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Nonlinear Alfvén Wave Interactions on the Large Plasma Device
BRIAN BRUGMAN, TROY CARTER, University of California, Los Angeles —
The nonlinear dynamics of large amplitude Alfvén waves is believed to play a major role in the evolution of the macroscopic properties of numerous laboratory plasmas and astrophysical systems. However, despite their importance the nonlinear dynamics of these fluctuations remains point of great controversy with few prior thorough experimental measurements. Nonlinear interactions between Alfvén waves are being studied in the Large Plasma Device (LAPD) at UCLA, using large amplitude, $\delta B/B_0 \sim 1\%$, waves generated by LaPD's Alfvén wave MASER or by antennas. In these experiments, two large amplitude shear Alfvén waves are launched at different frequencies and beat against one another. The subsequent nonlinear generation of density fluctuations at the beat frequency along with the formation of numerous discrete Alfvénic sidebands has been observed using both wave launching mechanisms over a broad range of plasma parameters and launch wave frequencies. Such interactions resemble a form of parametric decay, namely the modulational instability. In particular the spatial and temporal characteristics as well as amplitude scaling of the interaction as evident by its effects on magnetic, density, and potential fluctuations will be presented.

Brian Brugman
University of California, Los Angeles

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