DPP15-2015-001760

Abstract for an Invited Paper
for the DPP15 Meeting of
the American Physical Society

Laboratory Measurements of Linear Electron Acceleration by Inertial Alfvén Waves[1]

J.W.R. SCHROEDER, University of Iowa

Alfvén waves occur in conjunction with a significant fraction of auroral electron acceleration [1]. Inertial mode Alfvén waves ($v_A > v_{te}$) in the auroral magnetosphere ($2 - 4R_E$) with perpendicular scales on the order of the electron skin depth (c/ω_{pe}) have a parallel electric field that, according to theory, is capable of nonlinearly accelerating suprathermal electrons to auroral energies [2]. Unfortunately, due to space-time ambiguities of rocket and satellite measurements, it has not yet been possible to fully verify how Alfvén waves contribute to the production of accelerated electrons. To overcome the limitations of *in situ* spacecraft data, laboratory experiments have been carried out using the Large Plasma Device (LaPD), an NSF/DOE user facility at UCLA. An Electron Cyclotron Absorption (ECA) diagnostic has been developed to record the suprathermal parallel electron distribution function with 0.1% precision [3]. The diagnostic records the electron distribution while inertial Alfvén waves simultaneously propagate through the plasma. Recent measurements have isolated oscillations of suprathermal electrons at the Alfvén wave frequency. Despite complications from boundary effects and the finite size of the experiment, a linear kinetic model has been produced that describes the experimental results. To our knowledge this is the first quantitative agreement between the measured and modeled linear response of suprathermal electrons to an inertial Alfvén wave. This verification of the linear physics is a necessary step before the nonlinear acceleration process can be isolated in future experiments. Presently, nonlinear effects cannot be detected because of limited Alfvén wave amplitudes. Ongoing work is focused on designing a higher-power antenna capable of efficiently launching larger-amplitude Alfvén waves with tunable perpendicular wavenumber and developing a theoretical understanding of the nonlinear acceleration process in LaPD plasma conditions.

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[1] This material is based upon work supported by the National Science Foundation under Grants No. 1048957, PHY-10033446, and CAREER AGS-1054061. This work was performed in collaboration with F. Skiff, C. A. Kletzing, G. G. Howes, T. A. Carter, and S. Dorfman.