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Tension kills ... harmonic moments in viscous fingering MATTHEW THRASHER, ALEXANDER LESHCHINER, HARRY L. SWINNEY, Center for Nonlinear Dynamics, University of Texas at Austin, MARK B. MINEEV-WEINSTEIN, Los Alamos National Laboratory — We measure the displacement of oil by air between two horizontal, closely-spaced glass plates to track the evolution of harmonic moments, which are integrals of integer powers of $z = x + iy$ over the oil domain. Richardson's theory (1972) predicts that the harmonic moments should be *time invariant in the absence of surface tension*. When we extend the theory to include surface tension, the harmonic moments are predicted to *decay in time because of surface tension*. From measurements of the time decay of the harmonic moments, we obtain a value for the surface tension within 5% of the accepted value. To obtain such precise agreement, the effect of silicone oil wetting the glass plates must be included. Our results implicitly validate Richardson's theory and directly demonstrate that a full description of interface dynamics in terms of harmonic moments is physically realizable and robust. In addition, a novel growth method using feedback produces nearly n-fold symmetric bubbles.

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