Nonlinear excitation of ion acoustic waves by large amplitude Alfvén waves in LAPD

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The LArge Plasma Device (LAPD) at UCLA is a 17 m long, 60 cm diameter magnetized plasma column with typical plasma parameters $n_e \sim 1 \times 10^{12} \text{cm}^{-3}$, $T_e \sim 10 \text{eV}$, and $B \sim 1 \text{kG}$. The nonlinear three-wave interaction process at the heart of the parametric decay instability is studied by launching counter-propagating Alfvén waves from antennas placed at either end of LAPD. The two waves generate a nonlinear beat-wave response in the plasma which can be tuned in frequency by changing the frequency of the pump Alfvén waves. As the beat frequency is varied, a resonance in the beat wave response produced by the two Alfvén waves is observed and is identified as a damped ion acoustic mode.

This identification is based on the measured dispersion relation. Other properties of the interaction including the spatial profile of the beat mode and propagation direction are also consistent with theoretical predictions for a three-wave interaction between the two pump Alfvén waves. The details of these experiments will be presented, along with a discussion of extension of these experiments to higher plasma beta using new capabilities (a new plasma source) associated with LAPD.

\footnote{S. Dorfman and T.A. Carter, Phys. Rev. Lett. 110, 195001 (2013)}