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# Shaping and Toroidal Effects in a Local Linear Gyrokinetic Code*

Emily Belli, Gregory W. Hammett
*Princeton Plasma Physics Laboratory*

William Dorland
*Univ. of Maryland*

A local linear gyrokinetic code has been developed for fast scoping studies. It includes models of effects of plasma shaping, magnetic shear, and toroidal geometry by using representative values of $k_\parallel$, $k_\perp^2$, $\omega_d$, 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.†. This local code has recently been extended to include simple models for trapped particles and for the parallel free streaming of particles out of the bad-curvature region. The resulting reduced model is able to follow the scaling of the linear growth rate from the full GS2 code in many regimes studied so far, including trapped electron effects. We have also used this code to test a fast iterative implicit algorithm that can be useful for gyrokinetic codes. The full GS2 code and this local code have been used to examine the effects of local flux surface shape (in particularly elongation, triangularity, and their gradients, and also the second derivative of the Shafranov shift, as parameterized by the parameter $\alpha \approx -Rq^2\partial\beta/\partial r$) on gyrokinetic stability of tokamak plasmas. The most stabilizing influences are seen with 1) high elongation and elongation gradient with high triangularity at a fixed $\alpha$, and 2) high triangularity at high $\alpha$ at a finite elongation. A high degree of shaping, in effect, opens up access to a type of second-microstability regime at high $\alpha$, though it can have a destabilizing influence at low $\alpha$. This behavior is qualitatively reminiscent of the effects of triangularity on MHD ballooning stability in previous studies†.

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

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