30 Years of Photodissociation Regions:
A symposium to honor David Hollenbach's lifetime in science
Asilomar, CA, USA - June 28th to July 3rd, 2015

Role of GMC Collisions in Dense Filament, Clump, and Star Formation

Benjamin Wu[1], Jonathan C. Tan[1,2], Sven Van Loo[3,4], Fumitaka Nakamura[5] and Simon Bruderer[6]

[1] Department of Physics, University of Florida
[2] Department of Astronomy, University of Florida
[3] School of Physics and Astronomy, University of Leeds
[4] Harvard-Smithsonian Center for Astrophysics
[5] National Astronomical Observatory of Japan
[6] Max Planck Institute for Extraterrestrial Physics

e-mail: benwu@phys.ufl.edu

We utilize magnetohydrodynamic (MHD) simulations with adaptive mesh refinement (AMR) to explore the process of GMC-GMC collisions as a potential trigger for dense filament, clump, and star formation. We implement new PDR-based density/temperature/extinction-dependent heating and cooling functions in Enzo that span the atomic to molecular transition and can return detailed diagnostic information. We initially perform a parameter space study via a suite of idealized 2D simulations for GMC-GMC collisions, which track the fate of an initially stable clump embedded within one of the clouds. We then extend these calculations to 3D, including introduction of initial turbulence into the clouds. Different turbulent spectra types, magnetic field strengths and orientations are considered, as is the role of cloud collisions. The density and kinematic structure are visualized and characterized, in addition to magnetic field configuration. We discuss observational diagnostics of cloud collisions, focusing on 13CO(J=2-1), 13CO(J=3-2), and 12CO(J=8-7) integrated intensity maps and spectra, which we synthesize from our simulation outputs. We find the ratio of J=8-7 to lower-J emission is a powerful diagnostic probe of GMC collisions.

REFERENCES

Wu, B., Van Loo, S., Tan, J. C., Bruderer, S. (2015) ApJ, submitted