Studies of plasma shaping effects on ITG/TEM turbulence with the GS2 gyrokinetic code and a local linear gyrokinetic code*

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The effects of flux surface shape and other plasma parameters on the gyrokinetic stability and transport of tokamak plasmas are being studied. A local linear gyrokinetic code has been developed to aid in these studies. It includes models of the effects of plasma shaping, magnetic shear, and toroidal geometry by using representative values of $k_\parallel$, $k_\perp^2$, ω_d, etc. averaged over a trial eigenfunction, using the same geometrical information available in the full GS2 gyrokinetic code. Thus it can use either a full numerical equilibrium or a local parameterized equilibrium such as developed by Miller et.al †. The resulting reduced model is able to follow the scaling of the linear growth rate from the full GS2 code in the collisionless, electrostatic limit, with single and multiple gyrokinetic ion and electron species, for a range of shaped flux surface equilibria. A simple model of trapped particle effects also works fairly well. Extensions to include magnetic fluctuations and accurately recover the ideal ballooning limit were found to be more difficult, requiring coupling to higher order Hermite basis functions. The most stabilizing influences on the linear growth rate are seen with 1) high elongation and elongation gradient with high triangularity at a fixed α, and 2) high triangularity at high α at a finite elongation. Using GS2, we have also recently extended these results to include comparisons with JET data and to study the scaling of nonlinear turbulence levels with shaping parameters.

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†R. Miller, M.S. Chu, J.M. Greene et al, Phys. Plasmas **5**, 973 (1998).