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Gyrokinetic Simulation of Microturbulent Saturation at Finite β P.W. TERRY, M.J. PUESCHEL, D. CARMODY, G.G. WHELAN, University of Wisconsin-Madison — Saturation and zonal flow physics for microturbulence is investigated for tokamaks and the RFP using gyrokinetic computation to understand scalings with respect magnetic shear and β. Modeling an MST discharge shows that the critical instability gradient for TEM is higher than the tokamak threshold by the aspect ratio (R/a). This factor is rooted in the shorter magnetic field scale length of the RFP. Nonlinear simulations show strong zonal flows and a large Dimits shift exceeding the tokamak shift by a factor of order (R/a). The non zonal transition (NZT), a critical β for which zonal flows are disabled by flutter-induced charge loss is also considered. The critical β occurs when the radial displacement of a magnetic field line over a half connection length is equal to the radial correlation length. These quantities scale with the connection length and magnetic drift scale lengths entering the instability threshold and quasilinear diffusivities, making the RFP critical β for NZT higher than the tokamak value by $(R/a)^{1.5}$ times tokamak q. These results are consistent with magnetic shear and q dependence in the kinetic ballooning threshold, indicating that β effects will only arise at high β relative to typical RFP operation.

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