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Fluid motion surrounding a lifting sphere in turbulent boundary layers[1] YI HUI TEE, ELLEN LONGMIRE, University of Minnesota — A finite-size sphere with density ratio of 1.006 was released from rest on a smooth wall in turbulent boundary layers with Re_τ = 680 and 1320 (d^+ = 58 and 122). The marked sphere was illuminated with white LEDs and tracked using two pairs of stereoscopic cameras viewing from the side. At the same time, a streamwise-spanwise plane of fluid was illuminated by an infrared laser, and fluid motion was captured and tracked with a pair of stereoscopic PIV cameras viewing from the bottom. The 3C sphere translation and rotation were compared with the surrounding fluid motion to understand particle-turbulence interactions. Upon release, the sphere accelerated strongly and lifted off of the wall with minimal rotation before eventually descending. It typically collided with and slid along the wall before lifting off again, often reaching greater heights than after the initial lift-off. The sphere streamwise velocity correlated strongly with surrounding fast or slow moving fluid regions. The sphere's spanwise motion, up to 12% of the streamwise distance traveled, often correlated with large-scale spanwise fluid motions. In the talk, sphere lift-off will also be discussed in the context of the surrounding fluid motions.

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