Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Nonlinear Alfvén eigenmode studies through optimized PIC simulations[1] WENJUN DENG, GUO-YONG FU, Princeton Plasma Physics Laboratory — A marker optimization technique for δf PIC simulations has been developed and implemented in the kinetic/MHD hybrid code M3D-K. The technique removes markers to achieve importance sampling for δf, so as to save markers as well as computing time. The technique saves about 95% of markers in a nonlinear simulation of toroidal Alfvén eigenmode (TAE) driven by energetic particles. The technique is then applied to studies of nonlinear dynamics of energetic particles, TAE and reversed shear Alfvén eigenmode (RSAE). In our single mode study, a marginally unstable $n = 2$ RSAE is excited by energetic particles. The mode exhibits frequency chirping up and down in the nonlinear stage. The down chirping component has higher amplitude than the up chirping component. Such frequency chirping is due to the nonlinearities of the energetic particles, since the background MHD is linear in this simulation. The frequency chirping is probably related to hold-clump formation in energetic particle distribution function as predicted by analytic theory. In our multiple mode study, two TAEs with similar growth rates are excited simultaneously by energetic particles. The nonlinear mode-mode coupling effect is being investigated.

[1]This work is supported by the US DOE SciDAC Center for Nonlinear Simulation of Energetic Particles in Burning Plasmas (CSEP).

Wenjun Deng
Princeton Plasma Physics Laboratory

Date submitted: 11 Jul 2013 Electronic form version 1.4