Abstract Submitted
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Particle-turbulence and particle-wall interactions in a turbulent boundary layer[1] YI HUI TEE, ELLEN LONGMIRE, University of Minnesota — The motions of finite-size spheres moving in a turbulent boundary layer are affected by both wall friction and coherent structures. 3D particle tracking experiments conducted at $\mathrm{Re}_\tau = 700$ and 1300 with sphere diameters of 60 and 120 viscous units revealed two distinct sphere behaviors dependent on density ratio. Spheres held stationary on the wall with a density ratio of 1.003 always lifted off once released, translated without rotating, and subsequently fell back toward the wall. After the spheres had accelerated significantly, lift-off events with height larger than those following the initial lift-offs were observed frequently. These subsequent lift-off events are attributed to coherent structures in the flow. By contrast, spheres with a density ratio of 1.15 did not lift off initially, but slid along the wall once released. Further downstream, these spheres developed forward rotation as well as significant rotation about the wall-normal axis, and coincidentally experienced repeated weak lift-offs. Wall friction was crucial in impeding the sphere acceleration as well as in helping initiate rotation. In the talk, PIV results on surrounding flow fields will be used to help explain the various particle-turbulence and particle-wall interactions.

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