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Air mediated dynamics of droplet impact on a smooth, solid surface[1] JOHN KOLINSKI, Harvard School of Engineering and Applied Sciences; Department of Physics of Complex Systems, Weizmann Institute of Science, L. MAHADEVAN, Harvard School of Engineering and Applied Sciences; Harvard University Department of Physics, SHMUEL RUBINSTEIN, Harvard School of Engineering and Applied Sciences; Department of Physics of Complex Systems, Weizmann Institute of Science — Before a falling drop can contact a solid surface, it must displace the air beneath it. Recent calculations and experiments show that as the drop approaches the surface, the air fails to drain, and instead compresses. As the air compresses, the pressure in the gas layer deforms the surface of the drop, thus inhibiting liquid-solid contact. Ultimately, the liquid droplet skates over a nanometer-thin film of air at a strikingly high velocity. These dynamics take place at fleeting timescales and diminutive length-scales, and are obscured by the bulk of the drop, making experimental observation difficult. We directly image the dynamics of the liquid-air interface, and use a novel form of TIR microscopy to study the dynamics and stability of the thin film of air beneath the drop. We show that the stability of the air film governs a novel transition in droplet impact events.

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