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Gyrokinetic simulations of ETG Turbulence*

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Recent gyrokinetic simulations of electron temperature gradient (ETG) turbulence [1,2] produced different results despite similar plasma parameters. Ref.[1] differs from Ref.[2] in that [1] eliminates magnetically trapped particles ($r/R = 0$), while [2] retains magnetically trapped particles ($r/R \approx 0.18$). Differences between [1] and [2] have been attributed to insufficient phase-space resolution and novel physics associated with toroidicity and/or global simulations[2]. We have reproduced the results reported in [2] using a flux-tube, particle-in-cell (PIC) code, PG3EQ[3], thereby eliminating global effects as the cause of the discrepancy. We observe late-time decay of ETG turbulence and the steady-state heat transport in agreement with [2], and show this results from discrete particle noise. Discrete particle noise is a numerical artifact, so both the PG3EQ simulations reported here and those reported in Ref.[2] have little to say about steady-state ETG turbulence and the associated anomalous electron heat transport. Our attempts to benchmark PIC and continuum[4] codes at the plasma parameters used in Ref.[2] produced very large, intermittent transport. We will present an alternate benchmark point for ETG turbulence, where several codes reproduce the same transport levels. Parameter scans about this new benchmark point will be used to investigate the parameter dependence of ETG transport and to elucidate saturation mechanisms proposed in Refs.[1,2] and elsewhere[5-7].

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