

Abstract Submitted
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Viscous spread under an elastic lid JOHN LISTER, JEROME NEUFELD, University of Cambridge, DOMINIC VELLA, University of Oxford — We consider theoretically and experimentally the injection and axisymmetric spread of viscous fluid beneath a flexible elastic lid. In the experiments, glycerol is injected at a constant rate beneath the centre of a 1 cm thick, 50 cm diameter, soft rubber sheet laid on a rigid horizontal surface, which was prewet with an $\approx 200\mu\text{m}$ thick fluid film. Measurements of the surface elevation and radial propagation are in good agreement with lubrication calculations incorporating bending stresses and gravity. Remarkably, even this simple system evolves through four asymptotic regimes with successive radial spreading laws $r \sim t^{1/6}, t^{7/22}, t^{7/12}$ and $t^{1/2}$. We determine the corresponding prefactors, and confirm the results numerically and experimentally. An alternate problem without the prewetting film is relevant to shallow geological intrusions, called laccoliths, for which we obtain yet more exotic scalings. Our analysis of tip peeling processes in these relatively simple problems gives insight that may find application in more complex problems such as cell adhesion, delamination, and the dynamics of MEMS.

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