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Influence of Stabilizing van der Waals Forces on Benard Instability in Viscous Nanofilms[1] RYAN DENLINGER, SANDRA TROIAN, California Institute of Technology, 1200 E California Blvd MC 128-95, Pasadena, CA — While best avoided in most practical applications, hydrodynamic instabilities in ultrathin films can provide a useful method for self-assembly of large area arrays. As one example, studies have confirmed that polymer nanofilms subject to a transverse thermal field gradient can undergo a Benard-like instability to produce arrays of pillar-like structures. For polymers with low glass transition temperatures, these structures solidify in place once the driving force is removed. During the actual formation process, the region in between pillars can thin substantially below 50 nm. Stabilizing van der Waals forces then become significant and can slow pillar growth and modify the instability wavelength. In this talk, we first discuss results of a linear stability analysis of an initially uniform film subject to thermocapillary, capillary forces and van der Waals forces. We then use analytic and numerical studies to explore the dynamics of film thinning in between pillar formation to better understand transitions in force balance and subsequent film deformation in non-uniform films. Results of investigations based on self-similarity and asymptotic analysis will be presented.

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