A235a Full particle plasma simulations using the adaptively refined meshes

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Local kinetic processes in space and laboratory plasmas are, in many cases, considered to have a significant impact on global-scale energy transport and conversion processes. For example, magnetic reconnection is believed to be one of the most important phenomena which support the fast energy release associated with the magnetospheric substorm and solar flares. It facilitates the fast conversion of energy stored in a compressed magnetic field into plasma kinetic and thermal energies. However, many of the detailed processes around the diffusion region, where the reconnection and energy conversion take place, are poorly understood. The main issues are how fast reconnection is triggered, what suports a quasi-steady reconnection, and how the plasma is accerelated and heated. The difficulties in both the theoretical and numerical analyses come from the fact that the reconnection involves a number of physical scales from the electron to the MHD scales, and these scales seem to couple with each other.

The adaptive mesh refinement (AMR) technique is one of the promising methods to overcome the difficulties, which subdivides the computational meshes locally in space and dynamically in time. In this study, we applied the AMR technique to the plasma particle-in-cell (PIC) code for both the 2D and 3D systems, and successfully achieved the efficient high-resolution simulations on the nonlinear evolution of the plasma sheet. This talk will focus on the numerical algorithm of the AMR-PIC code and the efficiency by using the AMR technique, comparing with the usual PIC code.