P136-P003 **Room: Poster Session Hall** **Time: May 21**

The behaviors of Kelvin-Helmholtz vortices in protoplanetary disks

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We investigate the behavior of Kelvin-Helmholtz Instability (hereafter KHI) in protoplanetary disks (PPDs) by two dimensional hydrodynamic simlations in local and global boxes using the CIP method. The velocity shear generation and the subsequent excitation of the KHI are expected at the disk inner-edge as a result of the interplay between the PPD that hosts the Magneto Rotational Instability (MRI) and the central star's magnetosphere that does not. According to the local box simulations, we find that the KH turbulence in a rotating frame develops differently from those of ordinaly cases in a non-rotating frame. The spatial range of gas mixing is determined by the pressure structure determined by the initial equilibrium that reflects the density and the velocity profile, the effects of rotation, and the gravity of the central star, while in ordinary cases, the range of gas mixing is determined by the wave length of the instability. In addition, the results of the global simulations of the KHI at the PPD inner-edge show density fluctuation of ˜10% accompanying spiral waves launched outward into the disk from the vortices. The results have implications to the formation process of CAIs or chondrules, and to the proto-planet migration process.