BOSTON UNIVERSITY

Space Physics Seminar
Thursday, October 29, 2015

Volcanoes, Atmospheres, and Magnetospheres, Oh My!

Jeff Morgenthaler, Ph.D.

Planetary Science Institute

Abstract:

Jupiter, the largest and fastest rotating planet in the solar system, has attracted a complement of 4 large moons. The inner three moons dance in tidally locked orbits which induce particularly large tidal stresses on the innermost moon, Io. As a result, Io is the most volcanic body in the solar system. This volcanism helps Io maintain a tenuous atmosphere, which is stripped by interactions with Jupiter's powerful, rapidly rotating magnetic field. The coupling of the plasma to the strong magnetic field lines confines much of the plasma to a region about ~1 Jovian radius (Rj) tall near Io's 5.9 Rj orbital radius. The entire structure encircles Jupiter and wobbles with each Jovian rotation due to the ~10 degree tilt of Jupiter's magnetic field and pulsates at a mysterious and variable period ("system IV") which is slightly slower than Jupiter's magnetic field rotation rate.

This delightfully complicated, ethereal hula hoop, known as the Io plasma torus (IPT), has been the subject of intense study for nearly 40 years, yet there are several outstanding mysteries, three of which I will review in my talk: (1) Why is radial diffusion from the IPT so slow? (2) Where does the torus get so much of its energy from? (3) What causes the system IV periodicity? I will talk about recent progress which has been made toward understanding these mysteries, which points to the process of radial transport of material from the IPT as a common link.

Finally, I will sketch plans for the Io Input Output telescope (IoIO), a small- aperture robotically controlled telescope carrying a coronagraph, inspired by those produced at BU, which is designed observe the Jovian sodium nebula and Io plasma torus on a nightly basis for several Jovian oppositions. Together with periodic infrared observations of Io volcanism, these measurements would use the natural variations in Io volcanic output as an effective signal generator with which to measure the mass transfer function of Jupiter's magnetosphere and help to answer the outstanding questions about radial diffusion, energy generation, and mysterious periodicities in Jupiter's magnetosphere.

3:30 pm
Refreshments
CAS Room 500

4:00 pm
Seminar
CAS Room 502

Next Week

- Juha Vierinen
  MIT

- Low Frequency Radio Remote Sensing of Ionospheric Space Plasma

http://www.bu.edu/csp/edoutreach/seminar/

C · S · P

725 Commonwealth Avenue
Boston, MA 02215