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Crystallization of a quasi-two-dimensional granular fluid ROHIT INGALE, PEDRO REIS, MARK SHATTUCK, Levich Institute, CCNY — We experimentally investigate the structural changes in the crystallization of a uniformly heated quasi-2D granular fluid, as a function of filling fraction, ϕ. We present a direct mapping between our non-equilibrium experimental granular system and the equilibrium behavior of hard-disks. To quantify this connection we calculate a number of standard measures, namely the radial distribution function, the local bond order parameter and the Lindemann criterion for melting, all of which provide a consistent scenario. The value of the radial distribution function at contact, $g(D)$, closely follows the Carnahan-Starling theoretical prediction for hard spheres up to $\phi \sim 0.55$. In an intermediate region, $0.652 < \phi < 0.719$, there is a qualitative change in behavior which has the characteristics of a hexactic phase. At $\phi_s = 0.719 \pm 0.007$ crystallization occurs, in excellent accord with theoretical and numerical results for hard-disks. In addition to these standard measures we have calculated the *Shape Factor*, ζ, which is a detailed measure of the topology of Voronoi cells and was recently introduced in the context of Monte-Carlo simulations of hard-disks. Remarkably good agreement is found between the experimental and numerical probability density functions, $P(\zeta, \phi)$. Detailed analysis of $P(\zeta, \phi)$, provides a great deal of insight into the physical nature of the intermediate phase, where a coexistence of topologically distinct Voronoi cells occurs.

Rohit Ingale
Levich Institute, CCNY

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