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Quasicoherent Nonlinear Interactions in Ion Density Fluctuations

ILKER UZUN, FREDERICK SKIFF, Department of Physics and Astronomy, University of Iowa — Using Laser Induced Fluorescence(LIF) diagnostics, we present the phase-space resolved measurement of ion density fluctuations in a linearly magnetized device. These experiments are conducted in singly ionized ArII plasma, which is created by an inductively coupled plasma source, immersed in 1KG magnetic field along the axis of a cylindrical chamber. Cross and auto spectral estimates are calculated after the digitization of LIF signals collected from two independent periscopes having axially aligned mobility. The cross-power spectrum has a distinctive, broad peak near the drift wave frequency(ω^*) that can be dissected into two components; the one having a long wavelength consistent with drift wave theory, and the other, which we call the 'kinetic component,' with a shorter correlation length and ion particle velocity dependence. Bispectrum and bicoherence calculations, on the other hand, suggest a quasicoherent nonlinear interaction between the kinetic and the fluid components. As the neutral pressure and thus the ion-neutral collision frequency increase, we observe a certain threshold where the kinetic component vanishes from the cross-power spectrum. Meanwhile, in bicoherence calculations, the nonlinear coupling of ω^* to its sub-harmonics is taken over by another nonlinear interaction that is between ω^* and its second harmonic. We propose an explanation for these changes in the spectra and bispectra.

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