Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

A new method of driving turbulence in particle-in-cell simulations

JAMES JUNO, JASON TENBARGE, MARC SWISDAK, WILLIAM DORLAND, University of Maryland — We present a novel approach for driving turbulence in particle-in-cell (PIC) simulations with the implementation of an oscillating Langevin antenna which drives $A_{\|}$ across the domain. The antenna obtains its name from its similarity to the Langevin equation for Brownian motion and allows us to more realistically model the injection of energy from scales larger than the simulation domain so we can simulate a more computationally feasible subrange of the turbulent cascade. Oftentimes, PIC simulations are driven from a single point, or from the edge of the simulation domain; however, the Langevin antenna works like a body force, driving the plasma from all points in space. Furthermore, studies of turbulence with PIC are often decaying, but with the antenna, we can model steady state conditions. Thus, we can create a more physically motivated simulation of the turbulent evolution from large scales to small scales and better understand the dissipation of turbulence in systems such as the solar wind. Though we focus on driving low frequency Alfvén waves, the flexibility of the antenna allows for driving any range of frequencies. Comparisons to linear theory and fully non-linear gyrokinetic simulations are presented as validation of our method.

James Juno
University of Maryland

Date submitted: 11 Jul 2014

Electronic form version 1.4