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Spreading on viscoelastic solids: Are contact angles selected by Neumann's law? STEFAN KARPITSCHKA, Max Planck Institute for Dynamics and Self-Organization (MPIDS), Göttingen, Germany, MATHIJS VAN GORCUM, Physics of Fluids Group, University of Twente, Enschede, The Netherlands, BRUNO ANDREOTTI, Laboratoire de Physique Statistique, Univ. Paris-Diderot, France, JACCO H. SNOEIJER, Physics of Fluids Group, University of Twente, Enschede, The Netherlands — The spreading of liquid drops on soft substrates is extremely slow, owing to strong viscoelastic dissipation inside the solid. A detailed understanding of the spreading dynamics has remained elusive, partly owing to the difficulty in quantifying the strong viscoelastic deformations below the contact line that determine the shape of moving wetting ridges. Here we present direct experimental visualizations of the dynamic wetting ridge, complemented with measurements of the liquid contact angle. It is observed that the wetting ridge exhibits a rotation that follows exactly the dynamic liquid contact angle, as was previously hypothesized [Karpitschka et al., Nature Commun. (2015)]. This experimentally proves that, despite the contact line motion, the wetting ridge is still governed by Neumann's law. Furthermore, our experiments suggest that moving contact lines lead to a variable surface tension of the substrate. We therefore set up a new theory that incorporates the influence of surface strain, for the first time including the so-called Shuttleworth effect into the dynamical theory for soft wetting. It includes a detailed analysis of the boundary conditions at the contact line, complemented by a dissipation analysis, which shows, again, the validity of Neumann's balance.

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