

PHYSICAL MATH SEMINAR

Rupture, instability, and phase transitions via constrained expansion

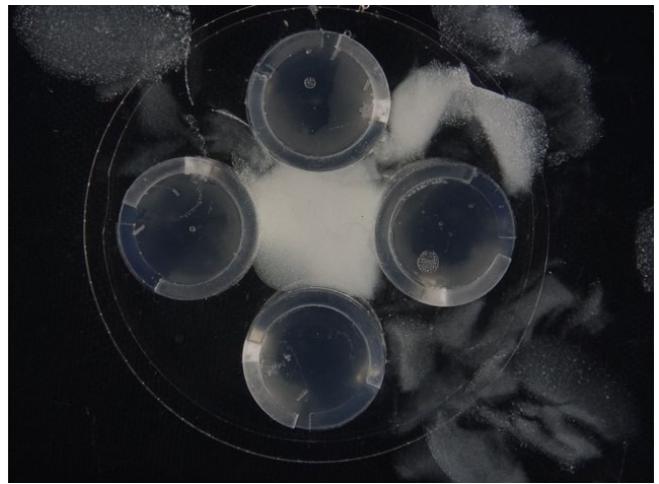


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ABSTRACT:

Consider an elastic material that increases in size due to growth or swelling. If the material is unable to expand freely, stresses develop. In this talk, I will present two systems in which stresses due to constrained expansion can generate complex and dramatic responses. First, I will discuss the



mechanics of thin sheets that have been locally dilated at a periodic array of sites. When the dilations are sufficiently large, the affected sites buckle either above or below their surroundings. These bistable dilations form a programmable metamaterial, and their behavior can be understood through an analogy to the Ising model. Second, I will describe how hydrogels, polymer networks that imbibe large amounts of water, behave when forced to swell around rigid obstacles. We identify a regime in which stresses due to obstacles cause swelling hydrogels to rupture, tearing themselves apart as they expand.

TUESDAY, MARCH 10, 2026

2:30 PM – 3:30 PM

Building 2, Room 449