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The Kelvin-Helmholtz instability induced by the magneto-rotational instability in the inner-edge region of an accretion disk

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Around protostars, the gases and the dusts falling to these objects form the rotating disks called accretion disks. When an accretion disk has a weak magnetic field, it is well known that the magneto-rotational instability (MRI) is excited in the disks. By using the local 2.5-dimensional MHD simulations with CIP-MOCCT method, we confirmed the generation of MRI and investigated the influences of MRI on the disks in accretion disks. Especially, we have done modeling of the boundary region (inner-edge) between the magnetosphere of a central star and an accretion disk. In this case the disk part is disturbed by MRI while the magnetospheric strong magnetic field does not allow MRI effects to propagate into the magnetosphere. Then large velocity shear is generated at the inner-edge. This result implies that the Kelvin-Helmholtz instability might be excited at the inner-edge. Actually, performing a 3-dimensional simulation, we observe the Kelvin-Helmholtz instability to be excited at the inner-edge. Implication of this result to the planetary system formation processes is discussed.