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A single liquid on a homogeneous substrate can lead to quantized contact angles and running droplets

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We have observed for the first time a quantized spectrum of contact angles in the dewetting of a liquid from a homogeneous solid substrate. Using structured liquids of a lamellar diblock copolymer above the order-disorder transition temperature, we observe that predominantly disordered droplets coexist with different discrete thicknesses of wetting layer. At a fixed temperature, the measured contact angle of a droplet depends only on the number of monolayers in the wetting layer, resulting in a temperature dependent spectrum of contact angles. To describe the behavior of this system, a self-consistent field theory calculation was performed to calculate the effective interface potential of a lamellar diblock copolymer in its disordered state. The calculation shows excellent qualitative agreement with experiment. Further experiments were performed examining droplets which coexist with two different thicknesses of wetting layer. These droplets experience an unbalanced force which leads to 'running droplets'—droplets that move and whose dynamics can be understood from the effective interface potential.

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