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Abstract for an Invited Paper
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James Clerk Maxwell Prize for Plasma Physics Talk: On Nonlinear Physics of Shear Alfvén Waves[1]

LIU CHEN, Department of Physics and Astronomy, University of California, Irvine

Shear Alfvén Waves (SAW) are electromagnetic oscillations prevalent in laboratory and nature magnetized plasmas. Due to its anisotropic propagation property, it is well known that the linear wave propagation and dispersiveness of SAW are fundamentally affected by plasma nonuniformities and magnetic field geometries; for example, the existence of continuous spectrum, spectral gaps, and discrete eigenmodes in toroidal plasmas. This talk will discuss the crucial roles that nonuniformity and geometry could also play in the physics of nonlinear SAW interactions. More specifically, the focus will be on the Alfvénic state and its breaking up by finite compressibility, non-ideal kinetic effects, and geometry. In the case of compressibility, finite ion-Larmor-radius effects are shown to qualitatively and quantitatively modify the three-wave parametric decays via the ion-sound perturbations. In the case of geometry, the spontaneous excitation of zonal structures by toroidal Alfvén eigenmodes is investigated; demonstrating that, for realistic tokamak geometries, zonal current dominates over zonal flow.

Present address: Institute for Fusion Theory and Simulation, Zhejiang University, Hangzhou, China.

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