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Electron velocity distributions in a global hybrid-Vlasov magnetospheric model

Thiago Brito (1), Urs Ganse (1), Yann Pfau-Kempf (1), Markus Battarbee (1), Lucile Turc (1), Lisa Juusola (2), Maxime Grandin (1), Sebastian von Alfthan (3), and Minna Palmroth (1)

(1) University of Helsinki, Department of Physics, Finland (thiago.brito@helsinki.fi), (2) Finnish Meteorological Institute, Finland, (3) CSC - IT Center for Science, Finland

Electron velocity distributions have been measured by satellite missions in the solar wind and in different regions of the magnetosphere. Recently, the MMS mission has been the source of several publications showing detailed measurements of electron velocity distribution functions near flux transfer event regions and even within the reconnection diffusion region. There have also been several recent advances in numerical modeling aiming at simulating in detail the environment near and around a reconnection site. These models use a variety of simulation methods and techniques to that end including solving the Vlasov equation, particle-in-cell method, full kinetic simulation, Monte-Carlo techniques, with their respective advantages and disadvantages. Vlasiator is a hybrid global magnetospheric model that solves the Vlasov equation up to 6D for ions, while electrons are treated as a charge-neutralizing fluid. Solving the full kinetic motion of electrons in magnetospheric scales is way beyond the capability of current HPC computing power. However, the combination of subgrid-scale methods and implementations such as gyrokinetics or multifluid electron representation can be carried out in order to resolve small scale phenomena and to more efficiently introduce electron effects and thus self-consistently simulate the whole magnetospheric environment. With the final goal of introducing electron physics into Vlasiator using subgrid-scale methods, initial results on an electron velocity distribution analysis near a dayside reconnection site are presented.