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

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Abstract

The fluid equations of Mikhailovskii and Tsypin have been applied to the problem of radial transport of angular momentum of plasmas in an axisymmetric magnetic field with flux surfaces of arbitrary shape. [P.J. Catto and A.N. Simakov, Phys. Plasmas **12,** 012501 (2005)]. We expand on this work and derive compact expressions for the radial angular momentum flux for both up down symmetric and asymmetric flux surfaces by utilizing the ratio of poloidal to toroidal fields as an additional small parameter. We present a systematic expansion of the fluid equations in the ratio of gyro-radius over plasma and magnetic field scale length, followed by a subsidiary expansion in the ratio of collisional mean free path to the scale length. We also present a derivation of the equations of Mikhailovskii and Tsypin in a form that facilitates application to the transport problem.

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