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Ginzburg-Landau and Weakly Nonlinear Analysis of 3D Pillar Growth in NanoBenard Instability CHENGZHE ZHOU, SANDRA TROIAN, California Institute of Technology, MC 128-95, Pasadena, CA — We examine the nonlinear response of a molten nanofilm subject to strong interface deformation and patterned growth by destabilizing thermocapillary forces and stabilizing capillary forces. The equation for the moving boundary describes 3D growth induced by large thermocapillary stresses in the long wavelength approximation.[1] A bifurcation analysis via the method of multiple scales elucidates the influence of initial conditions, system geometry and material properties on the regimes describing stable and unstable flow. Investigation of the corresponding Ginzburg-Landau amplitude equation by finite element simulations reveals the existence of rich spatio-temporal phenomena. We will discuss how tightly ordered symmetric growth can arise from resonance effects induced by spatially periodic external forcing,[2] in analogy to behavior recently reported for the spatially forced version of the Swift- Hohenberg equation in 1- and 2- dimensions.[3]

[1]M.Dietzel and S. M. Troian, Phys. Rev. Lett. 103 (7), 074501(2009); M. Dietzel and S. M. Troian, J. Appl. Phys.108, 074308 (2010)
[2]N. Liu and S. M. Troian, preprint (2014)
[3]Y.Mau, L. Haim, A. Hagberg and E. Meron, Phys. Rev. E 88, 032917(2013)

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