

Discoveries from the exploration of gyro-kinetic momentum transport

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ABSTRACT

Momentum transport due to gyro-radius scale turbulence in tokamak plasmas is very complex. In general, some type of breaking of the parity of the gyro-kinetic equation under simultaneous reflection of the poloidal angle and the sign of the parallel velocity phase space coordinate (poloidal parity) is always involved. There are three distinct types of poloidal parity breaking effects. In this paper, all three types of poloidal parity breaking are explored using the quasi-linear trapped gyro-Landau fluid (TGLF [G.M. Staebler et al., Phys. Plasmas **12**, 102508 (2005)]) transport code. Selected results are verified with full non-linear turbulence simulations using the GYRO [J. Candy et al., J. Comp. Phys. **186**, 545 (2003)] gyro-kinetic code. Observable properties like an energy pinch driven by parallel velocity shear and a dependence of momentum transport on the direction of the ion grad-B drift relative to the X-point location in single null divertor geometry have been discovered.

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