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δf Particle-in-Cell simulation of turbulent transport with Vlasov ions and gyrokinetic electrons YANG CHEN, SCOTT E. PARKER, University of Colorado at Boulder — There are certain limitations in using gyrokinetic ions for turbulence and reconnection simulations. Applications where Vlasov ions might be more appropriate include ETG turbulence, steep edge gradient turbulence and weak guide-field reconnection. In such a situation the ion gyrokinetic model presently used needs to be extended, but a satisfactory extension valid for fully electromagnetic turbulence is not presently available. Even if an accurate model is found, its numerical implementation could be very challenging, based on past experience of developing gyrokinetic algorithms. The Vlasov ion/gyrokinetic electron hybrid model avoids these difficulties. Numerically, the main constraint on the time step in gyrokinetic ion simulations is due to the electron motion along the magnetic field. We found that for small devices such as NSTX a time step of $\Omega_i \triangle t = 0.2$ has to be used for stability. With a time step slightly smaller it is possible to follow the ion gyro-motion accurately. The field equations of the hybrid model are the Faraday's equation and the Ampere's equation for $\delta\mathbf{B}$ and $\delta\mathbf{E}$. The scalar and vector potential are not used. We have devised an implicit scheme for this model, demonstrated in 3-D slab for the Alfven waves and the drift Alfven instability. Plans of implementation in toroidal geometry will be discussed.

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