

Kinetic theory of radial angular momentum flux of collisional plasmas in an axisymmetric magnetic field

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(Received on

Abstract. A recent calculation [P.J. Catto and A.N. Simakov, *Phys. Plasmas* **12**, 012501 (2005)] of the radial angular momentum flux for collisional plasmas with small toroidal flows using fluid equations is at variance with an existing result [R.D. Hazeltine, *Phys. Fluids* **17**, 961 (1974)] based on a drift kinetic approach. The difference has been ascribed to the incompleteness of the drift kinetic equation when second order accuracy in the ratio of gyroradius over scale length is required. This paper reformulates the problem starting from the full kinetic equation that includes gyromotion and performs an expansion in the same ratio. The drift kinetic equation being used is recovered by keeping leading order terms in an additional expansion of poloidal to toroidal magnetic fields. Solving the equation in the Pfirsch-Schlüter regime leads to agreement with the fluid approach, after correcting an error in the existing drift kinetic calculation.

PAC Nos.: 52.25Fi