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Jamming transition in plowed granular media NICK GRAVISH, Georgia Tech, PAUL UMBANHOWAR, Northwestern University, DANIEL I. GOLDMAN, Georgia Tech — We demonstrate in a three-dimensional laboratory plate drag experiment that a granular medium (250 μm glass beads) exhibits a bifurcation from fluid-like to jammed flow as the volume fraction (ϕ) is increased above a critical value $\phi_c = 0.603 \pm 0.0025$. We measure the force F_d on a flat plate (3.8 cm width, 10.0 cm depth) dragged at constant velocity v through the surface of a granular medium for $0.57 < \phi < 0.63$. For $\phi < \phi_c$, F_d is independent of time and particle image velocimetry indicates that the flow of the granular media is uniform around the plate. For $\phi > \phi_c$, F_d displays large periodic fluctuations which correspond to the formation of shear bands. Surface profile measurement of the post-drag net displaced volume ΔV of the granular material reveals that the medium compacts ($\Delta V < 0$) in response to drag for $\phi < \phi_c$ and expands ($\Delta V > 0$) for $\phi > \phi_c$. Thus the transition to jammed flow at ϕ_c is marked by the onset of dilation in granular media.

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