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Direct numerical simulation of forward- and backward-in-time relative dispersion of inertial particles in high-Reynolds-number ($R_\lambda \approx$ 580) turbulence[1] PETER IRELAND, ANDREW BRAGG, LANCE COLLINS, Cornell University — Turbulence-induced water droplet coalescence is considered to be an important factor in the onset of precipitation in warm cumulus clouds. Theory (Bragg and Collins 2013) shows that the collision kernel for suspended droplets in turbulence is fundamentally related to their backward-in-time relative dispersion, which has yet to be systematically investigated. Using direct numerical simulations on a 2048^3 lattice with $R_\lambda \approx 580$, we find that inertial particles, like fluid particles, separate more quickly backward than forward in time. However, the degree of asymmetry in the dispersion is significantly greater for inertial particles than for fluid particles. We present new parameterizations for both short and long time relative dispersion and discuss the physical mechanisms leading to the strong asymmetry in the dispersion processes. The results from this work will be used to the improve the theoretical model for particle relative velocities developed by Pan and Padoan (2010), enabling more accurate predictions of collisional droplet growth rates.

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