BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

2021—2022 SPACE PHYSICS SEMINAR SERIES

Energetic Electron Precipitation into Earth's Atmosphere Driven by Electromagnetic Ion Cyclotron Waves

The Earth's outer electron radiation belt is a highly dynamic environment, governed by the balance between processes of acceleration, transport and loss. One important mechanism that can significantly deplete the outer radiation belt is electron precipitation. This phenomenon occurs when electrons are no longer trapped by the magnetic field and fall along the magnetic field lines into the Earth's atmosphere. Here, the energy input due to electron precipitation can affect the chemistry of the atmosphere, changing the conductivity as well as potentially causing ozone reduction. Electromagnetic Ion Cyclotron (EMIC) waves are known to precipitate energetic electrons via pitch-angle scattering. These waves (frequencies of ~0.1–5 Hz) are excited during injections from the magnetotail or solar wind pressure changes, and are often associated with spatially localized dropouts of the outer radiation belt flux at ~MeV energies. EMIC waves are indeed efficient in driving electron precipitation in the dusk sector and can also produce isolated proton aurora. However, several key properties of EMIC-driven electron precipitation (e.g., energy range, spatial extent, location, etc.) are not fully understood yet.

In this talk, I will show examples of electron precipitation associated with EMIC waves using data from multiple low-Earth-orbiting satellites and CubeSats. Taking advantage of magnetic conjunctions between equatorial and low-altitude satellites as well as theory simulations, we demonstrate that EMIC waves can not only precipitate ~MeV electrons, but also sub-MeV and even sub-relativistic electrons as well –a wider energy range than previously thought. The collection of the EMIC-driven electron precipitation events also shows that these waves typically cause radially localized precipitation from the pre-dusk sector to post-midnight.

Thursday, February 10th

4:00-5:00 p.m.

See website for Zoom details

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