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Inertial Particle Relative Velocity in a High-Reynolds-Number Homogeneous and Isotropic Turbulence Chamber[1] ZHONGWANG DOU, ZACHARY PECENAK, ZACH LIANG, University at Buffalo - SUNY, LUJIE CAO, Ocean University of China, PETER IRELAND, LANCE COLLINS, Cornell University, HUI MENG, University at Buffalo - SUNY — Particle-pair radial relative velocity (RV) in turbulence plays a critical role in droplet collision and cloud formation. Both simulations and experiments are performed to better understand RV of inertial particles in homogeneous and isotropic turbulence (HIT). However, past experimental measurement of particle RV statistics exhibited large deviations from DNS results (de Jong et al., 2010). In the current study, we identified intrinsic limitations in our previous study and devised a 4-frame particle tracking velocimetry technique to measure particle RV. In a second-generation, enclosed, fan-driven HIT chamber, both tracer and inertial particles were studied at R_λ of 366. The experimentally measured RV statistics were compared with DNS with excellent agreement. Additionally, for both kinds of particles, the mean inward RV vs. particle separation distance r also matched very well with DNS, but at near-zero r, experimental values were slightly higher. To investigate the cause of this discrepancy, we compared DNS of both mono- and tri-dispersed particles. We found that the tri-dispersed particles exhibited higher mean inward RV at small r than any mono-dispersed particles. This suggests that the increase of mean inward RV in the experiment could be due to the Stokes number (St) distribution present in the particles, while DNS employed single St values.

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Hui Meng
University at Buffalo - SUNY

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