Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Bifurcation Analysis of 1D Steady States of the Bénard Problem in the Long Wavelength Limit CHENGZHE ZHOU, SANDRA TROIAN, California Institute of Technology, MC 128-95, Pasadena, CA 91125 — We investigate the character and stability of stationary states of the $(1+1)$D evolution equation $\partial_t h + \left(h^3 h_{xxx} + h^2 \partial_x \gamma\right)_x = 0$ describing the motion of an interface $h(x,t)$ separating a thin warm viscous film from a thin cool inviscid layer where $\gamma = \gamma(h)$ represents the interfacial tension. The phase diagram corresponding to all positive periodic steady states (PPSS) is specified by two variables - the global extrema of the equilibrum shape and a generalized mechanical interface pressure. The analytic forms describing the PPSS shapes, the minimal period, the average height and the generalized free energy are all confirmed numerically. We find there is at most one non-trivial PPSS for specified period and volume. We also find no stable perturbed PPSS near the critical point for volume conserving perturbations of identical period. A weakly non-linear analysis about the critical point yields bifurcations of the pitchfork-type. For all non-trivial PPSS, we verify the unstable nature of the PPSS by transforming the non-normal operator (resulting from the spatially inhomogeneous PPSS) to normal form, which we then solve by finite element computations.

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Date submitted: 01 Aug 2015 Electronic form version 1.4