PHYSICAL MATHEMATICS SEMINAR

Kinetics of particles with short-ranged interactions

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ABSTRACT:

Nature has solved the problem, and now engineers would like to -- how can we design small components to spontaneously form more complicated structures? To answer this question theoretically requires a way to describe the configuration space and assembly pathways of components with given interactions. For many systems of interest (e.g. colloids) these interactions are very short-ranged compared to the size of the components. This makes the landscape highly rugged, so traditional theoretical or computational approaches will struggle to capture the relevant dynamics.

We propose a new framework to look at particles with short-ranged interactions, based on taking the limit as the range of the interaction goes to zero. In this limit, the landscape is defined by a completely enumerable set of geometrical manifolds plus a single control parameter, while the dynamics on top of the manifolds are given by a hierarchy Fokker-Planck equations coupled by "sticky" boundary conditions. We illustrate this framework with several applications, such as computing the free energy landscape and transition rates for clusters of spheres, experimentally measuring the hydrodynamic interactions between colloids, and enumerating rigid packings of hard spheres.

TUESDAY, FEBRUARY 12, 2013
2:30 PM
Building 56, Room 180

Reception following in Building 2, Room 290
(Math Dept. Common Room)

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