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Particle-fluid-wall interaction of anisotropic inertial particles in a turbulent boundary layer LUCIA BAKER, FILIPPO COLETTI, University of Minnesota — The dynamics of dilute, inertial rod- and disk-shaped particles in a saltation-suspension regime are studied in a turbulent boundary layer. Simultaneous, time-resolved flow fields, particle trajectories, and particle orientations are obtained using particle image velocity and particle tracking velocimetry in a paddlewheel-driven water channel. Statistics of particle velocity, particle acceleration, and fluid velocity interpolated at particle locations are computed to investigate particle interaction with the fluid turbulence and with the wall. Both types of particle interact with the wall by touching down, sliding, rolling or tumbling, then lifting off. Particle lift-off is strongly associated with fluid ejection events occurring at the particle location, while touchdown is only weakly associated with sweep events. Particle orientation is compared between particle types and is found to differ significantly. Rod particles preferentially orient their axis of rotational symmetry in the streamwise direction and not in the vertical, whereas disks preferentially orient their symmetry axis in the vertical direction and not in the streamwise. In both cases the symmetry axis is rarely oriented spanwise, i.e., rarely aligned with the mean vorticity. These preferences are strongest in the near-wall region. Tumbling behavior is observed for both particle types, especially near the wall, and strongly affects the particle-fluid-wall interplay compared to spherical particles of similar inertia.

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