

Two-dimensional Vlasov code simulation of magnetic reconnection

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A two-and-half-dimensional and fully electromagnetic Vlasov simulation code is developed in which phase-space distribution functions are defined in five-dimensional position-velocity phase space (x,y,v_x,v_y,v_z) . The Vlasov equation in two-dimensional configuration and three-dimensional velocity spaces is solved with a non-oscillatory and conservative scheme, and the full set of Maxwell equations are self-consistently solved based on the standard Finite Difference Time Domain (FDTD) method. The Geospace Environment Modeling (GEM) magnetic reconnection challenge is chosen as a benchmark test of our two-dimensional Vlasov code. The result is compared with the past simulation results with Darwin-Vlasov, explicit and implicit particle-in-cell codes. The present simulation with a very-low spatial resolution gives a high growth rate of magnetic flux, which is in agreement with the results of the GEM reconnection challenge.

The GEM Reconnection Challenge used the conducting wall in the x direction and the periodic condition in the y direction, respectively. These conditions suppress the growth of magnetic reconnection. In the present study, we use the open boundary condition and investigate the growth of magnetic reconnection.