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MHD Turbulence Unified Polarimetry and Zeeman Observations

At the beginning of the 21st century, the prevailing belief was that primarily super-Alfvénic turbulence could rival gravity in the process of star formation. In the following decade, however, perceptions began to shift as polarized thermal dust emission indicated that cloud-scale magnetic fields were predominantly ordered, suggesting that both turbulence and gravitational contraction were **anisotropic**. Meanwhile, the relationship between the magnetic field (B) and density (n), B~n^2/3, derived from Zeeman measurements, was interpreted as **isotropic** gravitational collapse. The discrepancy in the interpretations of these two major magnetic field tracers puzzled astronomers, as discussed in the PPVII review. The logic and data behind the mystery will be discussed, followed the solution – I will demonstrate that a MHD simulation calibrated by polarimetry observations (i.e., ordered cloud-scale B-fields) can naturally replicate Zeeman results.

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