

δf Simulation of collisionless and semi-collisional Tearing Modes

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The evolution of the collisionless tearing mode is studied using a three-dimensional particle-in-cell simulation model that uses the δf -method with the split-weight scheme to enhance the time step, and a novel algorithm to accurately solve the Ampere's equation for experimentally relevant β values, $\beta \frac{m_i}{m_e} \gg 1$.¹ We use the model of drift-kinetic electrons and gyrokinetic ions. Linear simulation results are benchmarked with eigenmode analysis for the case of fixed ions, as can be shown that in small box simulations the ions response can be neglected. The nonlinear dynamics of magnetic islands will be studied and the results will be compared with previous theoretical studies.²

Recently we add collision operator to the particle weight equation to study tearing mode in the Rutherford regime. Width of the perturbed current, growth rate and saturation level are studied from linear and nonlinear simulation and compared with theory.

¹Y. Chen and S.E. Parker, J. Comput. Phys. **198**, 463 (2003)

²J.F. Drake and Y. C. Lee, Phys. Rev. Lett. **39**, 453 (1977)