Astrophysics Seminars

Tuesday

April 24

12:30 P.M.

Rm 184 NSH

Formation and Evolution of Giant Molecular Clouds: Gravity or Turbulence?

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The formation of molecular clouds from the turbulent, magnetized, diffuse interstellar medium and their subsequent evolution determines how star formation starts and proceeds. Magnetic support or turbulent pressure equilibrium was long argued to explain low observed star formation efficiencies in clouds. I present kiloparsec-scale, well-resolved, MHD simulations of the stratified, supernova-driven, interstellar medium performed with the Flash code, zooming in to reach resolutions of less than 0.1 pc within dense clouds. I use the results of these simulations to argue that gravitational collapse rather than any sort of turbulent equilibrium determines the dynamics of molecular clouds, with a focus on the relationships between size, velocity dispersion, and surface density of the clouds. In this presentation I will focus on the structure and dynamics of the magnetic fields in these clouds. We recover magnetic field strengths comparable to observed values. However, these fields are unable to prevent the densest regions from gravitationally collapsing, although they do appear to dominate the dynamics in the moderate density cloud envelopes. We conclude that molecular clouds are dynamically collapsing objects whose low star formation efficiencies likely come primarily from internal feedback leading to fast cloud destruction. I will end with preliminary results from cluster formation models done with the AMUSE framework to couple MHD and N-body computations, and using these models as initial and boundary conditions to follow the development of star clusters and their disruption of their parent clouds.

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