Mathematics Colloquium

Frustration in the Packing of Soft Materials

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Building 180, Room 107

Abstract

Many processes in material science involve entropic contributions from packing – the constraints imposed by volume occupied by other material. Diblock polymers offer a rich environment to study the packing of soft materials as gradient flows of a system energy. Ideas from Γ convergence provide powerful tools to extract simplified models in certain singular limits. We present examples of packing dichotomies in both continuous and discrete formulations and identify cases in which limiting problems may be more complex. We present a derivation of a random phase reduction of self-consistent mean field models, identify regimes in which they converge to functionalized Cahn-Hilliard energy, and provide a discrete system for the packing of soft balls that exhibits large-system frustration: the inability of gradient flows to obtain the global energy minimum, that significantly complicates the extraction of limiting processes.

About the speaker: Keith Promislow received his PhD in 1991 from Indiana University under the direction of Roger Temam and was an NSF Postdoctoral fellow at Penn State with Jerry Bona and Gene Wayne. He has been a faculty member at Simon Fraser and Michigan State Universities where he is currently the department chair. He represented the AMS at the Coalition for National Science Funding on Capital Hill, was a Kloosterman Professor at the University of Leiden, and a plenary speaker at the SIAM AGM and Nonlinear waves meetings. He is a past or current member of the editorial boards of SIADS, SIMA, and Physica D. His research blends PDE analysis with dynamical systems techniques and finds applications to the interaction of entropy and geometry in polymer chemistry, biology, and anywhere else that ionic solutions play a role.