

# Electron and ion heating during magnetic reconnection in weakly collisional plasmas

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Magnetic reconnection is topological re-organization of magnetic fields in highly conducting plasmas, and is observed in many environments of astrophysical and laboratory plasmas. During this process, the free energy stored in the magnetic field is released, and is transformed into different forms, such as the bulk plasma motion, plasma heating, and acceleration of energetic particles. Collisions are considered to be rare in most of the environments where magnetic reconnection occurs, but are still important. Phase mixing via Landau damping or finite Larmor radius effects can create oscillatory structures in velocity space, thus can significantly enhance collision effects.

In this study, we perform gyrokinetic simulation of magnetic reconnection using **AstroGK** [1], and investigate energy partitioning during the reconnection process. It is observed that the energy dissipation due to collisions asymptotic to a finite value as collisionality is decreased. This indicates fine velocity space structures generated by phase mixing effects. Figure 1 shows typical structures of electron distribution functions in velocity space for a weakly collisional, low- $\beta$  case. The result is consistent with the simulation by the reduced kinetic model [2] where only Landau damping can be considered, but it also contains perpendicular structures to the mean magnetic field. We also discuss plasma heating and energy partitioning due to the phase mixing in high- $\beta$  plasmas where ion dynamics becomes significant.

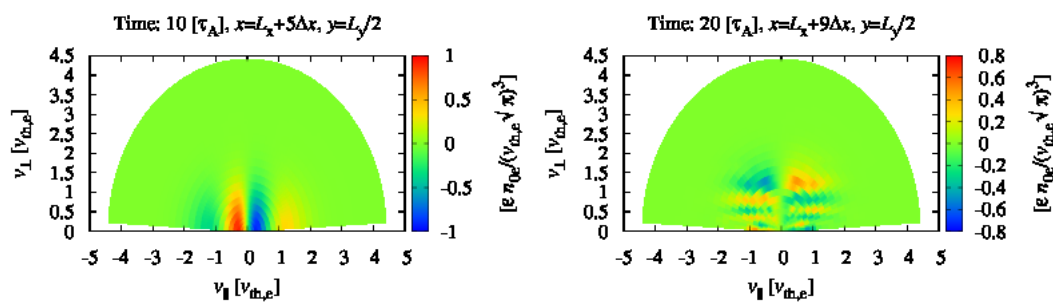


Figure 1: Typical electron distribution function structures in velocity space.

[1] R. Numata, *et al.*, J. Comput. Phys. **229** 93470 (2010)

[2] N. F. Loureiro, *et al.*, arXiv:1301.0338 (2013)