SPECIAL

Physical Mathematics Seminar

A General Theory of Mechanical Screening and Hexatic Mechanics in Amorphous Granular Matter

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ABSTRACT:

Holes in elastic metamaterials defects in 2D curved crystals localized plastic deformations in amorphous matter and T1 transitions in epithelial tissue are typical realizations of stress-relaxation mechanisms in different solid-like structures interpreted as mechanical screening. While screening theories are well established in other fields of physics e.g. electrostatics a unifying theory of mechanical screening applicable to crystalline amorphous and living-cellular matter is still lacking. In this talk I will present a general mechanical screening theory that generalizes classical theories of solids and introduces new moduli that are missing from the classical theories. Contrary to its electrostatic analog the screening theory in solids is richer even in the linear case with multiple screening regimes predicting qualitatively new mechanical responses. Specifically we predict a regime of screening that is mechanically similar to the celebrated Hexatic phase in disordered matter. The theory is tested in different physical systems among which are disordered granular solids and models of epithelial tissue. Experiments and numeric simulations in granular glass and tissue models uncover a mechanical response that strictly deviate from classical elasticity and is in full agreement with the theory. Finally I will discuss the relevance of the theory to 3D granular solids and a new Hexatic-like state in three-dimensional matter

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2:00 PM – 3:00 PM
Building 2, Room 361

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