Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Universal dynamics in the wrinkling of curved elastic bilayer systems NORBERT STOOP, JOERN DUNKEL, Massachusetts Inst of Tech-MIT —

Wrinkling in curved bilayer systems is a ubiquitous phenomenon, occurring, e.g., in embryogenesis, biological tissue differentiation or structure formation in heterogenous thin films. Using a recently developed effective wrinkling theory, we previously showed that near the wrinkling transition, a hexagonal pattern is selected, which exhibits characteristic properties of generic 2D curved crystals, including curvature-dependent defect localization and orientation. Here, we show that under a finite-time quench from the unwrinkled to the crystalline phase, curved bilayer systems exhibit dynamic scaling properties consistent with universal predictions of the celebrated Kibble-Zurek mechanism (KZM). Specifically, by increasing the film stress at constant rates, we find that the system arrests its dynamics near the wrinkling transition, rendering the quench non-adiabatic. Once dynamics is resumed, topological defects appear and their densities follow power-laws in the quench rate. Studying spherical and toroidal geometries, we find that the scaling exponent agrees with the KZM predictions and is independent of geometry and topology. Our results thus suggest that elastic bilayers provide a novel and accessible way to study universal aspects of dynamical phase transitions.

Norbert Stoop
Massachusetts Inst of Tech-MIT

Date submitted: 11 Nov 2016 Electronic form version 1.4