RSPP seminars

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"A diagnosis of plasma wave instabilities in the lead up to an auroral substorm"

During periods where the interplanetary magnetic field has a southward component, reconnection on the dayside magnetopause leads to a buildup of magnetic flux in the magnetotail lobes, and the magnetotail acts as a reservoir of plasma and energy. During a substorm this energy is explosively released, leading to the deposition of large quantities of energy into the polar ionospheres and leading to the bright and dynamic substorm aurora. Auroral substorm onset is observed at the equatorward edge of the auroral oval, suggesting that at least some of the processes which play an important role in energy release occur on closed magnetic field lines. Recent work has shown that periodic features, known as 'auroral beads', which grow in size and intensity form longitudinally along the substorm onset arc in the minutes before auroral breakup. Beads have been proposed to be the ionospheric projection of a magnetospheric instability in the near-Earth magnetotail.

We present statistical study to demonstrate how quantitative information such as wavenumber, exponential growth rate and wave frequency can be determined from auroral data. These properties can help narrow down the instability responsible for the beading signature in the aurora. We find that auroral beads are observed in over 90% of auroral substorms and grow exponentially through onset, indicating that plasma instability is a fundamental component of the magnetospheric substorm. We use magnetic field mapping to estimate the region of the tail conjugate to the substorm onset arc. Prevailing magnetotail parameters in this region are used to solve the warm plasma dispersion relation, showing overwhelming agreement with our measurements of the instability characteristics. We therefore demonstrate that plasma instability can be diagnosed from purely its optical signature

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Wednesday, November 15th at 2 pm in Physics LTD