



Seasonal Volatile Transport on Pluto: New Results from the 2013 Observing Season and Preparation for the New Horizons Encounter

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The New Horizons spacecraft will encounter Pluto in July 2015 for a fast flyby and close investigation of the dwarf planet and its five known moons. With a time-constrained mission it is essential to acquire ground-based observations for context and for a longer temporal excursion. An observing program at JPL's Table Mountain Observatory (TMO) has been in operation during the past decade and a half, with a goal of seeking temporal changes on Pluto's surface. This program, which has been largely implemented by undergraduate students, seeks changes in the color and albedo of Pluto. Seasonal transport of volatiles is predicted to occur on Pluto, and this transport should be detectable through changes in its rotational light curve as well as in color and albedo, once all variations due to viewing geometry have been accounted for. Occultation studies have shown that there has been a steady increase in Pluto's atmospheric pressure over the past two decades, so concomitant sublimation and recondensation of frost has likely occurred, as predicted by volatile transport models. Rotational light curves of Pluto through time have been created for static frost models based on images from the Hubble Space Telescope. These models, which account for changes in viewing geometry, have been compared with observed light curves obtained between 1950 and 2013. No evidence for transport was evident prior to 2000. However, starting in the early part of the millennium, evidence from new observations by HST (Buie et al., 2010, *Astron. J.* 139, 1128) and rotational light curves obtained in 2007-2008 (Hicks et al. 2008, *B.A.A.S.* 40, 460) suggest changes in the frost pattern on Pluto's surface.

An extensive and dedicated observing program at TMO was conducted over a period of five months in 2013 during Pluto's opposition. New observations of Pluto's light curve from the 2013 show continued volatile transport, but the most striking change is in Pluto's color. As the New Horizons encounter approaches, Pluto's surface appears to be reddening, which would be consistent with the removal of nitrogen frost from its surface and the uncovering of photolyzed, methane-rich substrate underneath. New Horizons will most likely encounter an active Pluto.

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