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Comparison of fluid, astrophysical, and laboratory turbulence using a permutation entropy and statistical complexity technique D.A. SCHAFFNER, Bryn Mawr College — Understanding turbulent processes as having a more random/stochastic mechanism or a more chaotic/deterministic mechanism is important for characterizing and comparing different turbulent systems. A statistical time-series analysis technique that quantifies the permutation entropy and statistical complexity of a signal can be used to distinguish noisy fluctuations from those arising from underlying chaotic behavior. This technique is applied to three turbulent datasets: velocity fluctuations from a fluid wind tunnel, magnetic and velocity fluctuations from satellite observation of the solar wind, and magnetic and velocity fluctuations from a turbulent laboratory plasma. The work aims to develop a more global understanding of turbulent behavior that spans both fluid and plasma regimes. Results show that fluid and astrophysical turbulence exhibit more stochastic like behavior while laboratory plasmas retain higher complexity features. The behavior of complexity and permutation entropy as a function of scale is also examined and such scans are useful for extracting important spatial and temporal scales in the system.

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