Spatial and velocity coherence of dissipation extrema in a turbulent molecular cloud

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Stars form in molecular clouds as the outcome of the coupled action of gravity and the dissipative dynamics driven by turbulence. Turbulent dissipation is known to be intermittent in space and time and its characteristics (energy dissipation rate, spatial distribution, size scales, …) are key to unravelling its impact on the gas micro-physics and the star formation process.

We have selected a highly turbulent diffuse molecular cloud, unperturbed by the feedback of star formation, in which a statistical analysis of the spatial velocity increments has singled out the positions of extreme velocity shears. They outline an elongated structure, remarkably straight on average over more than one parsec. This structure is bright in CO line emission, but almost undetected in dust continuum emission, unlike the bulk of interstellar filaments. High-angular resolution observations with the NOEMA interferometer unveil similarly elongated CO structures embedded within the parsec-scale structure with orientations and velocity differences strikingly preserved across almost three orders of magnitude in scales. Multi-line CO observations suggest a localized gas temperature increase in the vicinity of the extreme velocity shear so that it could be seen as a burst of turbulent dissipation to be analysed in the framework of numerical simulations of magneto-hydrodynamical turbulence.