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Marangoni convection in a thin film: Formation of a fractal hierarchy of droplets ARTHUR STRAUBE, Department of Physics, Humboldt University of Berlin, Germany, ANTON ASHMANOV, Perm State University, Russia, SERGEY SHKLYAEV, Institute of Continuous Media Mechanics, Perm, Russia, ARKADY PIKOVSKY, Department of Physics and Astronomy, University of Potsdam, Germany — A thin liquid film heated from below is known to demonstrate rupture due to the longwave Marangoni convection [J. Fluid Mech. 345, 45 (1997)]. Despite a number of numerical and theoretical studies nothing has been known about the final state that sets in as a result of the instability. In our recent one-dimensional analysis [Phys. Rev. E 82, 020601 (2010)] we have shown that the terminal state is a fractal built of a hierarchy of droplets, each of which can be represented as a dissipative compacton. The latter can be thought of as the stationary droplet with the zero contact angle and whose profile is determined by the interaction of the surface tension and thermocapillary flow. We show that the dimension of a set of the compactons is equal to unity or, equivalently, the dimension of gaps between the droplets is zero. For a generalized axisymmetric problem, two types of compactons are found: hat-like and ring-like ones, with the maximum either at the symmetry axis or at a finite radius, respectively. Again, an initially flat film becomes unstable, forming a hat-like compacton and a fractal sequence of ring-like compactons, whose stability is analyzed with respect to the perturbations breaking the axial symmetry.

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