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Cage Dynamics in a Uniformly Heated Granular Fluid PEDRO REIS, ROHIT INGALE, MARK SHATTUCK, Levich Institute, City College of New York — We report a novel experimental investigation of the dynamics of a uniformly heated, horizontal and quasi-2D granular fluid. Our study is done as a function of filling fraction, ϕ, in the region prior to crystallization which we observe at $\phi_s = 0.719 \pm 0.007$. We perform a statistical analysis based on two quantities that are typically employed in colloidal/molecular systems: the Mean Square Displacement (MSD) and the Self Intermediate Scattering Function (SISF). These are calculated from the trajectories obtained by tracking all particles inside a representative imaging window of the full system. At low ϕ the classic diffusive behavior of a disordered fluid is observed. As the filling fraction is increased towards ϕ_s, the MSD (or SISF) develops a two-step increase (or decrease) analogous to what is commonly observed in glassy systems. This plateau at intermediate timescales is a signature of the slowing down of the motion of particles due to temporary trapping inside the cages formed by their neighbors. This caging is increasingly more pronounced as ϕ_s is approached from below. For $\phi > \phi_s$, each particle becomes fully arrested by its six neighbors, for the whole time accessible experimentally. Moreover, the relaxation time extracted from the SISF, as a function of ϕ, is well described by the Vogel-Fulchers law. Our results are an important step in strengthening the analogy between colloidal/molecular glassy systems and dense granular materials under uniform thermalization.

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