Boston University College of Arts & Sciences Center for Space Physics

2022–2023 SPACE PHYSICS SEMINAR SERIES

The Evolving Subauroral Paradigm and Theory of Subauroral Arcs

A concise survey is given of the status quo of subauroral ion drifts. Recent multispacecraft observations revealed serious flaws of the generator paradigm and called for a new generation mechanism of fasttime subauroral flows and ring current (RC) injections. A novel concept includes them into the overarching problem of penetration of magnetotail plasma flow bursts (MPFs) into the plasmasphere and the substorm current wedge (SCW) development. SAID are created near the plasmapause where inbound MPFs are short-circuited by the cold plasma. Also presented is a novel scenario of subauroral arcs within SAID --STEVE and Picket Fence. Their explanation requires a local source of low-energy, ε <18.75 eV, suprathermal electrons, and N2 vibrational and electronic excitation below ~270 km. We show that the ionospheric feedback instability in strong SAID flows with depleted density troughs generates intense, small-scale field-aligned currents and parallel electric fields below the F2 peak. With these fields, we employed a rigorous numerical solution of the Boltzmann kinetic equation for the distribution of ionospheric electrons and determined the

power going to excitation and ionization of neutral gas (the energy balance). The obtained suprathermal electron population and energy balance at altitudes of ~130-140 km are just what is necessary for Picket Fence. Concerning STEVE, the kinetic theory predictions are in a good qualitative agreement with its basic features, such as the enhanced continuum emissions. Besides, the theory predicts that subauroral arcs should have a fine inner structure and the transient phase with typical aurora-like emissions that fade out afterwards.



Thursday, March 16th 4:00-5:00 p.m.

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Evgeny Mishin Air Force Research Laboratory