EPSC Abstracts
Vol. 6, EPSC-DPS2011-512, 2011
EPSC-DPS Joint Meeting 2011

Longitudinal and temporal variability of Pluto

S. Protopapa (1), H. Boehnhardt (2), L. Barrera (3), W.M. Grundy (4), D.P. Cruikshank (5), J. M. Sunshine (1), L. M. Feaga (1), and M. F. A' Hearn (1)
(1) Department of Astronomy, University of Maryland, College Park, MD 20742, USA
(2) Max-Planck Institute for Solar System Research, Max-Planck-Str. 2, 37191 Katlenburg-Lindau, Germany
(3) Universidad Metropolitana de Ciencias de la Educacion, Santiago, Chile
(4) Lowell Observatory, 1400 W. Mars Hill Rd., Flagstaff, AZ 86001, USA
(5) NASA Ames Research Center, Mail Stop 245-6, Moffett Field, CA 94035, USA

Abstract

Temporal changes of Pluto's surface due to interactions between the surface and atmosphere are expected [1] but difficult to observe. Indeed, because Pluto is highly heterogeneous, it is essential to disentangle temporal variations and changes in viewing geometry. The strongest evidence of temporal changes of Pluto's surface comes from light curve analysis using HST [2]. These data indicate an overall reddening of Pluto from 2000 to 2003. Additional evidence implying surface changes is the increasing pressure and size of Pluto's atmosphere between 1988 and 2002 measured by stellar occultation [3]. Comparing Pluto observations obtained at the VLT and Keck in 2005 and 2001, respectively, a significant change in the slope between 2.9 and 3.1μm, diagnostic of the mixing ratio between pure and diluted methane, has been found [4]. This evidence has been interpreted as being due to changes in the observed sub-solar latitude or a resurfacing process on Pluto.

With the goal of characterizing the spatial and temporal distribution of Pluto's surface ices, new spectroscopic measurements of Pluto were acquired in 2008 at the European Southern Observatory (ESO) in Chile, covering the wavelength range (1-4) μm. In particular, we present low dispersion L band spectroscopy together with high dispersion spectroscopy in H and K bands of Pluto acquired with the NACO instrument at the ESO VLT on 27 June 2008. The nature and properties of the compounds present on the surface of Pluto are investigated by applying a Hapke radiative transfer model to the measured spectra. The 2008 observations are compared with 2005 measurements obtained with the same instrument and spectroscopic mode, covering similar sub-earth longitudes. A systematic study of Pluto's surface composition is presented in order to characterize the spatial and temporal distribution of Pluto's surface ices. The spectra of Pluto obtained at different sub-earth longitudes do not show any significant difference in the wavelength range between 2.9 and 3.7μm. No changes in the ratio between pure and diluted methane ice are observed from 2005 to 2008, indicating that Pluto's resurfacing process has slowed down or stopped.

References

[1] Stern, S. A., Trafton, L. M., Gladstone, G. R., Why is Pluto bright? Implications of the albedo and lightcurve behavior of Pluto, Icarus, 75, 485-498, 1988

[2] Buie, M. W., Grundy, W. M., Young, E. F., Young, L. A., Stern, S. A., Pluto and Charon with the Hubble Space Telescope. I. Monitoring Global Change and Improved Surface Properties from Light Curves, AJ, 139, 1117-1127, 2010

[3] Elliot, J. L., Ates, A., Babcock, B. A., et al., The recent expansion of Pluto's atmosphere, Nature, 424, 165-168, 2003

[4] Protopapa, S., Boehnhardt, H., Herbst, T. M., Cruikshank, D. P., Grundy, W. M., Merlin, F., Olkin, C. B., Surface characterization of Pluto and Charon by L and M band spectra, A&A, 490, 365-375, 2008