Hybrid Simulation of Magnetic Reconnection on the Equatorial Plane of the Differentially Rotating Disk

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Differentially rotating disks threaded by weak magnetic field is subject to a plasma instability called Magneto Rotational Instability (MRI) [Velikhov 1959, Chandrasekhar 1961, Balbus and Hawley 1991]. This instability is considered to generate turbulence in the disk and may contribute to an effective transport of angular momentum of the plasma. Magnetic Reconnection, at the same time, can be an important process to determine the saturation level of MRI induced turbulence through annihilation of magnetic field enhanced by MRI.

In collisionless accretion disks, which are often found around blackholes, several non-MHD process such as evolution/relaxation of the pressure anisotropy and Hall effect would modify the evolution of MRI and magnetic reconnection which would exist in the MRI induced turbulence. In the past study we have carried out a Hybrid simulation of magnetic reconnection in a meridional plane of differentially rotating disk and found that the coupling of the Hall term and differential rotation leads to asymmetric evolution of the magnetic reconnection.

In this study, by adopting a shearing periodic boundary condition, we have carried out a two dimensional Hybrid simulation of magnetic reconnection in the equatorial plane of a differentially rotating disk. Like in the simulation in the meridional plane, we also found asymmetric evolution of the reconnection. This can be interpreted as a coupling of the Coriolis/Tidal force effect and the out flow of the magnetic reconnection. In the presentation we would like to discuss an implication of the results to the modification of MRI induced turbulence.