The interplay of turbulence and magnetic fields in the non-star-forming Pipe nebula

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The Pipe Nebula is a nearby (145 pc), filamentary shaped, molecular cloud in which star formation is concentrated in the western end of the cloud, the B59 region [1], whereas the eastern part of the cloud has no star formation. The projected magnetic field, constrained through both extinction and emission dust polarization measurements [2, 4], shows a well ordered morphology in the non-star-forming part of the cloud, compared to a less ordered ones towards B59. The comparison between the dispersion of magnetic field lines and velocity puts the eastern region in the strongly magnetized regime. Furthermore, kinematic studies in the eastern part indicate that it could be decomposed into two colliding filamentary clouds, 2 km/s apart [3]. The eastern region thus constitutes a high turbulence, strong magnetic field test case to be compared with numerical simulations.

In this talk, we present the first, large-scale (0.5^{o} x 0.7^{o}) $^{12}CO(1\text{-}0)$ map, at sub-arcmin resolution (22" HPBW) of the eastern region, obtained with the IRAM-30m antenna. The preliminary results confirm the extremely dynamic nature of the region, providing support to the converging flow scenario. The $^{12}CO(1\text{-}0)$ emission covers 4.5 km/s, split into up to 5 velocity components, and shows several structures connected in physical and velocity spaces. We also performed dedicated integrations towards a sample of dense cores identified based on dust extinction and emission, in $^{12}CO(1\text{-}0)$, (2-1) and isotopologues, as well as HCO^{+}, N_2H^{+}, HCN. Our preliminary results indicate that these targets are unlikely to be dense cores, but could instead result from projection effects. The large area mapped in ^{12}CO also offers the opportunity to explore the relative orientation of gaseous filaments with respect to the (projected) magnetic field lines, in the transition between tenuous (few 100 cm^{-3}) to denser gas. Analysis of the velocity field in terms of centroid velocity increments (CVI) shows elongated, 0.4-parsec long, coherent structures of extreme CVI, reminiscent of what is observed in the Polaris, non-star-forming cloud.

References

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