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Control of pressure-gradient-driven instabilities using shear Alfvén Beat-Waves[1]

DAVID AUERBACH, University of California, Los Angeles

A new technique for manipulation and control of gradient-driven instabilities through nonlinear interaction with shear Alfven waves (SAW) in a laboratory plasma is presented [1]. A narrow field-aligned density depletion is created in the background plasma of the Large Plasma Device (LAPD), resulting in coherent unstable fluctuations on the periphery of the depletion. Two independent SAWs are launched along the depletion at separately controlled frequencies, creating a nonlinear beat-wave response at or near the frequency of the original instability. Resonant drive of the instability is observed when the beat frequency matches the frequency of the unstable mode. More interestingly, when the beat-wave is driven at a frequency slightly above the instability frequency, the m=1 instability is suppressed in favor of (or synchronized to) an m=2 mode at the beat frequency. An amplitude threshold is observed for this behavior, and the frequency width of the region of beat wave control increases with beat wave amplitude. Although power is being added to the system by broadcasting into the gradient region, the low-frequency fluctuations (both broadband noise and the dominant coherent mode) are reduced when the instability is suppressed in favor of the m=2 mode. This behavior is only observed for long-wavelength beat waves driven by co- propagating SAWs; the interaction is not observed with short wavelength beat waves from counter propagating SAWs.

[1] D. W. Auerbach *et al.*, arXiv:1005.0647v2 [physics.plasm-ph].

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