Direct Measurement of Friction of a Fluctuating Contact Line

(Talk #24)

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What happens at a moving contact line, where one fluid displaces another (immiscible) fluid over a solid surface, is a fundamental issue in fluid dynamics. In this presentation, we report a direct measurement of the friction coefficient in the immediate vicinity of a fluctuating contact line using a micron-sized vertical glass fiber with one end glued to an atomic force microscope (AFM) cantilever beam and the other end touching a liquid-air interface. By measuring the broadening of the resonance peak of the cantilever system with varying liquid viscosity η, we obtain the friction coefficient ξ_c associated with the contact line fluctuations on the glass fiber of diameter d and find it has the universal form, $\xi_c = 0.8\pi d\eta$, independent of the contact angle. The result is further confirmed by using a soap film system whose bulk effect is negligibly small. This is the first time that the friction coefficient of a fluctuating contact line is measured.