Further investigations of electromagnetic gyrokinetic simulation of plasma turbulence

David W. Ross[1] and William Dorland[2]

[1]IFS and FRC, The University of Texas at Austin, Austin, TX 78712-0262
[2]The University of Maryland, College Park, MD 20742-3511

In previous gyrokinetic simulations of tokamak plasma turbulence with the electromagnetic nonlinear code GS2, we found an enhancement of the electron thermal flux owing to the magnetic fluctuations.[1,2] This effect is reduced, however, at high spatial resolution.[2] In the present work we extend the study to even higher resolution, retaining 14 Fourier modes poloidally and 99 in the radial direction. The computational flux-tube size is 112 ion gyro-radii poloidally and 72 radially. The runs appear to be approaching convergence but have still not converged completely, the energy fluxes being somewhat reduced from our previous highest-resolution case. The necessary radial resolution results from the presence of drift-Alfvén waves that are extended along the field line in this system with magnetic shear. These modes are linearly unstable. The most interesting result is that the presence of the Alfvén modes appears nonlinearly to suppress the ion thermal flux, which is substantially below that of the corresponding electrostatic run, even at the low value of $\beta = 0.003$. This could have a bearing on previous attempts to compare with experiment using electrostatic runs.[3]

[1]D. W. Ross, W. Dorland, and B. N. Rogers, Bull. Am. Phys. Soc. 46, 115 (2001).
[2]D. W. Ross and W. Dorland, presented at the Transport Task Force Meeting, Madison, WI April 2-5, 2003. See http://www.psfc.mit.edu/ttf/2003/previews/agenda.html
[3]D. W. Ross and W. Dorland, Phys. Plasmas 9, 5031 (2002).
Presented at the 2004 International Sherwood Theory Conference, April 26-28, Missoula, MT