Identification of magnetosonic modes in Galactic turbulence

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The multiphase nature of astrophysical environment and diversity of driving mechanisms give rise to spatial variation of turbulence properties. Nevertheless, the employed model of magneto-hydrodynamic turbulence is often oversimplified being assumed to be only Alfvénic due to a lack of observational evidence. Here we report the employment of our novel method, the signature from polarization analysis (SPA), on unveiling the plasma modes in interstellar turbulence. The method is based on the statistical properties of the Stokes parameters (I,Q,U) of the synchrotron radiation polarization. The application of SPA on the synchrotron polarization data from the Galactic medium has for the first time revealed that interstellar turbulence is magnetized with different plasma modes composition, pinpointing the necessity to account for plasma property of turbulence, which is neither hydrodynamic nor purely Alfvénic, but depends on local physical conditions, particularly the driving process. A highly promising research field is foreseen to unroll with ample results anticipated from the advanced analysis of high resolution synchrotron polarization data and multiple wavelength comparison, that will shed light on the role of turbulence in various physical processes.