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Kinetic Ballooning Mode turbulence in small-average-magnetic-shear equilibria[1] I.J. MCKINNEY, University of Wisconsin - Madison, M.J. PUESCHEL, Institute for Fusion Studies, The University of Texas at Austin, C.C. HEGNA, B.J. FABER, P.W. TERRY, University of Wisconsin - Madison — Kinetic ballooning mode (KBM) turbulence is studied in small-average-magnetic-shear equilibria, namely HSX, Heliotron-J, and a circular tokamak, to understand stellarator transport at finite β and to identify configurations with improved confinement. Electromagnetic flux-tube simulations of HSX using the gyrokinetic turbulence code GENE show that the onset of KBM instability at low k_y occurs at a value of normalized plasma pressure β that is an order of magnitude smaller than the MHD ballooning limit β^{MHD}. This small β^{KBM} is sensitive to modifications of the magnetic shear. Heliotron-J and an axisymmetric geometry exhibit behavior similar to HSX. Regardless, saturation of nonlinear simulations of HSX with $\beta^{\mathrm{MHD}>\beta>\beta^{\mathrm{KBM}}}$ is achievable and results in lower heat fluxes than the electrostatic case. A fluid model which expands upon an electrostatic model [C.C. Hegna, 2018] by including finite-β effects is introduced; it allows for ITG-KBM saturation in stellarators to be dominated by the transfer of energy from unstable to stable modes at similar scales via nonlinear coupling and will be used to build a physical understanding for the relationship between geometry and β^{KBM}.

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