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Air flows generated by an impacting drop IRMGARD BISCHOFBERGER, Univ of Chicago, BAHNI RAY, TAEHUN LEE, JEFF MORRIS, CCNY, SIDNEY R. NAGEL, Univ of Chicago, UNIVERSITY OF CHICAGO COLLABORATION, CCNY COLLABORATION — A drop impacting a solid surface with sufficient velocity will splash and emit many small droplets. Lowering the ambient air pressure suppresses splashing completely. This effect, robustly found for different liquid and substrate properties, raises the fundamental question of how air affects a spreading drop. We visualize the flow of air induced by the drop after it hits the substrate using a modified Schlieren optics technique combined with high-speed video imaging. Comparison with the air flow created by an impacting solid sphere allows us to decouple the vorticity components of the falling drop from that of the spreading liquid. Our studies reveal the emergence of vorticity on two length scales. On larger scales, the airflow induced in the drop's wake leads to vortex structures due to interaction with the substrate. On smaller scales, the spreading of the drop generates a vortex ring above the outer edge of the spreading liquid. We show that this vorticity generation is governed by a balance between inertial and viscous forces.

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