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Local origins of volume fluctuations in granular materials[1] JAMES PUCKETT, North Carolina State University, FREDERIC LECHENAULT, Universite Montpellier II, KAREN DANIELS, North Carolina State University — Recent experiments and simulations have observed that the fluctuations in the local volume fraction, ϕ, decrease as the granular material approaches jamming. We investigate the role of boundary condition and inter-particle friction, μ, on these fluctuations for a dense bidisperse granular monolayer driven at the perimeter. Using a radical Voronoi tessellation, we find a universal linear relationship between the mean variance of ϕ independent of boundary condition and μ. We examine the universality and origins of this trend using the recent granocentric model modified to draw neighbors from an arbitrary distribution $P(s)$, the edge-to-edge distance between neighbors. The mean and variance of the observed particle separation s are described by a single length scale controlled by mean ϕ. We tested diverse functional forms of $P(s)$ and found that each produces the trend of decreasing fluctuations, but only the experimentally-observed $P(s)$ provides quantitative agreement with the measured ϕ fluctuations. In conclusion, we find $P(\phi)$ and $P(s)$ encode similar information about the distribution of free volume in a driven granular system under different boundary conditions and inter-particle friction.

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