Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Zonal flows and ITG saturation in the presence of magnetic perturbations M.J. PUESCHEL, P.W. TERRY, University of Wisconsin-Madison, F. JENKO, D.R. HATCH, Max-Planck-Institut fur Plasmaphysik, W.M. NEVINS, Lawrence Livermore National Laboratory, T. GORLER, D. TOLD, Max-Planck-Institut fur Plasmaphysik — At large β but below the KBM threshold, gyrokinetic simulations of ITG turbulence may fail to saturate through zonal flows. It is shown that, if background gradients are sufficiently strong, a threshold exists for a transition to a non-zonal ITG regime with extremely large transport levels, an effect sometimes referred to as "runaway." Resonant (i.e., tearing-parity) radial magnetic fluctuations B_x are usually seen as the primary source of stochasticity, but non-resonant B_x may also become stochastic once the field line displacement after half a poloidal turn exceeds the correlation length. This rapidly shorts out the zonal flows, and they are no longer able to saturate the ITG mode. To examine how flux-surface-breaking magnetic fluctuations affect zonal flows, the Rosenbluth-Hinton residual flow scenario is studied: In the presence of a superimposed, constant resonant B_x, initial flows do not decay to the theoretical residual, but vary quadradically in time, reaching zero potential in the time $t_{\Phi=0} \propto q_0(1-\epsilon_t)B_x^{-1}$. The flow evolution is calculated analytically from the Laplace-transformed, bounce-averaged ion gyrokinetic equation with a B_x of the above type, and compared with the simulation results.

Paul Terry
University of Wisconsin-Madison

Date submitted: 12 Jul 2012 Electronic form version 1.4