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Fraction of clogging configurations in granular hopper flow CHARLES THOMAS, DOUGLAS DURIAN, University of Pennsylvania — The clogging of granular media flowing from a hopper is a quintessential example of a system that spontaneously evolves from a freely flowing state to a jammed state under constant forcing. If suitably arranged, the grains at the opening are stable, initiate a jamming front, and block the flow throughout the bulk. We measure the fraction F of possible grain arrangements that lead to such a system-spanning clog for a range of experimental conditions, varying aperture shape, size, and orientation. We find for circular holes that F is a function only of the aperture size projected in the direction of the average exiting grain velocity. Furthermore, for long narrow slits F is found to be identical to the value expected for a set of independent holes. Finally, we successfully model the form of F versus aperture size by considering the accessible microstates of individual grains near the exit. The data as interpreted through this model suggest that the fraction of individual grain microstates that can lead to a clog is constant for large opening sizes. This conclusion implies that there may be no well-defined critical aperture size above which clogging is impossible.

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