Astrophysics Seminar

Observational Diagnostics of Two-Fluid Turbulence in Molecular Clouds—As Suggested by Simulations

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Room 184 Nieuwland Science Hall

The star-forming plasma in molecular clouds is indeed partially ionized. The low level of ionization in the plasma makes it possible to sustain several interesting phenomena that do not occur in single fluid MHD turbulence. In this talk we first analyze MHD wave propagation in such a partially ionized plasma, showing that only certain waves might propagate on the shorter length scales where ions and neutrals decouple. This length scale, known as the ambipolar diffusion length scale, is also interesting because the formation of molecular cores takes place on those length scales.

We then simulate this two fluid turbulence and analyze its properties. Several trends are shown to conform to the theoretical analysis in the previous paragraph. Based on that, we extract observational diagnostics associated with linewidth-size relationships of isophotologues and also density PDFs. The first diagnostic is shown to match up with observed data. The second diagnostic is entirely new, and awaits observational confirmation. Taken together, these two diagnostics might give us a different handle on the direction of the magnetic field in three dimensions. Further theoretical analysis of the turbulence is also presented.

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