

Particle acceleration and angular momentum transport during magnetorotational instability in kinetic accretion disks

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Magneto-rotational instability (MRI) in a gravitational rotating system is known to play an important role on the formation of the astrophysical accretion disk and the angular momentum transport, and the nonlinear time evolution of magneto-rotational instability has been extensively investigated by using MHD simulations so far. The mean free path of plasma, however, is not necessarily smaller than the characteristic scale length for some classes of astrophysical accretion disks, and the collisionless behavior of MRI beyond the MHD approximation needs to be understood. In this talk, we study momentum transport and particle acceleration of the kinetic (collisionless) MRI by focusing on magnetic reconnection. We discuss that a strong pressure anisotropy is associated with the formation of the channel flow, and the anisotropic channel flow can lead to a rapid magnetic reconnection, that can occurs sporadically in three-dimensional system. As a result of the reconnection, non-thermal power law distribution with a hard spectral index $p=1-1.5$ is quickly formed. We also discuss that the so-called alpha parameter in the standard accretion disk model, which is numerically measured from the Reynolds and Maxwell stresses, can be dramatically enhanced during the nonlinear time evolution of MRI. The kinetic MRI is one of plausible mechanisms to explain much more efficient angular momentum transport and high-energy particle emissions observed from massive black holes such as Sgr A*.

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