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**Shear zones at the walls of a 2D gravity-driven flow of grains**[1]
KELSEY HATTAM, NALINI EASWAR, Smith College, Northampton, MA, NARAYANAN MENON, University of Massachusetts, Amherst, MA — We study the flow of spherical grains under gravity in a vertical, straight-walled 2-dimensional hopper, where the flow velocity is controlled by a taper at the outlet. We perform these studies both for monodisperse steel spheres as well as for a bidisperse system of equal numbers of spheres with a ratio of diameters of 1.25. The monodisperse system shows crystalline order even in flow, whereas there is no obvious structural order in the bidisperse system. The velocity profile across the flow is profoundly different in the two systems: the wall shear zone in the monodisperse system extends only a few particle diameters, and there are only small velocity gradients in the bulk of the flow. In contrast to this nearly-plug-like flow, there are significantly broader shear zones in the disordered flow. We report these profiles as a function of the width of the hopper in order to study the scaling of the shear zone with the system size, and with the flow rate.

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