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Arch Structure Dynamics in a 2d Vibrated Granular Hopper: Mapping to a Continuous Time Random Walk Process.[1] CARL MERRIGAN, BULBUL CHAKRABORTY, Brandeis University, SUMIT BIRWA, SHUBHA TEWARI, University of Massachusetts Amherst — Granular particles driven through a narrow opening can be blocked by the spontaneous formation of clogging arches. Experiments using controlled vibrations have found that the arch breaking times follow power law tails with exponents that can be tuned by changing the vibration strength or the opening size. In this talk, I will describe a mapping of the arch dynamics to a continuous time random walk model that can explain the occurrence of these continuously varying power law exponents. We have carried out molecular dynamics simulations of the arch breaking that produce distributions consistent with power laws cutoff by exponential tails at long times. Time series of the opening angles describing the arch shape resemble time series for continuous time random walks. Mean squared displacement analysis of these time series reveal results qualitatively similar to those expected for subdiffusive continuous time random walks. Hence, I will argue that the main mechanism for arch failure is the cooperative, stochastic evolution of the arch shape through a series of distinct, stable configurations until the first unsustainable configuration is reached. We are working towards achieving a precise quantitative implementation of this mapping.

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