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Global Multifluid Simulations of the Magnetorotational Instability in Protoplanetary Disks

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The mechanisms which drive circumstellar disk evolution are still poorly understood. In this context the MRI is likely to play an important role in the evolution of protoplanetary disks. I will discuss the results of O'Keeffe & Downes (2014) who perform global multifluid simulations of protoplanetary disks which study the magnetorotational instability (MRI). The inclusion of non-ideal effects have a significant effect on the ability to create turbulence in the disk. These simulations examine the role of non-ideal effects (ambipolar diffusion, the Hall effect and parallel resistivity) on the non-linear evolution of the MRI in weakly ionised protoplanetary disks in the region where the Hall effect is believed to dominate. The efficiency of angular momentum transport, parameterised by the alpha-parameter, is found to be significantly increased. The results strongly suggest that the Hall effect is responsible for enhancement of the MRI, with the appropriate orientation, where a net field is present. This result confirms the findings of Sano & Stone (2002a,b) and Salmeron & Wardle (2003). I will also present preliminary results from more recent simulations which focus on the effect of the inclusion of a charged dust species and the time evolution of the distribution of charged species.

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