

Collisionless Dynamical Friction and Relaxation in a simple Drift Wave-Zonal Flow Turbulence

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We present a study of the role of zonal flows in relaxation and transport in a reduced model of collisionless ITG turbulence. A fundamentally new constituent in the relaxation dynamics is revealed, namely that ion and electron guiding center motion together necessitate a radial flux of polarization charge, which in turn exerts a *dynamical friction* on phase space density evolution. This effect then enters the evolution of $\langle \delta f^2 \rangle$ and the transport dynamics, as described by a Lenard-Balescu type equation. The underlying physics is similar to that which follows from conservation of potential vorticity, albeit now for a phase space fluid, and is not simple shearing or wave packet modulation. Consequences for zonal flow momentum balance are discussed.