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Contact dynamics and morphology under drops impacting an oil-covered substrate

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Droplets impacting at low Weber numbers on sufficiently smooth solid substrates will bounce on a thin layer of entrained air, or will eventually contact the substrate. When and how this happens is influenced by the substrate properties, e.g., by charging or by elasticity. Here, we consider smooth glass slides covered by thin oil films of different thicknesses and viscosity. We investigate this impact situation using high-speed interferometry at oblique incidence and side / top view imaging. The thickness profile of the entrained air layer displays a central bubble, followed by a broad annual region of only slightly varying thickness in the range of few hundreds of nanometers. When the Weber number is just too large for the droplet to rebound or when local disturbances exist, a localized contact between the drop and oil layer emerges. While we do not control when and where the contact forms, we are mainly interested in the spreading dynamics and morphology of the contact line. The physical problem at hand can be seen from both the wetting perspetive of the drop liquid on the thin layer as well as from the perspective of the air film, rupturing between the drop and the microscopic viscous layer. We analyse the dynamics experimentally in view of both situations.

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Sitzung Einordnung: Short Talks