Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Nonlinear cross-field coupling on the route to broadband turbulence CHRISTIAN BRANDT, SAIKAT C. THAKUR, LANG CUI, Center for Energy Research, UC San Diego, JORDAN J. GOSSELIN, Center for Momentum and Flow Organization, La Jolla, JOSE NEGRETE JR., Max-Planck-Institute for Dynamics and Self-Organization, Goettingen, CHRIS HOLLAND, GEORGE R. TYNAN, Center for Energy Research, UC San Diego — In the linear magnetized plasma device CSDX (Controlled Shear De-correlation eXperiment) drift interchange modes are studied coexisting on top of a weak turbulence driven azimuthally symmetric, radially sheared plasma flow. In helicon discharges (helicon antenna diameter 15 cm) with increasing magnetic field ($B \leq 0.24\,\mathrm{T}$) the system can be driven to fully developed broadband turbulence. Fast imaging using a refractive telescope setup is applied to study the dynamics in the azimuthal-radial cross-section. The image data is supported by Langmuir probe measurements. In the present study we examine the development of nonlinear transfer as the fully developed turbulence emerges. Nonlinear cross-field coupling between eigenmodes at different radial positions is investigated using Fourier decomposition of azimuthal eigenmodes. The coupling strength between waves at different radial positions is inferred to radial profiles and cross-field transport between adjacent magnetic flux surfaces. Nonlinear effects like synchronization, phase slippages, phase pulling and periodic pulling are observed. The effects of mode coupling and the stability of modes is compared to the dynamics of a coupled chain of Kuramoto oscillators.

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Date submitted: 12 Jul 2013 Electronic form version 1.4