P113a Turbulence vs. Gravity? Toward Thorough Understanding of Core Formation in Turbulent Molecular Clouds

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Stars form from dense cores embedded in turbulent molecular clouds. In the standard model, these cores form via gravo-thermal fragmentation. However, recent studies (Ishihara et al. 2025a,b) suggest that turbulent, rather than gravity fragmentation, plays the dominant role in core formationin nearby star-forming regions.In this study, we conduct 3D hydrodynamic simulations of turbulent molecular clouds, focusing on the interplay between turbulence and self-gravity. We perform isothermal compressible turbulence in a uniform-density box of 3 pc with a mean number density of 10^3 cm^{-3} using the ENZO code. Supersonic turbulence is continuously driven to maintain $\mathcal{M} \approx 5$. Once a statistically steady state is established, the driving is turned off. Regarding the properties of turbulence, the gas develops a log-normal density PDF in the driven turbulence regime, comparing with the power law tail from self-gravitating turbulence with a slope equal to -0.98. In addition, the sonic scales are estimated to be 0.189 pc and 0.161 pc for the driven and self-gravitating turbulence, respectively. Dense, compact structures (cores, hereafter) are identified with `Astrodendro`. For virial parameter, cores are 99% bounded only by external pressure for both driven non-self-gravitating and self-gravitating turbulence. The cores are preferentially formed along the elongated structures or (non-self-gravitaing) filaments. In addition, the peak distribution of core separation for both simulations is around 0.2 pc, comparable to the sonic scales.