PRELIMINARY ANALYSIS OF THE PHOTOMETRIC PROPERTIES OF ASTEROID (101955) BENNU FROM OVIRS OBSERVATIONS.

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Introduction: NASA's OSIRIS-REx asteroid sample return mission is surveying the B-type near-Earth asteroid (101955) Bennu to understand its physical, mineralogical, and chemical properties. The spacecraft arrived at the asteroid on 3 December 2018 and will return to Earth with a surface sample on 24 September 2023. The OSIRIS-REx Visible and Infrared Spectrometer (OVIRS) is a point spectrometer covering the spectral range of 0.4 to 4.3 microns (25,000 to 2300 cm^{-1}). Its primary purpose is to map the surface composition of Bennu [1]. The information OVIRS returns will help guide the selection of the sample site. It will also provide global context for the sample and high-spatial-resolution spectra that can be related to spatially unresolved terrestrial observations of asteroids.

A global average photometric analysis of Bennu is performed over multiple wavelengths ranging from 0.4 to 2.5 microns based on disk-resolved reflectance spectra obtained with the OVIRS instrument.

Data: During the Preliminary Survey phase of the mission in December 2018, OVIRS acquired spatially resolved spectra covering the equatorial and southern regions of the asteroid. The phase angle coverage is from 37º to 95º, at footprint sizes from 30 m/spectrum to 96 m/spectrum, resolving the disk of Bennu to up to about 200 footprints in total. The data are calibrated by hand, following the basic process described in [2]. The thermal emission of the asteroid starts to take over from about 2.5 microns, out towards longer wavelengths [3]. To avoid complexities with thermal flux, we model only the wavelengths between 0.4 and 2.5 microns. The spot values are converted to I/F(λ), the radiance factor as defined by [4]. Then we follow the steps to construct the SPDIF (Spectral Photometric Data Information File) for photometric modeling: 1) Select only OVIRS spots that contain the illuminated portion of the asteroid, filling the field of view. 2) Spatially register the observations to the shape model to get the scattering geometry data for each spot. 3) Filter out spots with incidence or emission angles greater than 75º. 4) Retrieve the I/F from all valid spots, pair with respective geometry, time, and quality information, and fit the data with our suite of photometric models.

Global Average Photometric Models: We derive the global photometric properties of Bennu in terms of Hapke's photometric model [4], a Lommel-Seeliger model [4], a Minnaert model [5], a McEwen model [6], and an Akimov model [7]. We compare Bennu's surface photometric features, single-scatter albedo and single-particle phase function with other asteroids. The wavelength dependence of the photometric properties is revealed. We also constrain the photometric roughness of Bennu and compare our results with the OSIRIS-REx Camera Suite (OCAMS) photometry results [8]. Finally, we compare these preliminary photometric modeling results to other asteroids [9], including Ryugu [10].

Here we will present the photometrically corrected OVIRS data and our preliminary global analysis results from data obtained in December 2018.

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