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Spreading of liquid drop on superhydrophilic micropillar array

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When a drop is deposited on a superhydrophilic micropillar array, the upper part of the drop (referred to as the bulk) collapses while the bottom part penetrates into the gaps of the array, forming a fringe film. Here we quantify the dynamics of this process using a combination of experiment and theory. In the early stages when the fringe extension is negligible compared to the bulk radius, both the spreading of the bulk and the entire drop footprint follow the same power law ($t^{1/4}$), t being time. The bulk shrinks toward the end of the spreading process due to the drainage of liquid into the fringe film. The film spreads like $t^{1/2}$ until the end of the process. A remarkable finding is that the entire footprint grows like $t^{1/4}$ despite the diffusive growth of the fringe film, implying that the shrinkage of the bulk compensates for the outward spreading of the film. We rationalize some of these results with scaling analyses based on the balance of capillary forces that drive the flow and viscous shear forces.

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