MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

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4:10 – 5:00 PM
Roberts 101

Remote Sensing of Earth's Magnetosphere with Energetic Charged Particles

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Abstract:

Earth's magnetic bubble, the magnetosphere, provides a close-up view of how a star interacts with its magnetized planets. Driven by the solar wind, the magnetosphere's intense storms and explosive substorms lead to effects such as energized radiation belts and spectacular auroral displays. Activity in the magnetosphere is governed by a global circulation, known as magnetospheric convection. Earth's magnetic tail plays an important role in this convection cycle; how the magnetotail maintains steady convection, and when and how it decides to explosively release stored energy, are long standing questions. Magnetospheric convection involves dynamics at different scales, ranging from the largest (system-size) to the smallest (kinetic). At the largest scales, the spatial structure of the magnetic field is thought to play an important role in the stability of the magnetotail. At the smallest scales, plasma waves interact with energetic particles, leading to both their acceleration and loss into Earth's atmosphere.

Low-altitude measurements provide a unique vantage point for studying processes occurring in the magnetosphere, taking advantage of the fact that energetic particles move quickly along magnetic field lines, carrying information about processes occurring near the equator. Low-earth orbiting polar satellites sample a vast volume of space as they rapidly traverse magnetic field lines, providing a platform for studying the multiscale nature of the dynamics. This presentation will discuss two experiments that use energetic particles to remotely sense the magnetosphere. REAL (Relativistic Electron Atmospheric Loss) is a CubeSat mission that will make high time resolution (~50 ms) measurements of energetic particles over a wide energy range (~1 keV to 2 MeV), revealing information about the physics of plasma wave-particle interactions. CINEMA (Cross-scale INvestigation of Earth's Magnetotail and Aurora) is a mission concept that uses a constellation of nine satellites to remotely sense the structure and dynamics of the magnetosphere, providing the first system-level, cross-scale view of magnetotail convection.

Host: John Sample