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Coordinated Ground-Based Observations and the New Horizons Fly-by of Pluto

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The New Horizons (NH) spacecraft is scheduled to make its closest approach to Pluto on July 14, 2015. NH carries seven scientific instruments, including separate UV and Visible-IR spectrographs, a long-focal-length imager, two plasma-sensing instruments and a dust counter. There are three arenas in particular in which ground-based observations should augment the NH instrument suite in synergistic ways: IR spectra at wavelengths longer than 2.5 μm (i.e. longer than the NH Ralph spectrograph), stellar occultation observations near the time of the fly-by, and thermal surface maps and atmospheric CO abundances based on ALMA observations - we discuss the first two of these.

IR spectra in the 3 - 5 μm range cover the CH4 absorption band near 3.3 μm. This band can be an important constraint on the state and areal extent of nitrogen frost on Pluto's surface. If this band depth is close to zero (as was observed by Olkin et al. 2007), it limits the area of nitrogen frost, which is bright at that wavelength. Combined with the NH observations of nitrogen frost at 2.15 μm, the ground-based spectra will determine how much nitrogen frost is diluted with methane, which is a basic constraint on the seasonal cycle of sublimation and condensation that takes place on Pluto (and similar objects like Triton and Eris).

There is a fortuitous stellar occultation by Pluto on 29-JUN-2015, only two weeks before the NH closest approach. The occulted star will be the brightest ever observed in a Pluto event, about 2 magnitudes brighter than Pluto itself. The track of the event is predicted to cover parts of Australia and New Zealand. Thanks to HST and ground based campaigns to find a TNO target reachable by NH, the position of the shadow path will be known at the +/-100 km level, allowing SOFIA and mobile ground-based observers to reliably cover the central flash region. Ground-based & SOFIA observations in visible and IR wavelengths will characterize the haze opacity and vertical distribution in Pluto's atmosphere in transmitted light. Combined with NH observations of haze brightnesses in reflected light, the scattering properties and number densities of aerosols can be determined. In addition, the shapes of the central flash light-curve features are sensitive to Pluto's atmospheric oblateness, which is caused by zonal winds or equator-to-pole temperature gradients. Finally, the occultation and NH thermal measurements will confirm or refute the assumption that Pluto's atmosphere is supported by the vapor pressure of nitrogen frost.

References
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