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Instability of a liquid film non locally heated from below. WILLIAM BATSON[1], LINDA CUMMINGS[2], LOU KONDIC[3], New Jersey Institute of Technology Department of Mathematical Sciences, COMPLEX FLOWS AND SOFT MATTER GROUP TEAM[4] — By invoking the long-wave approximation to study thin liquid films, one typically derives a single nonlinear PDE for the evolution of the local film thickness. Without advection, linear analysis of these equations predict that perturbations that grow/decay monotonically because the evolution equation is first order in time. If, however, the film evolution equation is coupled to a second process with its own characteristic time scale, it is common to encounter linear operators that are not self-adjoint, and therefore one must consider the possibility of oscillatory dynamics.this talk, present oscillatory regimes that arise for long-wavelength, thermocapillary destabilization of a liquid film that is heated from the bottom of a solid substrate. For thick substrates, the film evolution equation is nonlocally coupled to the full substrate heat equation, and linear analysis leads to a transcendental, implicit dispersion relation between the perturbation growth rate and wavenumber. Towards highlighting the underlying physical mechanisms, we present analytical results for various asymptotic limits of the input parameters. Finally, conditions that lead to oscillatory dynamics in real film-substrate systems will be predicted.

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