ENHANCED AURORA AND INSTABILITIES IN THIN, DENSE, HEAVY ION IONIZATION LAYERS

JAY R. JOHNSON 1and Edgar Choueiri 2

1. Princeton University, Plasma Physics Laboratory, Princeton, NJ, USA
e-mail:jrj@pppl.gov
2. Princeton University, Electric Propulsion and Plasma Dynamics Laboratory, USA
e-mail: simon.wing@jhuapl.edu

Thin layers of enhanced luminosity are commonly observed during auroral displays. The enhanced luminosity occurs at altitudes where thin, dense, heavy ion layers are often observed in the E-region. Based on the spectral characteristics of the enhanced layers, it is believed that the enhanced emissions result when wave-particle interactions heat ambient electrons to energies at or above the 17 eV ionization energy of N_2. We investigate instabilities that could occur in dense, heavy ion layers in the presence of strong cross-field currents that accompany electron precipitation. We present analytical studies of the cross-field current driven instability including kinetic effects, ion-neutral, and electron-neutral collisions. Electrostatic simulations have shown that the instability heats ambient electrons into a suprathermal tail that could produce enhanced emissions. We discuss the nonlinear development of the instability and compare the expected electron energy flux with typical auroral observations.

Enhanced aurora, cross-field current instability, ionization layers

Jay R. Johnson, Princeton Plasma Physics Laboratory, Princeton University, PO Box 0451, Princeton, NJ 08543-0451, tel: 1-609-243-2603, fax: 1-609-243-2662,
e-mail: jrj@pppl.gov