

Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Multiscale Modeling Techniques for Plasma: 1D Scaling Results and Application to Magnetic Reconnection MICHAEL SHAY, University of Delaware, J. DRAKE, G. STANTCHEV, B. DORLAND, University of Maryland — We examine a novel simulation scheme called “equation free projective integration” which has the potential to allow global simulations which still include microscale physics, a necessary ingredient in order to model multiscale problems. Such codes could be used to examine the global effects of reconnection and turbulence in tokamaks, the Earth’s magnetosphere, and the solar corona. Using this method to simulate the propagation and steepening of a 1D ion acoustic wave, we have already achieved excellent agreement between full particle codes and equation free with a factor of 20 speed-up. In this method of simulation, the global plasma variables stepped forward in time are not time-integrated directly using dynamical differential equations, hence the name “equation free.” Instead, these variables are represented on a microgrid using a kinetic simulation. This microsimulation is integrated forward long enough to determine the time derivatives of the global plasma variables, which are then used to integrate forward the global variables with much larger timesteps. Results will be presented of the successful application of equation free to 1-D ion acoustic wave steepening with a PIC code serving as the underlying kinetic model. Initial results of this technique applied to magnetic reconnection will also be discussed.

Michael Shay
University of Delaware

Date submitted: 18 Jul 2005

Electronic form version 1.4