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Toroidal and Poloidal Flow Evolution C.J. MCDEVITT, P.H. DIAMOND, UCSD, O.D. GURCAN, CNRS, T.S. HAHM, PPPL — We present recent results in the theory of turbulent momentum transport pertinent to the description of intrinsic rotation. Emphasis is placed on the self-consistent evolution of poloidal and toroidal flows. Both turbulent and neo-classical stresses are considered, allowing for the recovery of purely neo-classical flows, as well as the description of deviations induced by the background turbulence. Along with radial force balance, toroidal and parallel force balance are utilized to constrain the evolution of poloidal and toroidal momentum. Within the turbulent toroidal momentum flux, in the limit of small but finite inverse aspect ratio, two distinct non-diffusive contributions capable of spinning up a plasma from rest are identified. The first results from E $\times$ B shear induced symmetry breaking of the underlying wave population, whereas the second follows from charge separation induced by the polarization drift. An expression for the poloidal flow, including both neo-classical and turbulent stresses, is obtained from parallel force balance. Potentially significant deviations from neo-classical poloidal rotation are found, which are in turn seen to provide a robust means of enhancing toroidal flow generation. Ongoing work is devoted to the development of a self-consistent model describing the coupled poloidal and toroidal flow evolution.

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