Announcing the Final Examination of Jenna Jones for the Degree of Doctor of Philosophy in Physics

Date: Wednesday, December 6, 2017
Time: 10:00 a.m.
Room: PS 160
Dissertation title:
Investigating Compositional Variations of S-Complex Near-Earth Asteroids: (1627) Ivar

Abstract:

We seek to investigate the complexity and heterogeneity of the surfaces of near-Earth asteroids (NEAs). In particular, we are studying the S-complex NEAs, which account for a large portion of the observed near-Earth objects. Here we present our results for (1627) Ivar, an Amor class NEA with taxonomic type Sqw.

In 2013, Ivar's large size and close approach to Earth (minimum distance 0.32 AU) provided an opportunity to observe the asteroid over many different viewing angles for an extended period of time. We collected delay-Doppler radar images and Doppler spectra using the Arecibo Observatory's 2380 MHz radar, and, by incorporating an extensive lightcurve collection, we have constrained the shape and spin state. In addition, we observed Ivar using NASA's IRTF's SpeX mode to gather rotationally resolved reflected and thermal spectra in the near-IR regime.

We have created a high-resolution shape model, and we have found Ivar to have a sidereal period of 4.7951689 ± 0.0000026 hours with a pole at ecliptic longitude and latitude 336°, +37° (± 6°) respectively. We also show that Ivar is more elongated than previous studies suggests, with dimensions along the principal axis 15.15 x 6.25 x 5.66 ± 10%. This model has been incorporated into our thermal modeling code, SHERMAN, in order to determine which reflective, thermal, and surface properties best reproduce our numerous and rotationally resolved spectra. Primarily, we vary thermal inertia, geometric albedo, and crater fraction (surface roughness) although SHERMAN has many parameters that are allowed to vary. Our findings show that Ivar's thermal observations cannot be reproduced with a homogeneous model, but rather a heterogeneous model with a thermal inertia spot, and possibly different crater fraction values, needs to be applied in order to reproduce all of the spectra. Due to the variations in observing geometry for our thermal spectra, the properties of this spot are well constrained. We find that, with this spot, that the values of thermal inertia, geometric albedo, and crater fraction are 80 ± 20 J m-2 s-1/2 K-1, 0 – 0.3, and 0.27 ± 0.02, respectively. This work shows the advantage of having many datasets for deep study of an individual NEA, and with these results, we will learn more about the detailed regolith and surface properties of Ivar and how those properties compare to those of other NEAs.

Outline of Studies:
Major: Physics

Educational Career:
B. S. University of Arkansas at Little Rock, USA, 2008

Committee in Charge:
Dr. Yanga R. Fernandez (Chair)
Dr. Ellen Howell (External Committee Member)
Dr. Humberto Campins
Dr. Dan Britt

Approved for distribution by Dr. Yanga R. Fernandez, Committee Chair, on December 1, 2017.

The public is welcome to attend.