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Experimental evidences of the Gardner phase in a granular glass
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— The constituent particles of a glass are caged by their neighbors and thus cannot relax density fluctuations. This is also true for hard particles under compression. The associated slowing down of the dynamics is related to a complex free energy landscape. It was recently shown theoretically that the hard sphere glass in infinite dimension undergoes a Gardner transition, at which the glass basin breaks into a hierarchy of marginally stable sub-basins. This was very recently confirmed in simulations of 2d and 3d hard sphere (HS) glasses. We present the first direct experimental evidences of the Gardner phase, taking advantage of a well controlled granular experiment, which has already proven to successfully probe the vicinity of the jamming transition in a bi-dimensional granular glass former. More precisely, we perform independent compressions of a carefully prepared granular glass and show that for large enough compression, the final state differs from one compression to another. To do so we compare the average cage size within one state, and the average distance separating the cages of the same particles across successive compression cycles. The latter plateaus to a constant value, when entering the Gardner phase.

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