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Large box gyrokinetic δf simulation of field line reversing plasmas
WEIGANG WAN, YANG CHEN, SCOTT PARKER, University of Colorado, Boulder — Instabilities caused by the filed line reversing configuration are studied using a three-dimensional particle-in-cell simulation model that utilizes the δf-method.[1] We use the model of drift-kinetic electrons and gyrokinetic ions. In the simulation with box size of 64 ion gyro radii and a wide equilibrium current, we have observed a linear instability that is not seen in the previous simulation of smaller box size. In small box simulations,[2] the ions response can be neglected but for large box simulations an instability which is different from tearing mode is observed with gyrokinetic ions response. However, in previous studies the parallel direction is not distinguished from the external guiding field, and it is not clear whether this instability is physical or numerical. To resolve this issue, we propose to use the field line following coordinates, to clearly separate parallel and perpendicular motions, and solve the field equations strictly in the perpendicular plane. We also studied the nonlinear magnetic island evolution in a otherwise linearly stable plasma by initializing a big island. Nonlinear instability and some clues of kinetic Alfvén waves are observed.

[1]Y. Chen and S.E. Parker, J. Comput. Phys. **198**, 463 (2003)
[2]W. Wan, Y. Chen and S. E. Parker, Phys. Plasmas **12**, 012311 (2005)

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