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Interface structure behind a moving contact line MENGFEI HE, SIDNEY NAGEL, The University of Chicago — When a flat solid substrate straddles the boundary between two fluids (e.g., water and air), there is a contact line where the two fluids and the solid meet. When the substrate is forced to penetrate further in either direction, it distorts the fluid interface and carries along with it a wedge of the trailing fluid. Numerous studies have investigated the onset of the contact-line motion in a two-dimensional geometry where it was assumed that no flows occurred in the direction along the surface of the substrate transverse to its direction of motion. Contrary to this assumption, we discovered that in steady state the fluid interface develops dramatic three-dimensional structure; there are multiple thin and thick regions of the fluid film alternating in the transverse direction. Thus the dynamics behind the contact line is not invariant in the transverse direction suggesting the existence of a new instability. We use interference to map the relative shape of this wedge-shaped region and a new interference technique to identify the absolute thickness of the wedge. It is particularly noteworthy that the same structure appears both in dewetting (when a substrate is removed from a liquid into the air) and in wetting (when it is plunged into the liquid).

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