Abstract Submitted
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Surface drag in a fluidized bed[1] DANIEL GOLDMAN, WYATT KORFF, University of California, Berkeley — Animal locomotion on sand involves drag at the sand surface for a range of substrate conditions. Inspired by this, we study drag of a half-submerged 2 cm disk using a large aspect ratio (1200x800 particle diameters) air fluidized bed of $250\mu m$ glass beads to control the properties of the granular material. We vary the air flow rate Q to the bed and the drag velocity v_d (0-40 cm/sec) of the disk. Below fluidization, the drag force F_d increases linearly with v_d, with nonzero intercept; the intercept decreases as fluidization onset is approached. Above onset, F_d is no longer linear in velocity, but has positive curvature. For large enough v_d, we observe the formation of a wake behind the disk. We find a sharp onset in drag associated with this wake after removing the viscous drag, similar to studies of wave drag in a viscous Newtonian fluid[2]. The existence of an onset to wake formation resulting in rapid increase in drag in fluids at a critical velocity is a result of the competition between surface tension and gravitational restoring force; in the fluidized cohesionless grains it is not clear what mimics the effect of the attractive force.

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[2]T. Burghelea and V. Steinberg, Phys. Rev. Lett. **86**, 2557, (2001)

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