The Wrinkle-to-Crumple Transition in Thin Elastic Solids

Abstract: The last decade has seen a renaissance in the buckling of thin elastic solids, in part because of its impact on the mechanics of synthetic skins, biological tissues, textiles, and 2D materials like graphene. Significant effort has been devoted to understanding and exploiting buckled morphologies that decorate otherwise planar surfaces. Yet, we show that one of the most-studied morphologies—sinusoidal wrinkling—does not persist in a variety of curved geometries. Instead, smooth wrinkles generically give way to sharp "crumples". We characterize this transition in a suite of experiments across geometries and scales, using ultrathin polymer films on liquid droplets and macroscopic membranes that we inflate with gas. These setups reveal robust morphological features of the crumpled phase, and they allow us to disentangle the effects of curvature and compression. Our work highlights the need for a theoretical understanding of this ubiquitous elastic building block, and we lay out concrete directions for such studies.

Bio: Joseph Paulsen has BAs in Mathematics and Physics from St. Olaf College in Northfield, MN, and a PhD in Physics from the University of Chicago. He won a National Science Foundation CAREER Award for his work that studies connections between geometry and mechanics in thin materials. When he is not at work or chasing around his two toddlers, he is playing as much disc golf as he possibly can.

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4:00 PM

Innovation Hall

Room E105

Refreshments will be available at

3:30 PM.

In E217

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