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Overview of the Basic Plasma Science Facility: the physics of waves Relevant to space, astrophysical and fusion plasmas

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The Basic Plasma Science Facility (BaPSF) at UCLA is a US national user facility for studies of fundamental processes in magnetized plasmas. The centerpiece of the facility is the Large Plasma Device(LAPD),a20mlong,magnetizedlinearplasmadevice[1]. This LAPD has been utilized to study a number of fundamental processes, including: collisionless shocks [2], dispersion and damping of kinetic and inertial Alfvén waves [3], turbulence and transport [5] and interactions of energetic ion sand electrons with plasma waves[6]. An overview of research using the facility will be given, followed by a more detailed discussion of studies of the nonlinear physics of Alfvén waves [7] and the physics of high power ICRF waves in LAPD [8]. Recent experiments have resulted in the first laboratory observation of the parametric instability of shear Alfvén waves. Shear waves with sufficiently high $\omega/\Omega c,i$ (> 0.6) and above a threshold wave amplitude are observed to decay into co-propagating daughter waves; one a shear Alfvén wave and the other a low-frequency quasimode. The observed process is similar to the modulational decay instability. Another series of experiments using LAPD have studied high power (~ 200kW)fast wave excitation (ω~2−10Ωci).

Highlights of this work include documenting: the structure and scaling of RF sheaths, the formation of convective cells and associated density modification, and parasitic coupling to the slow mode in the low density plasma in front of the antenna.

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