# Application of supercomputing- based HPIC-LBM (hybrid particle in cell & lattice Boltzmann method) on magnetic energy dissipation mechanism in large scale turbulent magnetic reconnection

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The classical energy cascade theory suggests that energy is transferred from large to small scale at a constant rate and nonlinear interactions occur predominately between comparable scales. One can envision that energy residing in large-scale fluctuations is transported to smaller scales where dissipation occurs and finally drives kinetic processes that absorb the magnetic energy and energize charged particles. But the coupling of micro physics and large scale (cross-scale coupling) problem in large turbulent reconnecting current sheet still pose many physical and numerical challengers, as there are no established solutions for dealing with the so-called 'MHD cascade to Kinetic cascade energy release and translation gray zone'. I proposed a temporal-spatial scale-adaptive scheme (hybrid particle-in-cell & lattice Boltzmann, HPIC-LBM) to model fluid-kinetic coupled scales physics of reconnection for solar activities. i.e., solar flare, CME, and applied it to investigate the fluctuations produced turbulence and cascade of energy release-translation mechanism from large scales to small scales.The presented code employed high resolution in term of both grid points and number of particles, allow us analyzing turbulent cascade develops both in few non-linear times and instabilities induced large scale plasmoid bubbles evolution process. We investigate following questions with HPIC-LBM on MilkyWay-2 supercomputer

1.Exploring the translation between kinetic energy and internal energy (including potential, heating and electromagnetic energy) from MHD cascade scales to kinetic cascade scales through exploring turbulent fluctuations and associated dissipation process in different energy/charge diffusion windows.

2.Figure out the threshold value of when getting to kinetic scales, the role of resistive and viscous in the energy releases from magnetic fields and converts it into heating and kinetic energy, and the effect of instabilities in the scale-adaptive energy translation process.

3.Improve understanding of such connections between the fundamental mechanisms of kinetic energy and internal energy translation and the instabilities induced turbulence at dynamo-kinetic scales.