EGU21-13267
https://doi.org/10.5194/egusphere-egu21-13267
EGU General Assembly 2021

On ion temperature dependence of symmetric magnetic reconnection

Ivan Zaitsev[1], Andrey Divin[1], Vladimir Semenov[1], Daniil Korovinskiy[2], Jan Deca[3], Yuri Khotyaintsev[4], and Stefano Markidis[5]

[1]Saint-Petersburg State University, Physics Department, Saint-Petersburg, Russian Federation (ioannzaicev@gmail.com)
[2]IWF/ÖAW, Austrian Academy of Sciences, 8042 Graz, Austria
[3]Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, 1234 Innovation Drive, Boulder, CO, USA
[4]Swedish Institute of Space Physics, Uppsala, Sweden
[5]KTH Royal Institute of Technology, Stockholm, Sweden

Various simulations of collisionless magnetic reconnection reveal that the process is typically fast, with the reconnection rate being of the order of 0.1. Systematic numerical and observational studies of upstream parameters dependence (density, magnetic field) concord the basic Sweet-Parker-like predictions that the dynamical properties scale globally with the Alfven speed, with particle heating scaling as the Alfven speed squared. In this study, we perform a set of symmetric 2D PIC simulations starting from Harris current sheet but differ in upstream background plasma ion temperature. The exhaust velocity in such a setup is known to have explicit temperature dependence, leading to a reduction of the jet velocity at high temperatures. We suggest that the global reconnection rate is controlled by this outflow velocity since the reconnection electric field in the quasi-steady stage is the motional (convective) electric field of the ion bulk flow within the exhaust. Consequently, if the upstream thermal speed is above the Alfven velocity, then the reconnection rate drops. On top of that, the electron-ion temperature partition in the exhaust depends strongly on the upstream ion temperature, which we attribute to the scaling in plasma compression and development of the parallel electrostatic potential in the exhaust.