Comparison of Thermophysical Properties of (101955) Bennu from OSIRIS-REx Approach Phase Data with Spitzer and HST Observations in 2012

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The OSIRIS-REx spacecraft arrived at near-Earth asteroid (101955) Bennu in December 2018 and ultimately will return a sample of ≥60 grams of regolith to Earth. During the Approach phase of the mission, we obtained disk-integrated observations of thermal emission, in the longest wavelength region of the OSIRIS-REx Visible and InfraRed Spectrometer (OVIRS), over an entire rotational cycle. Previous disk-integrated thermal observations of Bennu using the Spitzer space telescope revealed a thermal inertia of 310 ± 70 J m^{-2} K^{-1} $s^{-1/2}$ and suggested no significant variation in thermal inertia with rotational phase (Emery et al. 2014). We measured the visible lightcurve using the Hubble Space Telescope (Nolan et al. 2018, submitted) close in time to the Spitzer thermal infrared observations and revealed a phase lag between the lightcurves, consistent with the derived thermal inertia (Crowell et al. 2018).

We present an initial analysis of the Approach-phase disk-integrated spectra obtained by OVIRS, concentrating on the thermal tail emission in the region from 2 to 4 microns. Comparison of the thermophysical properties derived from OVIRS observations with those derived from Spitzer at longer wavelengths (5.2 to 35 microns) provides a link between spacecraft and telescopic observations. The spatially resolved images of Bennu from Approach begin to reveal surface features and texture that allow us to better interpret the surface roughness parameters from the thermal models. We compare independent thermal models and find similar but distinct values of surface roughness, resulting from different implementations of roughness simulated using spherical section craters on a fraction of each model facet. We have the opportunity to perform a more detailed evaluation of Bennu's thermal behavior than is usually possible for asteroids observed telescopically in the thermal infrared.