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Progress on gyrokinetic simulation of high-n energetic particle driven instabilities[1] YANG CHEN, SCOTT PARKER, University of Colorado at Boulder, GUO-YONG FU, Princeton Plasma Physics Laboratory — A hybrid model, in which ions are described by the gyrokinetic equations and electrons are treated as a massless fluid, has been developed for arbitrary shape flux surfaces and equilibrium profiles, based on the GEM turbulence simulation code (Y. Chen and S. E. Parker, J. Comp. Phys. 189 (2003). The perturbed magnetic field is given by $\delta\mathbf{B}_\perp = \nabla A_\| \times \mathbf{b}$, with $A_\|$ given by the parallel Ampere's law. The electric field is given by $\mathbf{E} = -\nabla\phi - (\partial A_\|/\partial t)\mathbf{b}$, with ϕ obtained from the quasi-neutrality condition. The primary coupling of the hot particles to the bulk plasma comes from the hot particle term in the quasi-neutrality condition. This hybrid model can be shown to reduce to the MHD equations for the shear Alfvén modes under the assumption $E_\| = 0$. Linear simulation shows the existence of global modes with TAE features in terms of mode location and frequency. However, small variation in the equilibrium profiles (such as q-profile and temperature profile) often leads to strongly unstable unphysical mode peaking at the inner mid-plane. We will attemp to resolve this difficulty, either by improving the electron model or by improving numerical algorithms to avoid the unphysical modes.

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Yang Chen

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