

Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

General expression of the gyroviscous force¹ J.J. RAMOS, PSFC, MIT — Assuming only small gyromotion periods and Larmor radii compared to any other time and length scales, and retaining the lowest significant order in the small Larmor radius asymptotic expansion, the general expression of the ion gyroviscous stress tensor is presented. This expression covers both the “MHD” ordering where the time derivative and the ion gyroviscous stress are first order in the ratio between the ion Larmor radius and other lengths relative to the ion gyrofrequency and scalar pressure respectively, and the “drift” ordering where the time derivative and ion gyroviscous stress are respectively second order. This general stress tensor applies to arbitrary collisionality and does not require the distribution function to be close to a Maxwellian. Its exact divergence (gyroviscous force) is written in closed vector form, allowing for arbitrary magnetic geometry, parallel gradients and flow velocities. Considering in particular the contribution from the velocity gradient (rate of strain) term, the final form of the momentum conservation equation after the “gyroviscous cancellation” and the “effective renormalization of the perpendicular pressure by the parallel vorticity” is precisely established.

¹Work supported by the U.S. DOE

J.J. Ramos
PSFC, MIT

Date submitted: 24 Jul 2005

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