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Identification of plasma modes in Galactic turbulence with synchrotron polarization

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Supplementary Text

Supplementary References

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Simulation on decomposed MHD modes

In order to establish the classification recipe, we perform MHD simulations to generate datacubes of sub- and trans-Alfvénic turbulence with low- and high- plasma beta and decompose these MHD turbulence into three linear modes (Alfvén, fast and slow,³³). We use probability distribution analysis to study the signatures produced from these decomposed MHD data cubes. The “MS” signature stands out only in low- β fast modes and the dominance of “Alfvénic” signature only appears in Alfvénic turbulence (see Extended Data Fig. 1). This analysis indicates that, in the total datacubes, “MS” signature will be the revealing signature for the dominance of MS modes since the quantities s_{xx} are additive. We note that, current classification recipe identifies plasma modes in trans-Alfvénic turbulence, whereas in all our tests for sub-Alfvénic turbulence, there is no violation to the current classification recipe.

References

¹ Cho, J. & Lazarian, A. Compressible magnetohydrodynamic turbulence: mode coupling, scaling relations, anisotropy, viscosity-damped regime and astrophysical implications. *Mon. Not. R. Astron. Soc.* **345**, 325–339 (2003).