Ion and electron heating during magnetic reconnection in weakly magnetized plasmas

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Magnetic reconnection is a commonly observed fundamental process in both astrophysical and fusion plasmas. It allows topological change of magnetic field lines, and converts the free energy in the magnetic field into various forms of energy, such as bulk plasma flows, plasma heating, or non-thermal particle acceleration. In this work, we discuss ion and electron heating due to kinetic effects during magnetic reconnection in weakly collisional plasmas.

In weakly collisional plasmas, the phase mixing process caused by kinetic effects, such as Landau damping and finite Larmor radius effects, creates oscillatory structures in velocity space, which must eventually regularized by collisions. Therefore, even if collisions are infrequent, energy dissipation and resulting plasma heating may be significant, as demonstorated by recent investigations using both a reduced [1] and a fully gyrokinetic model [2].

In this work, we extend the results of [1, 2] and present results of gyrokinetic simulations of magnetic reconnection for high beta plasmas, and discuss the relative and absolute importance of ion and electron heating due to the phase mixing. In high beta plasmas, compressible fluctuations will be excited which are strongly damped collisionlessly. The phase mixing of ions can be another dissipation channel as well as that of electrons. Figure 1 shows the ratio of the energy dissipation rate of ions to electrons. As beta increases, the ion energy dissipation becomes comparable to the electron dissipation.

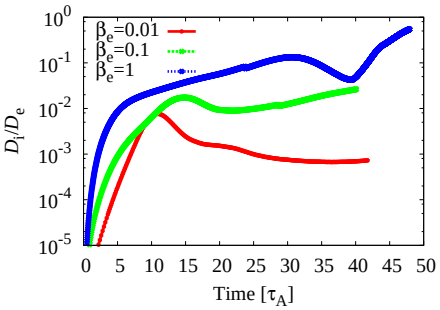

Figure 1: *The ratio of energy dissipation of ions to electrons.*

References

[1] N. F. Loureiro, A. A. Schekochihin, and A. Zocco, Phys. Rev. Lett. **111**, 025002 (2013).

[2] R. Numata and N. F. Loureiro, JPS Conf. Proc. (2014), in press.