Visualizing Kinetic Pathways of Homogeneous Nucleation in Colloidal Crystallization

(Talk #6)

Peng Tan[1], Ning Xu[2] and Lei Xu*[,1]

[1]Physics Department, The Chinese University of Hong Kong, Hong Kong

[2]Physics Department, The University of Science and Technology of China, China

***Email of Presenting Author: xulei@phy.cuhk.edu.hk**

During liquid-to-solid transition, particles pass through multiple intermediate structures to reach the final state. However, the exact pathways remain elusive, due to the difficulty of direct observation. Using various colloidal systems, we experimentally study the evolutions in both symmetry and density, and visualize kinetic pathways with single-particle resolution. Before nucleation, we observe relatively-ordered precursor structures in multiple symmetries, which subsequently convert into meta-stable solids. During this precursor-to-solid conversion, surprisingly, two major cross-symmetry pathways are always observed, regardless of the final state and the interaction potential. During this same process, moreover, we discover a broad decoupling between density variation and symmetry development, and reveal that nucleation rarely starts from the densest regions. These findings are universally observed in all our samples, raising the possibility of finding a unified picture for the complex crystallization kinetics in colloidal systems [1].

Reference:

[1] P. Tan, N. Xu, L. Xu, *Nature Physics*, in press (2013).