Prospects in modeling low-mass star formation

Michael Küffmeier*[1]

[1]Niels Bohr Institute (NBI) – Blegdamsvej 17, DK-2100 Copenhagen, Denmark

Abstract

We study the accretion process around six protostars in magnetohydrodynamical (MHD) simulations of star formation with RAMSES. We start with a turbulent Giant Molecular Cloud of 40 pcˆ3 in volume as our initial condition, and we resolve the vicinity of six protostars with a resolution down to 2 au for each system. Comparing our results with spherical core collapse models incorporating non-ideal MHD effects, we show differences and similarities between the models. In our ideal MHD model, we expect lower magnetic field strengths and higher plasma-β – especially at high densities within radial distances of r $<$ 10 au from the protostar – when accounting for non-ideal magnetohydrodynamics though we only expect modest variations from long-term models at lower densities at distances beyond 10 au. Against the background of observed variations in cosmic-ray ionization rates in different stellar environments, we explicitly focus on the dependency of resistivities on properties such as density or ionisation rate that can vary significantly in different regions of star formation. The study is complementary to isolated core collapse and disc models in the sense that the initial configurations are intrinsically provided by the dynamics of the Giant Molecular Cloud. Finally, we outline possible paths to merge the efforts made in incorporating the effects of non-ideal MHD as well as in accounting for variations of the protostellar environment successfully.

*Speaker