The effect of large-scale Galactic environment on star formation at local scales: Does the turbulent cascade provide the defining role in regulating star formation at small scales?

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In the Milky Way Galaxy, the types of stars that form vary dramatically with position in the Galaxy. Massive star formation is largely confined to the spiral arms, and it is thought that large-scale kinematics, through Galactic rotation, are responsible for this.

In this presentation we investigate the possibility that the turbulent cascade, which is carrying energy from large scales to small, plays a defining role in regulating star formation.

To investigate the role that turbulence plays in regulating star formation, we have undertaken an Australia Telescope National Facility Mopra telescope survey of some 20 different molecular transitions in the G333 and Vela C molecular clouds. We use a probability density function (PDF) analysis of molecular gas, as seen in different molecular tracers, to show that a significant amount of energy is injected into the molecular gas at the largest scales, as shown by the PDF analysis for CO and it less common isotopologues (^{13}CO and C^{18}O).

However, by using molecular tracers of intermediate and high critical density (tracing denser gas), such as HCN, HCO^+, CS and $N2H^+$, we show that there is also likely some local injection of turbulence to the interstellar medium, through processes associated with local star formation, such as expanding molecular shells and outflows.

Additionally, molecules with a high critical density, such as HCN and $N2H^+$, show a clear gravitationally bound region in the PDF, which will be important for investigating the clump/ core initial mass function.