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An anomalous current drive mechanism in low collisionality plasmas[1] CHRIS MCDEVITT, XIANZHU TANG, ZEHUA GUO, LANL — Steady state tokamak operation requires non-inductive current drive, of which the neoclassical bootstrap current is the most economic option. Here we report a novel mechanism through which a bootstrap current may be driven even in a collisionless plasma. In analogy with the neoclassical mechanism, in which the collisional equilibrium established between trapped and passing electrons produces a steady state current, we show that resonant scattering of electrons by drift wave microturbulence provides an additional means of determining the equilibrium between trapped and passing electrons. The resulting collisionless equilibrium is shown to produce a mean current whose magnitude scales with the thermodynamic forces. Employing a linearized Fokker-Planck collision operator, the plasma current in the presence of both collisions and resonant electron scattering is computed as a function of collisionality. It is found that while the volume integrated electron current is only modestly affected by the turbulent fluctuations, the radial distribution of electron current is significantly modified in low collisionality plasmas.

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Chris McDevitt
LANL

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