Kinetic Alfvén Waves From Magnetotail to the Ionosphere in Global Hybrid Simulation Associated With Fast Flows

Yu Lin
Physics Department
Auburn University, AL 36849, USA

In this talk, we present the recent results on the generation and dynamics of kinetic Alfven waves (KAWs) from the Earth's magnetotail to the ionosphere based on the Auburn Global Hybrid Code in 3-D (ANGIE3D). Our results show that KAWs are generated in magnetic reconnection in the plasma sheet, located around fast flows, and carrying transverse electromagnetic perturbations, parallel Poynting fluxes, parallel currents, and parallel electric field. Overall, shear Alfvenic turbulent spectrum is found in the plasma sheet. The KAWs are identified by their dispersion relation and polarizations. The structures of these KAWs embedded in the plasma sheet are also revealed by placing a virtual satellite in the tail. In order to understand whether the Poynting fluxes carried by the shear Alfven waves/KAWs in the plasma sheet can be carried directly along field lines to the ionosphere, we have tracked the wave propagation from the plasma sheet to the ionosphere. It is found that in front of the flow braking region, the structure and strength of the shear Alfven waves are significantly altered due to interaction with the dipole-like field, mainly by the flow shear associated with the azimuthal convection. Also in front of the dipole-like field region, ion kinetic effects (Hall effects) lead to the generation of additional pairs of KAWs. The simulation results are compared with THEMIS in-situ observations in the magnetotail and the DMSP observations in the ionosphere. As such, the generation and transport of the shear Alfven waves/KAWs to the ionosphere are illustrated for the first time in a comprehensive manner on the global scale.