RMHD Simulations of Magnetorotational Turbulence in Protoplanetary Disks

Markus Flaig[1], Willy Kley[1], Patrick Ruoff[2], and Ralf Kissmann[3]

[1]University of Tuebingen, Germany
[2]Karlsruhe Institute of Technology, Germany
[3]University of Innsbruck, Austria

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Abstract

Protoplanetary disks are accretion disks around young, solar-type stars that are supposed to be the birthplace of planets. The accretion dynamics is most likely driven by hydromagnetic turbulence due to the magnetorotational instability (MRI). Since the interior of protoplanetary disks is not directly accessible to observations, numerical simulations play an important role in our quest to understand the physical processes operating inside these objects. When considering the planet-forming region (which is located at a distance of several au from the central star), two major complications arise: (1) The disk gas is mostly optically thick (requiring radiative transfer modelling), and (2) due to insufficient ionization there exists a non-turbulent 'dead zone'. The ionisation level, and therefore the extent of the dead zone, depend on factors like the stellar X-ray luminosity, the temperatures in the disk and the abundance of micron sized dust grains. We present recent results from simulations which take into acount all relevant physical processes, leading to a realistic model of magnetorotationally turbulent protoplanetary disks.