Symposium | A. Advances in Materials Theory for Multiscale Modeling

[SY-A8]Symposium A-8

Chair: Thomas Hochrainer(TU Graz, Austria)

Wed. Oct 31, 2018 4:00 PM - 5:30 PM Room6

[SY-A8]Pattern formation in doubly curved thin shells

Invited

○Eleni Katifori[1], Desislava Todorova[1], Octavio Albarran[2], Lucas Goehring[2] (1.University of Pennsylvania, United States of America, 2.Max Planck Institute, Germany)

Pattern formation in thin elastic shells has attracted increasing interest in both fundamental studies and practical applications. Examples include biological systems and engineering applications, such as the fabrication of flexible microelectronics. In this talk we explore the mechanical instabilities of an intrinsically curved thin shell deposited on a liquid surface. Here, the pattern formation is not a direct result of externally imposed strain, but is due to the geometric incompatibility between a curved, stiff membrane and an (initially flat) liquid substrate. We observe several types of instabilities, including a wrinkle-to-fold transition from periodic sinusoidal solutions to morphologies that combine sinusoidal wrinkles and folds; a transition from dimples (geometric inversions) to periodic sinusoidal solutions; and a transition from flat bands with zero Gaussian curvature, to dimpled periodic patterns. We show that whe wrinkling patterns can be described via an effective theory of liquid crystalline smectics at intermediate length scales. This insight allows better understanding of the wrinkling patterns seen in such systems, with which we explain pattern breaking into domains, the properties of domain walls and wrinkle undulation. We compare our predictions with numerical simulations and experimental observations. We investigate how the global geometry of the curved shells and their elastic properties control the transitions between the various morphologies. Last, we discuss various new strategies for creating and controlling patterns in thin elastic shells with natural curvature.