# Gyrokinetic simulations of angular momentum transport and comparisons with measurements

R.V.Budny, *PPPL*,

Understanding angular momentum transport is important for creating reliable predictions of rotation in fusion reactors which are expected to have negligible applied torque. The GYRO gyrokinetic code [1] is being used to simulate turbulent-driven energy, angular momentum, and species flows. Recent GYRO simulations of profiles of angular momentum flows in JET L-mode plasmas with low $\beta_n$ are in approximate agreement with measurements [2]. Also recent GYRO simulations have been performed for a well-matched pair of TFTR supershots, one with D plasma and the other with DT. These are especially interesting since they exhibit a very clear and strong isotopic scaling of $\chi_i$. The simulated energy and angular momentum transport profiles for both are high by a factor of 2-3. Comparisons of GYRO simulations with results from TRANSP analysis are shown below. We find $\chi_i^{tot}$ slightly larger than $\chi_{mom}$.

We are using the same techniques to study angular momentum flows in DIII-D plasmas. The plasmas studied include Ohmic and ECCH plasmas probed with NBI blips [3]. These results help understand the intrinsic rotation seen in a various experiments.

The method used in GYRO for simulating profiles of the angular momentum flow is to compute the drive from the measured $\nabla(v_{tor})$, and the flow from moments of the distributions of the kinetic ion species. The GYRO code is being upgraded to include a number of improvements [4]:

1) The diffusive contributions to $\chi_\phi$ in the parallel and perpendicular directions and the convective contributions will be written separately,

2) The $v_{i,\phi}$ contribution to the curvature drift will be added.

We plan to discuss effects of these improvements on the simulations.

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[2] R.V. Budny, talk at the JET TFT annual meeting, Jan 22-25, 2007

[3] J.S. deGrassie, *et al*, APS invited talk (2006) and submitted to Physics of Plasmas (2007)

[4] R.E. Waltz, G.M. Staebler, and J.Candy, TTF/Sherwood 2007