PHYSICAL MATHEMATICS SEMINAR

Phase separation in multicomponent liquid mixtures

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ABSTRACT:

Multicomponent systems are ubiquitous in nature and industry. While the physics of binary and ternary liquid mixtures is well-understood, the thermodynamic and kinetic properties of N-component mixtures with N>3 have remained relatively unexplored. Inspired by recent examples of intracellular phase separation, which have important cellular functions, we investigate equilibrium phase behavior and morphology of N-component liquid mixtures within the Flory-Huggins theory of regular solutions. In order to determine the number of coexisting phases and their compositions, we developed a new algorithm for constructing complete phase diagrams, based on numerical convexification of the discretized free energy landscape. Together with a Cahn-Hilliard approach for kinetics, we employ this method to study mixtures with N=4 and 5 components. In this talk I will discuss both the coarsening behavior of such systems, as well as the resulting morphologies in 3D. The topology of phase separated mixtures can be described in terms of graphs, which enabled us to reverse engineer the interaction parameters of components in order to obtain all topologically distinct morphologies and to achieve a range of desired packing structures, such as nested "Russian dolls" and encapsulated emulsions droplets.

TUESDAY, FEBRUARY 18, 2020
2:30 PM – 3:30 PM
Building 2, Room 139

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

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