PHOTOMETRIC PROPERTIES OF ENCELADUS' SOUTH POLAR TERRAIN. A. M. Annex[1], A. J. Verbiscer[1], P. Helfenstein[2], [1]Astronomy Department, University of Virginia, P.O. Box 400325 Charlottesville, VA 22904-4325, USA, [2]Center for Radiophysics and Space Research, Cornell University, Ithaca NY 14853, USA.

Introduction: Cassini Imaging Science Subsystem (ISS) data acquired from the south polar region of Saturn's active icy moon Enceladus reveal variations in surface terrains [1]. The most prominent features of the South Polar Terrain (SPT) are four young fractures (sulci) informally called "tiger stripes" arranged en echelon across the region [2]. Each about 130 km long, 2 km wide, and 0.5 km deep, the tiger stripes are the eruptive conduits for moon's famous water-rich jets and plumes [1] and centers of anomalously high thermal emission [3]. Terrains between the tiger stripes classified as funiscular (i.e., ropy) plains [2] are morphologically and texturally distinct from the smooth and platy flanks of the tiger stripes. Here we investigate the photometric properties of the SPT, specifically the photometric parameters which distinguish the scattering behavior of particles on the tiger stripe flanks and the funiscular plains through fits to the Hapke photometric model [4].

Procedure: We import Cassini ISS clear filter (CL1 CL2) images (centered at 0.611 μm) and all relevant SPICE kernels to the USGS Integrated Software for Imagers and Spectrometers (ISIS) package and perform radiometric calibration using Cassini Imaging Science Subsystem Calibration (CISSCAL) within ISIS. Photometric bands were extracted from each image cube and contain planetocentric and photometric latitude and longitude; incidence, emission, and solar phase angles; and I/F for each pixel. Using Region Of Interest (ROI) tools within the Interactive Data Language (IDL), we create separate ROIs for the tiger stripe flanks and the funiscular plains (Figure 1). To avoid exceeding the maximum number of data points allowed in the Hapke fitting software, we binned data acquired from high resolution images into blocks up to 16 x 16 pixels in size. Our data sets include images at solar phase angles ranging from 14° to 92° for the funiscular terrains and 12° to 73° for the tiger stripe flanks.

Hapke model fits: Since our data sets largely exclude any low phase angle observations near opposition, we fit each subset to Hapke's 2002 equation holding the opposition surge width and amplitude parameters equal to those measured by fits to Hubble Space Telescope observations at 0.5 μm [5]. The remaining parameters include the single scattering albedo, macroscopic roughness, and single particle scattering function. Our preliminary analysis using a limited number of clear filter images indicates that the macroscopic roughness of the tiger stripe flanks is higher than that of the funiscular plains. This result is consistent with the analysis of multi-wavelength Cassini ISS [1] and Visual and Infrared Spectrometer (VIMS) [6, 7] data which determined that ice on the tiger stripe flanks is coarse grained in comparison to that coating the ropy plains. In addition, the single scattering albedo of the funiscular terrain is approximately 10% higher than that of the tiger stripe flanks.

Figure 1: Regions Of Interest (ROIs) from which disk-resolved data were collected from the funiscular terrain (yellow) and tiger stripes (cyan). The red dot marks the location of Enceladus' south pole.

Conclusions: We find that particles on the tiger stripe flanks are photometrically distinct from those coating the funiscular terrains due to their proximity to jet activity and high thermal emission. Cassini Composite Infrared Spectrometer (CIRS) data acquired at high spatial resolution from the SPT indicate that the anomalously high thermal emission is locally constrained to the tiger stripes and their flanks [8]; therefore, annealing of particles in these regions could account for their higher roughness and larger grain sizes.

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