

**Abstract Submitted for the Forty-Seventh Annual
Meeting
Division of Plasma Physics
October 24–28, 2005, Denver, Colorado**

Category Number and Subject:

Theory Experiment

The Connection Between Upwind Dissipation, Entropy Production, Velocity-Space Resolution and Steady-States of Turbulence in GYRO Simulations,* J. Candy, GA – The connection between dissipation and steady states of turbulence in gyrokinetic simulations has been discussed by Krommes [1] who argued that nondissipative simulations cannot achieve a true turbulent steady state. The issue was revisited in the context of Eulerian simulations by Watanabe [2], providing a clear and precise confirmation of Krommes' analysis.

In this presentation we show how the upwind advection schemes used in GYRO [3] provide the dissipation required for the achievement of steady states of turbulence. These steady states are grid-converged not only with respect to transport coefficients but also with respect to entropy. We put to rest the commonplace but ill-founded notions that Eulerian simulations (a) require velocity-space dissipation and (b) miss important velocity-space structure.

- [1] J.A. Krommes and G. Hu, *Phys. Plasmas* **1**, 3211 (1994).
- [2] T.-H. Watanabe and H. Sugama, *Proc. of 20th IAEA Fusion Energy Conf., Vilamoura, 2004*, Paper TH/8-3Rb.
- [3] J. Candy and R.E. Waltz, *J. Comput. Phys.* **186**, 545 (2003).

*Work supported by US DOE under DE-FG03-95ER54309.

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