The effects of an optically-thin synchrotron radiation cooling in the Petscheck type reconnection process

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Abstract

In recent studies, relativistic magnetic reconnection processes are investigated by relativistic resistive magnetohydrodynamic (RRMHD) simulations. In the classical reconnection model, the inflow magnetic energies are converted to the outflow thermal and kinetic energies of outflow plasmas. For relativistic plasmas in a strong magnetic field, the synchrotron radiation has an important role for cooling plasmas. Therefore, in the steady reconnection processes, the balance between the reconnection heating and the radiation cooling can be important. In this study, we investigated effects of the radiation cooling in the Petscheck type reconnection process, using RRMHD simulations considering the radiation process. In our simulations, for simplicity, we assumed an optically-thin radiation and introduced a radiation cooling rate as source term. As a result, we found that the reconnection outflow is compressed and collimated, and that the larger cooling rate becomes, the larger reconnection rate becomes.