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Experimental study of dense suspension of large particles in a turbulent boundary layer LUCIA BAKER, FILIPPO COLETTI, Univ of Minnesota - Twin Cities — Turbulent flows laden with high concentrations of particles are encountered in many natural and industrial settings, from river sediment to fluidized beds. In many of these situations the size of the particles is comparable to the energetic flow scales, violating basic assumptions of standard numerical models and calling for careful experimental observations. We experimentally investigate an open channel flow with a bulk Reynolds number of 70,000 laden with spherical particles slightly denser than the fluid. The particle diameter is around one tenth of the boundary layer thickness, and particle volume fractions between five and twenty percent are examined. Refractive index matching allows us to simultaneously characterize both fluid and particle motion by laser imaging. Because the particles are slightly heavier than the fluid, a vertical gradient of volume fraction exists, and the particles form stable layers above the floor. Even at the lowest volume fractions, the particles drastically alter the boundary layer structure: the fluid velocity profile is almost linear, suggesting that the effective fluid viscosity is greatly augmented by the particle presence. Moreover, increasing the volume fraction enhances the streamwise and wall-normal velocity fluctuations of both phases.

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