Abstract Submitted
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Molecular Events Kick-off Droplet Coalescence[1] SREEHARI PERUMANATH, MATTHEW K. BORG, Univ of Edinburgh, MYKYTA V. CHUBYNSKY, JAMES E. SPRITTLES, Univ of Warwick, JASON M. REESE, Univ of Edinburgh, MICRO NANO FLOWS COLLABORATION — Ranging from the formation of thunderstorms to the operation of office printers, droplet-based systems are ubiquitous in our everyday life. However, thus far we have only had a partial understanding of the mechanisms by which two or more droplets coalesce to form a larger droplet. The classical mechanism underlying coalescence of two droplets is that surface tension drives the process right from the beginning. Using computationally expensive molecular simulations, here we show that it is in fact thermal capillary waves on the droplets' surface that initiate single or multiple contacts between nanodroplets, and coalescence thereafter commences in a 'thermal regime'. Here, the bridge expands linearly in time due to collective molecular jumps near the bridge fronts. In this non-classical regime, surface tension instead acts to suppress the bridge growth rather than enhance it. Transition to the classical hydrodynamic regime only occurs once the bridge radius exceeds a size-dependent thermal length scale, which needs to be considered in hydrodynamic analyses of droplet coalescence.

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