Modification of angular velocity distribution and dust concentration by inhomogeneous growth of MRI in accretion disks

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We have performed two-dimensional and three-dimensional CIP-MOCCT simulations of Magneto Rotational Instability (MRI) in protoplanetary disks. MRI is excited when a protoplanetary disk has a magnetic field and is sufficiently ionized. This instability has been a focus of attention as a likely agent for angular momentum transport in accretion disks (Balbus & Hawley, 1991). Linear analyses by Sano & Miyama(1999) show that MRI growth rates are affected by various factors. Here we are interested in the situation where MRI growth rate varies in the radial direction. We set a spatial variation in the magnetic configuration with uniform non-zero resistivity in our local simulation box. By this scheme one can set both an unstable region and a stable region within the system. As a result of inhomogeneous growth of MRI, gas in some part of the disk comes to rotate faster than the Keplerian velocity. This indeed may resolve the dust in-fall problem. It is well known that, because the gas under the influence of outwardly directed pressure gradient force rotates slower than the dust particles, meter-sized dust particles, whose motion is affected substantially by the gas drag, fall to the central star quickly. The gas angular velocity profile modification seen in our result is possible to prevent the dust in-fall and also to enhance the dust particle density for subsequent planetesimal formation. We have also followed the dust particle motion immersed in the gas described as above to investigate this issue.