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Light Scattering by Titan's Surface: Similarities to Triton

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Abstract

The Descent Imager/Spectral Radiometer (DISR) onboard Huygens observed Titan through the atmospheric methane windows during its descent to the surface [1]. Infrared spectra obtained during the last stage of the descent, for which the atmospheric contribution is negligible, show that the reflectance of the surface around the landing site increases with decreasing solar phase angle. Just before landing DISR illuminated the surface with the a lamp, providing data at virtually zero phase angle [2]. The combined phase curve shows evidence of a strong opposition effect (Fig. 1). We fit the phase curve with the well known Hapke model [3].

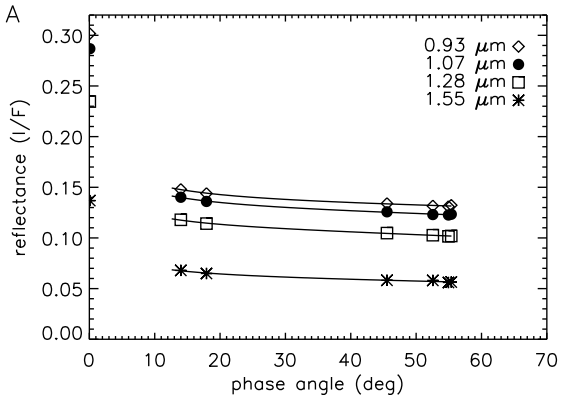

Figure 1: Titan surface phase curves with Hapke model fits superimposed. The data between 10° and 60° phase angle are DISR measurements of reflected sunlight acquired during descent. The zero phase angle data was obtained by illuminating the surface with the Surface Science Lamp.

The model is sensitive to the Henyey-Greenstein particle phase function asymmetry parameter g. The best fits in Fig. 1 have $g \approx 0$, indicating approximately isotropic scattering by surface particles. This is highly unusual for planetary bodies, which usually have $g < 0$. An analogy can be found on Triton in the so-called Anomalous Scattering Region (Fig. 2) [4]. We propose that this peculiar scattering behavior is connected with the presence of tholins on the surface of both worlds. Tholins are the product of photodissociation of atmospheric methane, and laboratory analogs have been found to scatter in a fashion similar to what we find for Titan's surface [5].

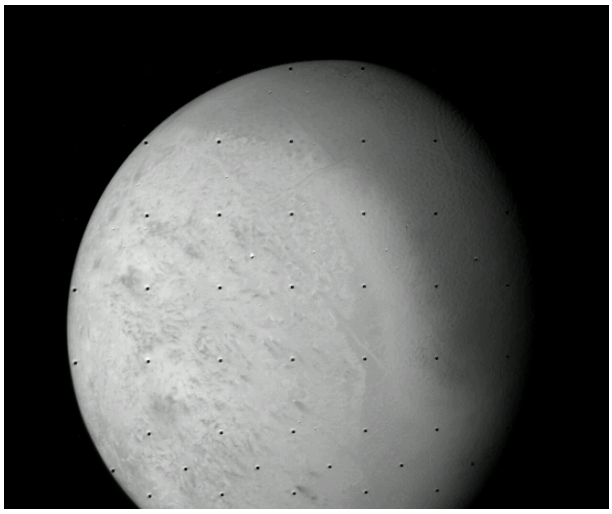

Figure 2: Voyager 2 clear filter image of Triton (C1138709), showing the relatively dark Anomalous Scattering Region on the right.

Bibliography

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