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Direct visualization and self-similarity of contact line depinning ADAM PAXSON, KRIPA VARANASI, Massachusetts Institute of Technology — We report a novel technique to observe the microscale three-dimensional geometry of the contact line of a drop of water on a superhydrophobic surface as it recedes and depins from roughness features. We measure the local receding contact angle at the base of the capillary bridges at the contact line and find them to be equivalent to the macroscale receding contact angle observed on a chemically equivalent smooth surface, providing experimental validation of the Gibbs criterion at the microscale. We use this technique on a dual-scale hierarchically textured surface and reveal a self-similar depinning mechanism that explains how the geometry of the roughness at each length scale affects the adhesion of the contact line. This mechanism allows us to propose a model for predicting the adhesion force of a macroscopic drop, and we use a tensiometer to experimentally verify the model's applicability to both synthetic and natural surfaces.

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