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Coalescence of drops on a substrate

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When two drops come into contact they will rapidly merge and form a single drop. Here we address the coalescence of drops on a substrate – an elementary process encountered for example during condensation and inkjet printing. We focus on the dynamics just after contact, by characterizing the growth of the thin bridge connecting the two drops. For very viscous drops we present similarity solutions for the bridge, and find that the bridge size grows linearly with time t. Both the dynamics and the self-similar bridge profiles are verified quantitatively by experiments. We then consider the coalescence of water drops, for which viscosity can be neglected and liquid inertia becomes rate-limiting for the merging process. Once again, we find that experiments display self-similarity, but now the bridge size grows with as $t^{2/3}$ or $t^{1/2}$, depending on whether the contact angle is above or below 90°. A geometry-based scaling theory is able to capture these observations.