Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Asymptotic Behavior in Liquid Drop Coalescence JOSEPH PAULSEN, JUSTIN BURTON, SIDNEY NAGEL, University of Chicago, SANTOSH APPATHURAI, MICHAEL HARRIS, OSMAN BASARAN, Purdue University — During coalescence, two drops first touch and then merge, as a liquid bridge grows from initially microscopic scales to a macroscopic size comparable to the drop diameter. The initial dynamics of coalescence are expected to be universal, owing to a singularity in the Laplace pressure, which diverges when the curvature of the liquid interface is infinite at the point where the drops first touch. Conventionally, this process has been thought to have just two regimes: a highly viscous one dominated by macroscopic flows pulling the two drops together and an inertial one described by local deformations near the growing neck. We use high-speed imaging, electrical measurements and full Navier-Stokes simulations to reveal a new regime that dominates the asymptotic dynamics of coalescence for any finite viscosity. The character of this new regime improves our understanding of the unexpectedly late viscous-to-inertial crossover [1]. An argument based on force balance and an appropriate choice of length-scales allow the construction of a new phase diagram of coalescence.

[1] J. D. Paulsen, J. C. Burton, S. R. Nagel, PRL 106, 114501 (2011).

Joseph Paulsen
University of Chicago

Date submitted: 21 Nov 2011 Electronic form version 1.4