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Collisionless magnetic reconnection under the Landau fluid approximation

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Magnetic reconnection has been widely researched as a mechanism of generation of hot and fast plasma flow by releasing magnetic enregy stored in a system. Especially, the reconnection accompanied by slow shocks around a localized diffuion region, so-called Petschek type reconnection, is regarded as important from the point of view of the rate for magnetic energy release. In collisionless plasmas, however, the knowledge of this type of fast reconnection is not enough now.

In general, it is known that ions are accelerated along magnetic field lines from a diffusion region. Due to this beam component, the distribution function of ions is largely disorted and the temperature along the magnetic filed is enhanced. Althogh PIC or hybrid simulations have been performed to solve the effect of the beams self-consistently, the results do not indicate the clear evidence for generation of slow shocks predicted by Petschek's theory.

In our research, as an intermediate picture between the ordinary isotropic MHD aproximation and the kinetic theory, we performed a series of fluid simulations by using the double adiabatic limit and the Landau closure model. We investigated the effect of the pressure anisotropy and the Landau damping on global dynamics of magnetic reconnecion.
Under the fluid apprximation, the parallel pressure is enhanced across the slow shock since mirror motions are accelerated with the deformation of magnetic flux tubes. The structure downstream is greatly difference from the isotropic MHD case, and the outflow region becomes wider. In this talk, we report the detail of the structure formation.

Keywords: magnetic reconnection, collisionless plasmas, Landau fluid