Calculations of the probabilities of mechanically stable packings of hard spheres

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In this talk I will describe a novel computational method for calculating the volumes of the basins of attraction of mechanically stable (MS) jammed packings of hard spheres, which are the collection of initial points in configuration space at zero packing fraction that map to a given MS packing by following steepest descent dynamics on the density landscape. For jamming processes where systems evolve from low to high packing fraction, we define the basin of attraction as the collection of initial configurations at zero packing fraction that map to a given MS packing, which differs significantly from the definition of the basin of attraction in glassy systems. In that case, density is fixed and initial configurations map to the 'nearest' local minimum in terms of Euclidean distance. Calculations of basin volumes are of fundamental importance because they determine the probabilities with which MS packings occur. In fact, this method can be employed to understand the strongly nonuniform probabilities that are obtained for MS packings when using rapid quenching protocols.

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