Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

First Laboratory Observation of a Shear Alfvén Wave Parametric Instability[1] S DORFMAN, T CARTER, S VINCENA, P PRIBYL, G ROSSI, UCLA, Y LIN, Auburn U, R SYDORA, U Alberta — Alfvén waves, a fundamental mode of magnetized plasmas, are ubiquitous in lab and space. The non-linear behavior of these modes is thought to play a key role in important problems such as the heating of the solar corona, solar wind turbulence, and Alfvén eigenmodes in tokamaks. In particular, theoretical predictions show that these Alfvén waves may be unstable to various parametric instabilities. Recent results from the Large Plasma Device at UCLA have recorded the first observation of a sheer Alfvén wave parametric instability in the laboratory [Dorfman and Carter, PRL 2016]. When a single finite ω/Ω_i, finite $k_\perp$ Alfvén wave is launched above a threshold amplitude, three daughter waves are observed: two sideband Alfvén waves co-propagating with the pump and a low frequency nonresonant mode. Frequency and parallel wave number matching relations are satisfied. Although these features are consistent with the $k_\perp = 0$ modulational instability theory, the theoretical growth rate is too small to explain observations. Efforts are underway to determine the nature of the perpendicular (to the background magnetic field) nonlinear drive, conduct comparative simulation studies, and identify parametric instabilities in spacecraft data.

[1]Supported by DOE, NSF, and NASA Eddy Postdoctoral Fellowship

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Date submitted: 14 Jul 2016 Electronic form version 1.4