Abstract Submitted
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Large-Scale Structures in Dense Granular Flows through a Vertical Channel[1] KEVIN FACTO, DONALD CANDELA, University of Massachusetts Amherst — We have used NMR/MRI techniques to probe the dense, gravity-driven flow of a dry granular medium (400 μm diameter seeds) through a 10 mm diameter vertical channel with rough walls. The flow rate, controlled by a variable-diameter outlet restriction many channel diameters downstream from the measurement region, is macroscopically steady and continuous for all flow rates used. Averaged over long times, the flow is plug-like in the channel center with a shear band near the wall a few particles wide. However, the NMR measurements reveal short-lived structures in the flow with size scales comparable to the channel diameter. At low mean flow speeds (< 3 cm/s) transient jamming events appear randomly in space and time; these events appear key to determining the average flow profile and speed. It does not appear that the flow would be correctly explained by a local constitutive relation in this regime, due to the large spatial scale of the transient events. At higher flow speeds an organized density wave appears, traveling upward opposite the mean flow direction.

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Donald Candela
University of Massachusetts Amherst

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