Coordinated Thermal and Physical Analysis of OSIRIS-REx Samples of Asteroid Bennu

Andrew Ryan[1] and the OSIRIS-REx Sample Analysis Team
[1]*University of Arizona, Tucson, Arizona, USA*

Remote sensing and sample analysis both provide insight into the thermal and physical properties — and thereby the origin and evolution — of asteroidal material. Remote determination of thermal properties can be used to infer the physical characteristics of boulders and regolith on asteroid surfaces and to predict the evolution of an asteroid's orbit due to the Yarkovsky effect. Analysis of returned particles and particle assemblages informs the interpretation of remote sensing data and can powerfully constrain models of dynamic events such as robotic sampling and impacts at different scales.

It is well-known that the strength of stony material obeys scaling laws, such that larger boulders (or bodies) are weaker than smaller ones and thus are more susceptible to collisional damage. It is also likely (but not yet as widely recognized) that thermal properties of boulder materials may depend on the size of the sample and/or the length scale of the remote sensing observations. Therefore, to link the properties of returned samples and relevant meteorite analogs to remote sensing data of asteroid surfaces, a coordinated physical and thermal sample analysis campaign with measurements across multiple length scales is necessary.

Below (Figure 1) is a summary of the physical and thermal measurements that are planned for the returned samples from Bennu. In addition to addressing specific hypotheses related to the formation and evolution of Bennu's boulders and fine regolith, we seek to collect coordinated sample data that can contribute to the development of a broadly applicable multi-scale thermal and mechanical model for primitive rubble-pile asteroids.

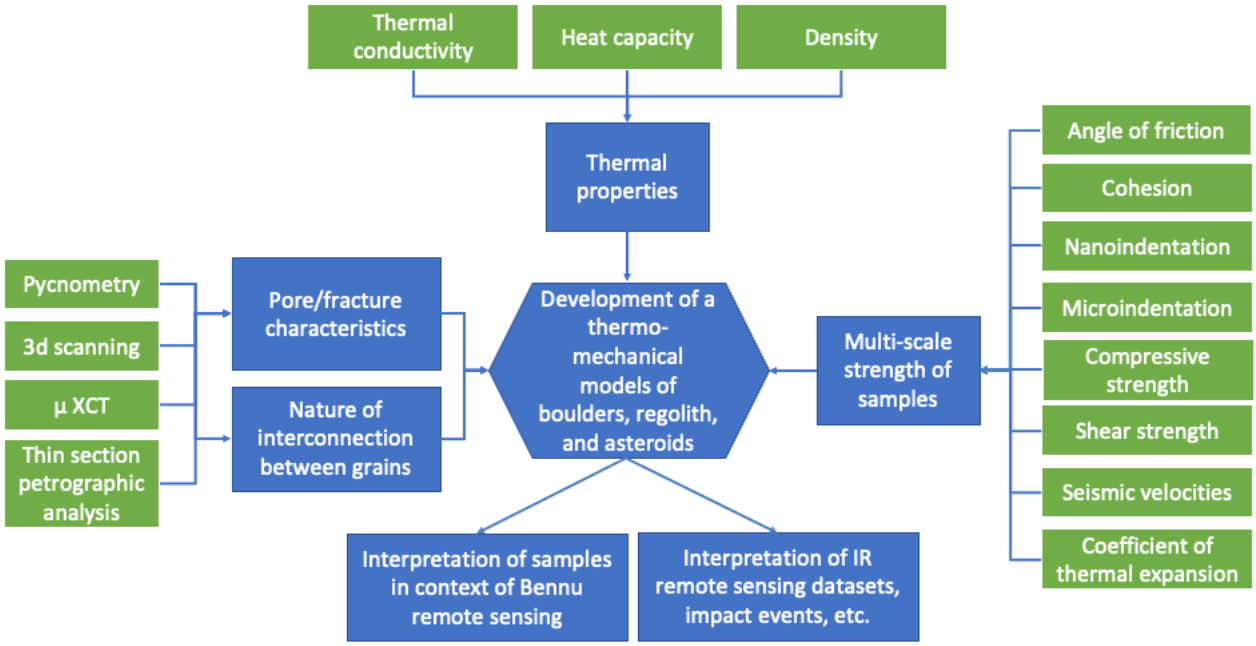

Figure 1. Planned OSIRIS-REx sample measurements (green) feeding into a multi-scale model for regolith, boulder, and asteroid thermophysical properties (blue).