Gyrokinetic stability calculations for related stellarator and tokamak configurations

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In comparison with axisymmetric configurations such as tokamaks, stellarators possess much greater configuration complexity – particularly in regard to the existence of local ripple wells – and this complicates the calculation of microinstability properties [1]. On the other hand, the greater complexity also probably enables more independent control of configuration parameters, and thus may extend parametric studies beyond what is possible with tokamaks alone. With the ultimate aim of broadening our understanding of toroidal microinstabilities, we have begun to compare the linear stability of related stellarator and tokamak configurations. The two codes used in these studies, GS2 and GENE, have been benchmarked with tokamak [2] and stellarator configurations (results are reported at this conference).

We will examine several axisymmetric configurations which match selected poloidal cross sections of the NCSX and W7-X configurations, and evaluate the linear threshold, the growth rates and frequencies of 'pure' ITG microinstabilities (i.e., with adiabatic electrons) as well as 'pure' TEM (no ion temperature gradient) and more realistic combined ITG/TEM modes, together with collisionality scans.

Pure ITG turbulence simulations with the GENE code are presented for the optimized stellarators W7-X and NCSX. We examine the effect on the transport fluxes of zonal flows, trapped particle population, and kinetic electron dynamics.

[1] G. Rewoldt, L.-P. Ku, W. M. Tang, Phys. Plasmas **12** (2005) 102512.
[2] P. Xanthopoulos, D. R. Mikkelsen, F. Jenko, W. Dorland, and O. Kalentev, "Validation and application of numerically generated coordinate systems in linear gyrokinetics", submitted to Phys. Plasmas 2008.