Surface characterization of Pluto, Charon, and Triton using NACO observations.

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Abstract

We present the first resolved Pluto and Charon spectra up to 5 \( \mu m \) and 4 \( \mu m \), respectively, and Triton spectrum in the range (1-5) \( \mu m \) obtained with the adaptive optics instrument NACO during 3-7 August 2005.

It is the first time that the complete L-band spectrum of Pluto is measured without unresolved contamination by light from Charon and the first M-band spectrum ever measured. A new absorption band centered near 4.6 \( \mu m \) has been detected. CO ice, known to be present on the surface of Pluto, and nitriles, expected but never detected, are proposed as main candidates to explain this signature. A geographic mixture of pure methane ice with two different grain sizes, methane and CO ice diluted in nitrogen, \( \text{CH}_2\text{CHCN} \), and Titan tholin gives the best-fit to Pluto’s spectrum. Differences compared to published Pluto spectra from 2001 taken at similar longitude could be due to a different surface coverage in latitude or to a possible resurfacing process on Pluto. These results complement NASA’s New Horizons mission, expected to arrive in 2015, that will perform spectroscopy of Pluto’s surface in JHK band only.

The NACO spectrum of Triton in the range (1-5) \( \mu m \) is presented and compared with the spectra for Triton acquired by Grundy et al. (2002) [1] and Cruikshank et al. (2009) [2] in the ranges (2.8-4.1) \( \mu m \) and (2.5-5.0) \( \mu m \), respectively, and with our NACO spectrum of Pluto. The comparison between Pluto and Triton spectra up to 5 \( \mu m \) can give important information about the origin of Triton, which is generally thought to be a large TNO captured by Neptune. Modeling analysis of Triton spectrum is also presented.

Finally, our Charon spectrum, the first one in the L-band, is characterized by broad water ice signatures in agreement with the short wavelength measurements. NACO observations for Charon allowed us to compute a standard spectroscopic model for Pluto’s moon. This can be used to subtract Charon’s contribution from spectra of the combined Pluto/Charon system.

References
