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Geometric nature of particle trajectory in isotropic turbulence YONGNAM PARK, Yonsei University, YEONTAEK CHOI, National Institute for Mathematical Science, CHANGHOON LEE, Yonsei University — The geometric nature of particle trajectory is investigated for understanding the Lagrangian nature of turbulence using direct numerical simulation of isotropic turbulence. Probability density functions and autocorrelations along a fluid particle trajectory associated with geometric quantities such as curvature and torsion of the Lagrangian trajectory are provided. We propose the ratio of torsion to curvature as an important parameter to identify the particle trajectory, and it is found to play a crucial role in understanding the geometric shape of particle trajectory. The relationship between Lagrangian helicity and the ratio of torsion to curvature is investigated where Lagrangian helicity is defined as a dot product of velocity and vorticity vectors at the point of a fluid particle. We also found that probability density functions of torsion and torsion normalized by curvature clearly show well-established slope in log–log plots. Lagrangian helicity is intermittently distributed and high Lagrangian helicity is always found, where high acceleration is observed. Regarding the relationship between coherent structure and acceleration, coherent structure can be understood in terms of Lagrangian helicity, curvature, and torsion. Geometric characteristics for solid particles are also investigated and its behavior differs depending on the Stokes number.

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