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New Measurements of Inertial Particle Relative Velocity and Radial Distribution Function down to Near-contact Separations in Isotropic Turbulence Reveals Hydrodynamic Interaction Effects[1] ADAM HAMMOND, SUNY Buffalo, ANDREW BRAGG, Duke University, HUI MENG, SUNY Buffalo — Understanding particle collision mechanisms in isotropic turbulence is important to applications such as droplet coalescence. It is known that particles with finite Stokes numbers (St) experience enhanced clustering due to turbulence, measured by the radial distribution function $g(r)$, and increased inward relative velocities, measured by the mean inward radial relative velocity $\langle w_r(r)\rangle^-$, compared to inertia-free particles. However, collision occurs when particles are near contact. When their separation distance r approaches the collision radius, particle pairs begin to experience hydrodynamic interactions (HI). Yavuz et al. (2018) (Phys Rev Lett 120 244504) observed $g(r)$ enhancement by HI; however their data exhibited significant scatter at $r/a = O(10)$, (a: particle radius). We used a new high-resolution particle tracking technique by LaVision[1] and optimized it for small-r measurements of particles in a fan-driven enclosed isotropic turbulence chamber. This enabled high-resolution measurements of $g(r)$ and $\langle w_r(r)\rangle^-$ down to near contact (r/a =2.07) using particles of different radii (2.5μm<a<22.5μm) and inertia (0.1<St<3.7). When r/a<$O(10)$, we observe that $g(r)$ varies as r^{-6}, and $\langle w_r(r)\rangle^-$ begins to increase drastically. In this talk we explore how inertia affects clustering and relative velocities of particle pairs near contact through HI as well as turbulence.

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Adam Hammond
SUNY Buffalo

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