Abstract Submitted
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**From streamline jumping to strange eigenmodes: Learning from simple continuum models of granular mixing**[1] IVAN C. CHRISTOV[2], JULIO M. OTTINO, RICHARD M. LUEPTOW, Robert R. McCormick School of Engineering and Applied Science, Northwestern University — Simple continuum models of granular flow can provide fundamental insight into how and why granular materials mix. Though a similar kinematic framework can be used to study both fluid and granular mixing, there are striking differences that we explore through a computational–experimental study of granular flow in a slowly rotating quasi-two-dimensional polygonal container. In the Lagrangian frame, for small numbers of revolutions, we show that the mixing pattern is captured by a model termed "streamline jumping." This minimal model, arising at the limit of a vanishingly-thin surface flowing layer, possesses no intrinsic stretching or streamline crossing in the usual sense, yet it can lead to complex particle trajectories that resemble chaos. In the Eulerian frame, meanwhile, we show the presence of naturally-persistent granular mixing patterns ("strange" eigenmodes) for intermediate numbers of revolutions. Unlike fluid mixing, however, strong diffusive effects (due to particle collisions in granular flows) result in fast decay of these transient patterns in monodisperse mixtures. Meanwhile, segregation leads to permanent excitation of eigenmodes in bidisperse mixtures.

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