

Excitation of Helicon Modes in the Earth's Plasmasheet

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In an electron-proton plasma, the dispersion relation for the parallel propagating right-hand polarized low-frequency modes yields the MHD Alfvén modes. However, in the presence of O^+ ions in the plasma sheet region, the electron Hall current is not completely neutralized by the ion Hall current, thus giving rise to helicon waves. When the ionospheric-origin oxygen ion beams have anisotropic pressure, they can excite helicon mode instability in the near-Earth plasma sheet region provided their Alfvénic Mach numbers lie in a certain range. The helicon mode instability can occur under the conditions when the usual long wavelengths fire-hose modes are stable. The typical frequencies of the excited helicon modes are between 1 to 10 mHz, and the typical e-folding time of the instability is about 3 to 15 minutes at wavelengths of 1 to 5 R_E . Therefore these modes are likely to attain saturation during enhanced convection events lasting for a few hours. Large amplitude helicon modes would distort the ambient magnetic field and may be observable as flux ropes. "Low-frequency turbulence produced by these modes could, scatter electrons and help excitation of the ion tearing modes leading to substorm onset,

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