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Nonlinear Simulations of Trapped Electron Mode Turbulence in Low Magnetic Shear Stellarators[1] B.J. FABER, M.J. PUESCHEL, P.W. TERRY, C.C. HEGNA, Univ of Wisconsin, Madison — Optimized stellarators, like the Helically Symmetric eXperiment (HSX), often operate with small global magnetic shear to avoid low-order rational surfaces and magnetic islands. Nonlinear, flux-tube gyrokinetic simulations of density-gradient-driven Trapped Electron Mode (TEM) turbulence in HSX shows two distinct spectral fluctuation regions: long-wavelength slab-like TEMs localized by global magnetic shear that extend along field lines and short-wavelength TEMs localized by local magnetic shear to a single helical bad curvature region. The slab-like TEMs require computational domains significantly larger than one poloidal turn and are computationally expensive, making turbulent optimization studies challenging. A computationally more efficient, zero-average-magnetic-shear approximation is shown to sufficiently describe the relevant nonlinear physics and replicate finite-shear computations, and can be exploited in quasilinear models based on linear gyrokinetics as a feasible optimization tool. TEM quasilinear heat fluxes are computed with the zero-shear approximation and compared to experimentally-relevant nonlinear gyrokinetic TEM heat fluxes for HSX.

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