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Irreversibility-inversions in 2D turbulence ANDREW BRAGG, Duke University, FILIPPO DE LILLO, GUIDO BOFFETTA, Universit di Torino — We consider a recent theoretical prediction that for inertial particles in 2D turbulence, the nature of the irreversibility of their pair dispersion inverts when the particle inertia exceeds a certain value (Bragg et al., Phys. Fluids 28, 013305, 2016). In particular, when the particle Stokes number, St, is below a certain value, the forward-in-time (FIT) dispersion should be faster than the backward-in-time (BIT) dispersion, but for St above this value, this should invert so that BIT becomes faster than FIT dispersion. This non-trivial behavior arises because of the competition between two physically distinct irreversibility mechanisms that operate in different regimes of St. In 3D turbulence, both mechanisms act to produce faster BIT than FIT dispersion, but in 2D, the two mechanisms have opposite effects because of the inverse energy cascade in the turbulent velocity field. We supplement the qualitative argument given by Bragg et al. (Phys. Fluids 28, 013305, 2016) by deriving quantitative predictions of this effect in the short-time dispersion limit. These predictions are then confirmed by results of inertial particle dispersion in a direct numerical simulation of 2D turbulence.

Andrew Bragg
Duke University

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