Weekly Seminar

Criticality of the jamming tranition at zero temperature and zero shear stress

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Time: **4:00pm, Nov. 19, 2014 (Wednesday)**
时间: **2014年11月19日 （周三） 下午4:00**
Venue: **Room 607, Science Building 5**
地点: **理科五号楼607会议室**

Abstract

Packings of frictionless spheres interacting via repulsions undergo the jamming transition at the so-called point J. The jamming transition corresponds to the sudden formation of rigidity and exhibits unusual scaling relations, which cannot be simply classified into any known type of phase transition. As a typical noncrystalline liquid-solid transition and a simple model related to the long-standing glass transition problem, the jamming transition at point J has attracted a lot of attention in the past decade. In this talk, I will present some of our recent studies suggesting the criticality of point J. By adding a small amount of thermal energy to the system, we define a jamming-like transition, which is associated with the emergence of the maximum height of the first peak of the pair distribution function and converges to point J at zero temperature (T=0). Material properties change significantly across the transition with the high density side retaining the scaling relations of the T=0 jammed solids. The existence of the jamming-like transition leads to the scaling collapse of multiple quantities, implying the criticality of point J. By applying a shear stress to the system, we obtain the yield stress of jammed solids from the probability of finding jammed states under applied shear stress. To realize the calculation, we introduce a new method to quickly search for jammed states under desired shear stress by minimizing a thermodynamic-like potential. The yield stress and multiple other typical quantities exhibit finite size scaling with a unique length scale, which again suggests the criticality of point J. We also find that the jamming transition under nonzero shear stress is discontinuous, analogous to typical phase transitions in external fields.

About the Speaker

Ning Xu got his Ph.D. degree from Yale University in 2005. From 2006 to 2009, he was a postdoc at University of Pennsylvania and University of Chicago. After that, he had worked as a research assistant professor at Department of Physics, Chinese University of Hong Kong for half a year. He started his professorship at University of Science and Technology of China from 2010, supported by the 100-Talent Program of Chinese Academy of Sciences. He received the National Natural Science Foundation Grant for Distinguished Young Scholars in 2013. His research interests are in the phase transitions and material properties of soft materials, especially the noncrystalline liquid-solid transitions and the nature of disordered solids.