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Particle-in-Cell simulation of energetic particles driven instabilities[1] YANG CHEN, SCOTT E. PARKER, University of Colorado at Boulder, JIANYING LANG, GUOYONG FU, PPPL — We present simulations of the evolution of energetic particles driven modes with the gyrokinetic turbulence code GEM[2], except that kinetic electrons are replaced by a mass-less fluid model. PIC simulations of energetic particles use either the conventional full-f method or the δf method. The latter is adequate for low-amplitude fluctuation amplitudes. The collisional δf-method[3] is used to systematically account for collisions and particle source and sink. Steady state saturation amplitudes are benchmarked with predictions of analytic theory. We also employ full-f simulations[4] to study bursty events in which the instabilities reach large amplitudes and cause macroscopic redistribution or loss of the particles. With full-f it is easy to retain all the nonlinear effects and treat accurately discontinuities in the distribution function at phase-space boundaries. Whereas the energetic particle current is neglegible in the Ampere's law in δf simulations, it is important in full-f simulations. Thermal ion kinetic effects are observed to be important.

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