Geophysical Research Abstracts, Vol. 9, 09401, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09401

Vertical structure in Pluto's atmosphere from the 12 June 2006 stellar occultation

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Pluto occultations are historically rare events, having been observed in 1988, 2002, and most recently in June 2006. We observed the 12 June 2006 event from several sites in Australia and New Zealand. We present four results based on these observations. First, we show that Pluto's 2006 bulk atmospheric column abundance, as in 2002, is over twice the value measured in 1988, implying that nitrogen frost on Pluto's surface is 1.2 to 1.7 K warmer in 2006 than 1988 despite a 6.5% drop in received solar flux. We measure a half-light radius of 1216 ± 8.6 km in 2006, nominally larger than published values of 1213 ± 16 km measured in 2002 (Elliot et al. 2003; Sicardy et al. 2003), but, given the current error bars, consistent with either continued atmospheric growth or shrinkage. Second, we resolve temporal spikes in the occultation lightcurve that are similar to those seen in 2002 (Sicardy et al. 2003; Pasachoff et al. 2005) and model the vertical temperature fluctuations that cause them. Third, we show that Pluto's upper atmosphere appears to hold a steady temperature of $\sim$100 K, as predicted from the methane thermostat model, even at latitudes where the methane thermostat is inoperative. This implies that energy transport rates are faster than radiational cooling rates. Fourth, we show that a haze-only explanation for Pluto's lightcurve is extremely unlikely; a thermal inversion is necessary to explain the observed lightcurve.

Elliot, J. L., et al. 2003, *Nature*, 424, 165.

Pasachoff, J. M., et al. 2005, *Astronomical Journal*, 129, 1718

Sicardy,B., et al. 2003, *Nature*, 424, 168.