Colloquium

JAMMING AS THE EPITOME OF DISORDER

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Wednesday, November 7 ❖ 4:00 P.M. ❖ 118 NSH

Refreshments at 3:30 P.M. in 202 NSH

Solids always have some structural disorder. Yet we are customarily taught to understand solids by first considering the physics of perfect crystals. This may be an acceptable approach when a crystal has only a few defects but becomes increasingly untenable as the amount of disorder increases. For a glass, with no well-defined long-range order, a crystal is a terrible starting place for understanding the existence of the glass's rigidity or its excitations. Is there an alternative–the opposite of a crystal–where order, rather than disorder is the perturbation?

Jamming, as opposed to crystallization, is an alternate way of creating a rigid structure. It is an alternate paradigm for thinking about how many different types of fluids–from molecular liquids to macroscopic granular matter–develop rigidity. In contrast to crystals, at the jamming transition the solid is the epitome of disorder in that there exists no length scale over which one can do an appropriate average to recover the elastic constants. At zero temperature, the jammed solid has a new class of normal-mode vibrations that dominates the low-frequency excitations. The properties of the jammed solid are highly unusual and provide a new way to think about disordered systems generally.

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