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Moving contact lines in partial wetting: bridging the gap across the scales AMIR PAHLAVAN, LUIS CUETO-FELGUEROSO, GARETH MCKINLEY, RUBEN JUANES, Massachusetts Inst of Tech-MIT — The spreading and dewetting of liquid films on solid substrates is a common phenomenon in nature and industry from a snail secreting a mucosal film to printing and coating processes. A quantitative description of these phenomena, however, requires a detailed understanding of the flow physics at the nanoscale as the intermolecular interactions become important close to the contact line. Classical hydrodynamic theory describes wetting as an interplay between viscous and interfacial forces, neglecting the intermolecular interactions, leading to a paradox known as the moving contact line singularity. By contrast, molecular kinetic theory describes wetting as an activated process, neglecting the bulk hydrodynamics in the spreading viscous fluid film altogether. Here, we show that our recently developed model for thin liquid films in partial wetting, which properly incorporates the role of van der Waals interactions in a thin spreading fluid layer into a height-dependent surface tension, bridges the gap between these two approaches and leads to a unified framework for the description of wetting phenomena. We further use our model to investigate the instability and dewetting of nanometric liquid films, and show that it brings theoretical predictions closer to experimental observations.

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