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Deformation and dewetting of liquid films under gas jets CHINASA OJIAKO, Loughborough University, RADU CIMPEANU, Oxford University, HEMAKA BANDULASENA, ROGER SMITH, DMITRI TSELUIKO, Loughborough University — We study the deformation and dewetting of a liquid film in a cylindrical beaker under the influence of an impinging gas jet. To obtain initial insight into relevant regimes and timescales of the system, we first derive a reduced-order model (a thin-film equation) based on the long-wave assumption and on appropriate decoupling the gas problem from that for the liquid [1-3] and taking into account a disjoining pressure [4]. We also perform direct numerical simulations (DNS) of the full governing equations using two different approaches, the Computational Fluid Dynamics (CFD) package in COMSOL and the volume-of-fluid Gerris package. The DNS are used to validate the results for the thin-film equation and also to investigate the regimes that are beyond the range of validity of this equation. We additionally compare the computational results with experiments and find good agreement.
[1] E. O. Tuck, J. Austral. Math. Soc. (Ser. B) 19, 66 (1975)
[2] D. Tseluiko and S. Kalliadasis, J. Fluid Mech. 673, 9 (2011)
[3] R. Vellingiri, D. Tseluiko and S. Kalliadasis, J. Fluid Mech. 56, 93 (2015)
[4] M. Galvagno, D. Tseluiko, H. Lopez and U. Thiele, Phys. Rev. Lett. 112, 137803 (2014)

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