Space Science Seminar
Tuesday, 2018 January 9
10:30 a.m.
NSSTC/2096

A Spectral and Physical Characterization of Multiple Asteroid Systems

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Host: Mitzi Adams
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Currently there are more than ~225 identified multiple asteroid systems (MASs). These systems exhibit a large diversity in physical and orbital characteristics indicating that multiple formation mechanisms are likely responsible for their formation. The hypothesized formation mechanisms, however, still require observational evidence for their testing and refinement. The critical piece of evidence required for this task is the internal structure, or porosity, of the MASs. In turn, the estimation of internal structure requires both the density of the MAS and the identification of an appropriate meteorite analog or mineral composition. With the aim to identify the mineralogy and meteorite analogs for MASs, we present the results of a visible and near infrared (NIR) reflectance spectral (0.45 – 2.45 μm) survey and analysis of 42 Main Belt MASs. The NIR reflectance spectra for S- and V-type asteroids contain two broad absorptions centered near 1- and 2-μm (Band I and II) due to olivine and pyroxene. Through a parameterization of these two bands coupled with laboratory measurements to serve as a calibration, it is possible to measure the mineralogy and identify meteorite analogs. Using a custom band parameter analysis code, the Spectral Analysis Routine for Asteroids (SARA), we perform an analysis of the S- and V-type MASs in our sample to determine the relative/modal abundances, as well as ordinary chondrite and HED meteorite analogs. Using the results of previous studies and presence/absence of the 0.7 μm absorption feature associated with CM chondrites, we also assign meteorite analogs for C-type MASs. Using the MAS density estimates from Marchis et al. (2012) and measured meteorite bulk and grain porosities from Consolmagno et al. (2008), we are able to estimate the porosity for 13 MASs. We find all porosities to be commensurate with the predications based upon the MAS formation hypotheses.

Biography:
Sean Lindsay is the Astronomy Coordinator for the University of Tennessee, Knoxville (UTK) Department of Physics and Astronomy. His overarching research emphasis is on understanding the origins of our solar system through the study of the small bodies (asteroids; comets; etc.). He earned his Ph.D. from New Mexico State University, where he received the NASA Graduate Student Researcher (GSRP) fellowship to fund his dissertation work on determining the silicate mineralogy of the sub-micron-sized dust component observed in comet comae. During this project, Dr. Lindsay became an expert in computational modeling of the optical properties of minerals and synthetic spectral modeling for optically-thin radiative transfer environments within the thermal infrared spectral range (5 – 40 μm). Prior to his post as Astronomy Coordinator, Dr. Lindsay completed two post-doc positions. The first post-doc was in the Earth and Planetary Sciences Department at UTK working the Dr. Josh Emery on the mineralogical characterization of asteroids from visible and near-infrared studies. During this post-doc, Dr. Lindsay created the freely available IDL software, the Spectral Analysis Routine for Asteroids (SARA). His second post-doc was at the University of Oxford in the Atmospheric, Oceanic, and Planetary Physics (AOPP) sub-department. In this post-doc, Dr. Lindsay worked on developing a radiative transfer code to model the thermal infrared spectra of airless bodies with regolith (e.g., asteroids and the Moon). Other research interests include applying his thermal infrared spectral analysis expertise to understand the composition and origins of the Jupiter Trojan Asteroids.

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