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Soft Levelling: Capillary Relaxation of a Thin Liquid Film on an Elastic Substrate MARCO RIVETTI, CHRISTINE LINNE, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, THOMAS SALEZ, MAXENCE ARUTKIN, ELIE RAPHAEL, UMR 7083 Gulliver, ESPCI and CNRS, PSL Research University, Paris, France, OLIVER BAEUMCHEN, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — A thin liquid film with non-zero curvature at its free surface spontaneously relaxes towards a flat configuration. The flow of this liquid film is driven by Laplace pressure gradients and it is resisted by viscosity. In the last few years the dynamics of this system has been studied experimentally, numerically and analytically. Inspired by recent progresses on the wetting behaviour of liquid droplets on soft substrates, we here consider the relaxation of a thin viscous film supported by an elastic foundation. We present experiments involving thin polystyrene films on polydimethylsiloxane substrates, where the dynamics of the liquid-air interface is monitored using an atomic force microscope. In this system, Laplace pressure gradients not only drive the flow but they also induce elastic deformations on the substrate. These deformations affect the flow and the shape of the liquid-air interface itself, giving rise to an original example of elasto-capillary interaction that is not mediated by the presence of a contact line. We show that the width of the profile scales with the time to the power 1/6, rather than 1/4 which has been observed on rigid substrates. A theoretical model that describes the coupled evolution of the elastic-liquid and liquid-air interfaces is also presented.

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