CHIMPS 2
A First Look at Turbulence in the Inner Galaxy

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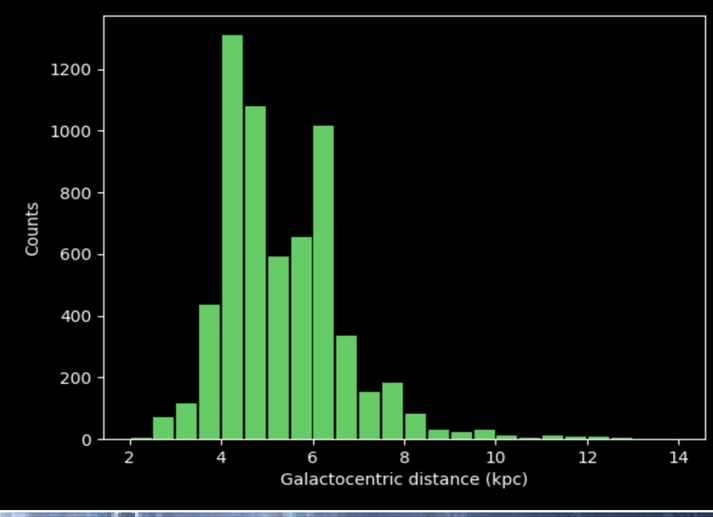
CHIMPS2 is the follow-up to the ^{13}CO/C^{18}O(3-2) Heterodyne Inner Milky Way Plane Survey (CHIMPS) and the CO Hi-Resolution Survey (COHRS) and is a Large Program on the JCMT. The CHIMPS2 Inner Galaxy observations cover longitudes between 16° and 47° with $-0.5° \leq b \leq 0.5°$. When combined with the complementary ^{13}CO/C^{18}O/^{12}CO(1-0) survey at the Nobeyama 45m at matching 15 arcsec resolution and sensitivity, and other current CO surveys, CHIMPS2 provides a complete set of transition data with which to calculate accurate column densities, gas temperatures and turbulent Mach numbers, that would otherwise rely on estimations and underlying assumptions. We construct a novel catalogue of CHIMPS2 Inner Galaxy sources and link their positions, physical properties and star-forming efficiency to the solenoidal modes of turbulence in the clouds (defined as the solenoidal fraction, the relative fraction of power in the solenoidal modes of the density momentum field). The range of Galactic longitudes covered by CHIMPS2 allows us to probe the relationship between turbulence modes and different Galactic environments, covering, in particular, the transition into the region spanned by the rotation of the Galactic bar and arm and inter-arm regions. Our investigation confirms the negative correlation between star formation efficiency and solenoidal turbulence and shows that the solenoidal fraction is highest in the Inner Galaxy (within about 3 kpc of the Galactic centre) and declines with increasing Galactocentric distance. In this framework, spiral arms do not seem to act as direct triggers of star formation..

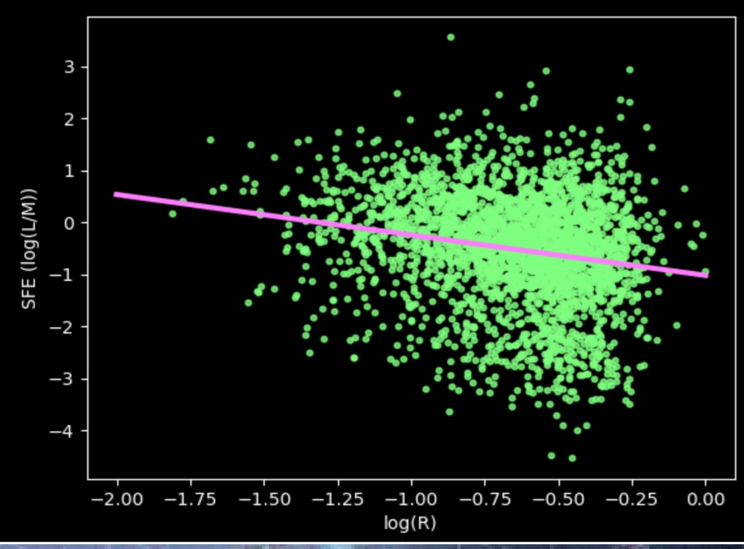
Sample

6173 SCIMES extracted, ^{13}CO sources Distances were assigned through matching with CHIMPS, ATLASGAL catalogs and Galactic rotation curves.

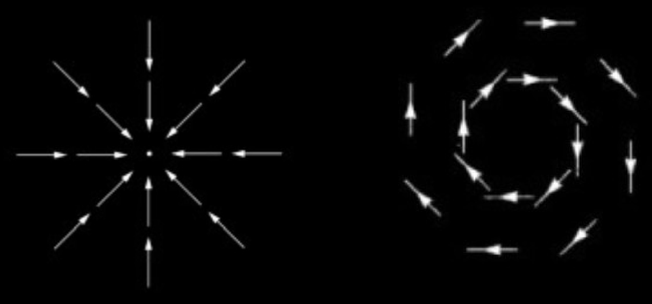


Star formation efficiency

IR luminosities obtained by matching sources to HiGal catalog. Mass calculated throgh column density maps.



Solenoidal fraction



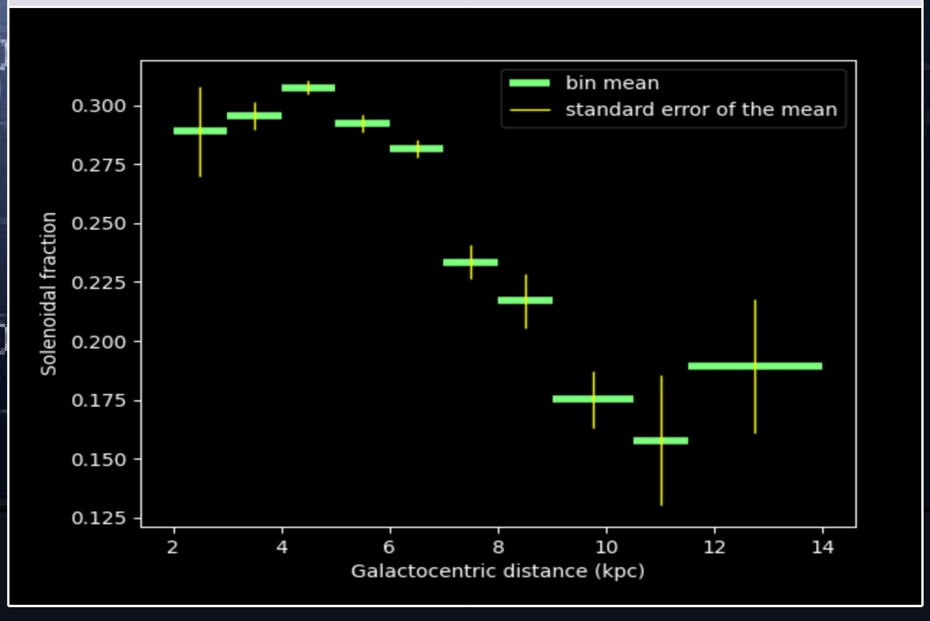
Compressive Solenoidal

We consider the density momentum field defined as **p** = ϱ**v** (product of volume density and velocity). The solenoidal fraction, R, is the relative amount of power in the solenoidal mode of the turbulence in the **p** field and is defined as the ratio of the variance of the line-of-sight projected transverse momentum the variance of total momentum,

$R = \sigma^2_{p\perp} / \sigma^2_p$.

The solenoidal fraction can be inferred from the projected observable emission in a position-position-velocity cube through its velocity-weighted moments and azymuthally average the power spectra of the moment maps.

Different environments



References

Brunt, 2010, MNRAS, 403, 1507 / Brunt, 2014, MNRAS, 442, 145 / Elia, 2017, MNRAS, 471, 100 / Rigby, 2016, MNRAS, 456, 2885 / Rani, 2022, MNRAS, 515, 371

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