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Poloidal rotation in strongly magnetized plasmas C.J. MCDEVITT, P.H. DIAMOND, CMTFO and CASS, UCSD, O.D. GURCAN, LPP-CNRS, T.S. HAHM, PPPL — Poloidal flows play a critical role in the regulation and stabilization of numerous modes within tokamak devices which are known to have detrimental effects on plasma confinement. In this work, a novel mean field formulation of poloidal rotation is developed, with emphasis on the elucidation of mechanisms through which microturbulence drives poloidal flows. In particular, a kinetic generalization of a Taylor identity appropriate to a strongly magnetized plasma is derived, providing an explicit link between the poloidal Reynolds stress and the transport of potential vorticity. A quasilinear calculation of the flux of potential vorticity is carried out, yielding diffusive, turbulent equipartition and thermo-electric convective components. Self-consistency is enforced via the quasineutrality relation, revealing that for the case of a stationary small amplitude wave population, deviations from neoclassical predictions of poloidal rotation can be closely linked to the growth/damping profiles of the underlying drift wave microturbulence, in accord with expectations from wave energy balance at stationarity. Applications of the above theory to poloidal spin up in the vicinity of a transport barrier will be discussed.

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