are also planning **follow-up observations** in February 2006 with the HRC to confirm this discovery, and further refine the preliminary characterizations presented here. More information is available at:

[www.boulder.swri.edu/plutonews](http://www.boulder.swri.edu/plutonews)



**Figure 2:** Diagram illustrating the relative positions of P1 and P2 on May 15 and May 18, 2005, and their estimated orbits relative to Pluto, Charon, and the barycenter of this quadruple system. Note: North is up in this diagram, but not in the corresponding images in Figure 1.

**References**  
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