Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Phase mixing vs. nonlinear advection in drift-kinetic plasma turbulence A. SCHEKOCHIHIN, J. PARKER, E. HIGHCOCK, P. DELLAR, U. of Oxford, A. KANEKAR, W. DORLAND, U. of Maryland, G. HAMMETT, Princeton U., N. LOUREIRO, IST, Lisbon, C. STAINES, U. of Oxford, L. STIPANI, U. of Pisa — A scaling theory of drift-kinetic turbulence in a weakly collisional plasma is proposed, with account both of the nonlinear advection of the perturbed particle distribution by the fluctuating ExB flow and of its parallel phase mixing, which in a linear problem causes Landau damping. It is found that little free energy leaks into high velocity moments of the distribution, rendering the turbulence in the energetically relevant part of the wave-number space essentially fluid-like. The velocity-space free-energy spectra expressed in terms of Hermite moments are steep power laws and so the energy content of the phase space does not diverge and collisional heating due to long-wavelength perturbations vanishes at inifinitesimal collisionality (both in contrast with the linear problem). The ability of the energy to stay in the low moments is facilitated by "anti-phase-mixing," which in the nonlinear system is due to the stochastic version of plasma echo (the advecting flow couples the phase-mixing and anti-phase-mixing perturbations). The partitioning of the wave-number space between the (energetically dominant) region where this is the case and the region where linear phase mixing wins its competition with nonlinear advection is governed by the "critical balance" between linear and nonlinear timescales, which for high Hermite moments splits into two thresholds, one demarcating the wave-number region where phase mixing predominates, the other where plasma echo does.

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Date submitted: 15 Jul 2015 Electronic form version 1.4