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Swirls and splashes: pressure dependence of the airflow created by drop impact[1] IRMGARD BISCHOFBERGER, KELLY W. MAUSER, JFI and Department of Physics, The University of Chicago, Chicago, IL 60637, BAHNI RAY, TAEHUN LEE, Department of Mechanical Engineering, CCNY, NY 10031, SIDNEY R. NAGEL, JFI and Department of Physics, The University of Chicago, Chicago, IL 60637, JFI AND DEPARTMENT OF PHYSICS, THE UNIVERSITY OF CHICAGO, CHICAGO, IL 60637 COLLABORATION, DEPARTMENT OF MECHANICAL ENGINEERING, CCNY, NY 10031 COLLABORATION — A drop impacting a solid surface with sufficient velocity will splash and emit many small droplets. However, removing the ambient air suppresses splashing completely. The transition between splashing and non-splashing occurs gradually: decreasing the air pressure systematically delays and eventually fully inhibits the occurrence of a splash. The mechanism by which the surrounding gas affects the drop dynamics remains unknown. We use modified Schlieren optics combined with high-speed video imaging to visualize the airflow created by the rapid spreading of the drop after it hits the substrate. We observe the generation of a vortex ring that is initially bound to the outer edge of the spreading liquid and subsequently detaches from the liquid to form a beautiful toroidal vortex sheet that expands and curls up into a roll. We have studied the dynamics of this vortex as a function of gas pressure and find that the sheet gets progressively smaller as the air pressure is decreased. This suggests a weakening of the vortex strength at low pressure.

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