THE INTERACTION BETWEEN SHEAR ALFVÉN WAVES AND WARM ELECTRONS IN THE EARTH'S MAGNETOSPHERE

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Shear Alfvén waves (SAW) are a wave mode with ultra-low frequencies (f<30Hz) which propagate through the magnetosphere, carrying information and energy along the magnetic field between plasma regions. Magnetospheric and ground-based observations demonstrate that SAW are associated with auroral acceleration, field-line resonances and substorm expansion phase onset, although the wave generation mechanisms are not well understood. In this talk we will focus on the kinetic physics of shear Alfvén waves and their resulting relationship with electrons in the collisionless plasma of the Earth's magnetosphere. In auroral regions, SAW travel through both warm and cold plasma on their way from the magnetosphere towards the ionosphere, and their propagation characteristics are dependent upon the relationship between the local Alfvén and thermal velocities. After discussing how warm plasma and short perpendicular scale lengths alter SAW characteristics and parallel electric field strength, we will present results from a self-consistent simulation code which follows the interaction between SAW and electrons along an inhomogeneous geomagnetic field. The results from this nonlinear kinetic simulation demonstrate that kinetic trapping effects and nonlinear damping can provide clear physical explanations for particle observations made in the plasma sheet boundary layer. We compare the numerical simulation results with in-situ observations to demonstrate how, where and to what energies electrons can be accelerated by SAW in auroral regions.

Aurora, electron acceleration, numerical simulations

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