

Laboratory Studies of Space Relevant Alfvén Wave Processes

J. Maggs, G. Morales, A. Burke, T. Carter, W. Gekelman, D. Leneman, C. Mitchell, M. Van Zeeland, and S. Vincena

Department of Physics and Astronomy, UCLA, Los Angeles, CA

A series of laboratory studies of the effects of plasma non-uniformities on the spatial and temporal structure of Alfvén waves have been conducted in the LAPD (Large Plasma Device) at the BaPSF (Basic Plasma Science Facility) at UCLA. The effects of both cross-field and field aligned gradients has been studied over a wide range of scale lengths. A key modification to the Alfvén wave structure is the drift-Alfvén wave which results from the coupling of the drift wave and shear Alfvén wave in the presence of cross-field pressure gradients. Drift Alfvén waves are spontaneously excited in narrow field aligned pressure filaments. These waves feature fluctuations in both magnetic field and plasma density. Gradients along the magnetic field lead to changes in wave group and phase velocities. These changes can lead to wave focusing and reflection. Alfvén wave focusing has been observed in both cross-field and field-aligned beta gradients. A striking example of the influence of wave reflection and magnetic field-aligned gradients is the Alfvén wave maser which has been created and studied in the LAPD. Alfvén masers may play important roles in particle acceleration in both magnetospheric and astrophysical plasmas. (Research sponsored by NSF)