Thermophysics of (101955) Bennu: Observing and Thermal Modeling Plans of OSIRIS-REx and Initial Results from Approach Phase Data

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Asteroid (101955) Bennu is the target of NASA's OSIRIS-REx mission, which will return a sample of ≥60 grams of regolith from the asteroid's surface. Before collecting the sample, the OSIRIS-REx spacecraft will spend more than a year characterizing the surface with its onboard cameras, spectrometers, and laser altimeter. The primary data set to be used for thermophysical analyses consists of thermal spectra from the OSIRIS-REx Thermal Emission Spectrometer (OTES). The long-wavelength end of the spectra obtained by the OSIRIS-REx Visible and InfraRed Spectrometer (OVIRS) is also dominated by thermal emission. We plan to carry out thermophysical analysis of these data with a custom thermal model that is based on the Advanced Thermophysical Model of Rozitis and Green (2011, 2012, 2013).

Approach lasted from August 17 until December 3, 2018. During this phase, we obtained the first spatially resolved images of the asteroid and disk-integrated OTES observations of thermal emission at several different rotational phases. 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 will provide an overview of the OSIRIS-REx thermal observations and discuss the rich array of potential thermophysical analyses of Bennu enabled by the OTES and OVIRS data. We will also present analysis of the Approach-phase thermal observations obtained by OTES, including a more sensitive search for rotational variation in thermal inertia, and a reanalysis of the previous Spitzer data using the updated shape model from the OSIRIS-REx science team. The spatially resolved images of Bennu from Approach will provide context for the interpretation of diskintegrated thermal inertia in terms of regolith properties that is not available for asteroids observed telescopically in the thermal infrared.

References:

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