Abstract Submitted
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An Analytical Criterion for Separation-Driven Coalescence of Droplets ANN LAI, HOWARD STONE, Harvard University — Recent experiments by Bremond *et al.* [1], along with simulations by Yoon *et al.* [2], have demonstrated that two droplets coalesce as they are separating rather than upon their collision. We analyze the experimental configuration in the limit that the continuous phase is more viscous than the droplet phase by applying lubrication analysis followed by the method of domain perturbations to determine the evolution of the deformation as a function of time. We find that there is a universal shape for the deformed droplet at the time of contact. In particular, for two droplets of radius, R, moving apart according to $h_0(t) = h_0(0) + \alpha t^2$, where $2h_0(t)$ is the separation distance, we define a nondimensional parameter, $A = \frac{3\mu R^2\sqrt{\alpha}}{\gamma[h_0(0)]^{3/2}}$, where μ is the viscosity of the continuous phase and γ is the interfacial tension. There exists a critical value, $A_{crit} = 3.0792$, below which coalescence cannot occur.

[1] N. Bremond, A.R. Thiam, and J. Bibette 2008 *Phys. Rev. Lett.* 100, 024501.
[2] Y. Yoon, F. Baldessari, H. Ceniceros, and L.G. Leal 2007 *Phys. Fluids* 19, 102102.

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