Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Mechanism Leading to Formation of Periodic Nanopillar Arrays in Confined Ultrathin Polymer Films SANDRA TROIAN, MATHIAS DIETZEL, Dept of Applied Physics, California Institute of Technology, Pasadena, CA — Previous groups have reported the spontaneous formation of periodic nanopillar arrays in ultrathin polymer films (order 100 nm in thickness) confined inbetween two flat smooth substrates and subject to an ultrahigh transverse thermal gradient (order $10^6 - 10^7$ °K/cm). Crucial to these experiments is the presence of an overlying nanofilm of a second fluid to preserve a deformable interface at the polymer-fluid boundary. The formation of structures resembling stripes, columns or spirals has been attributed to a normal interfacial radiation pressure arising from phonon-like reflections at the interface separating media with different acoustic impedance. A linear stability analysis of a thin bilayer film within the lubrication approximation shows that tangential thermocapillary stresses at the free interface can well explain the phenomena observed. Predictions of the most unstable wavelength as a function of the plate spacing, thermal gradient, and material parameters provide a good fit to the experimental data. This instability can be classified as a long wavelength Bénard instability studied a decade ago by VanHook *et al.* The parameter range in current experiments, however, as characterized by the ratio of thermocapillary to capillary to gravitational forces, falls beyond the range studied previously.

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Date submitted: 06 Aug 2008 Electronic form version 1.4