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Drop shaping and fragmentation by laser-pulse impact ALEXANDER L. KLEIN, WILCO BOUWHUIS, CLAAS WILLEM VISSER, Physics of Fluids Group, Faculty of Science and Technology, University of Twente, The Netherlands, HENRI LHUISSIER, Laboratoire Matière et Systèmes Complexes, Université Paris Diderot, France, JACCO H. SNOEIJER, Physics of Fluids Group, Faculty of Science and Technology, University of Twente, The Netherlands, EMMANUEL VILLERMAUX, Aix-Marseille Université, IRPHE, France, DETLEF LOHSE, HANNEKE GELDERBLOM, Physics of Fluids Group, Faculty of Science and Technology, University of Twente, The Netherlands — We show how the deposition of laser energy in a superficial layer of an unconfined liquid drop can lead to propulsion, strong deformation and eventually fragmentation of the drop. Combining high-speed with stroboscopic imaging, we reveal that the laser-induced vaporization at the drop surface is the driving mechanism for the hydrodynamic response of the drop. We provide scaling arguments for the linear relations between the absorbed laser energy and both the propulsion speed and the lateral expansion of the drop prior to its fragmentation. The resulting drop shape is well reproduced by Boundary Integral simulations. Last, we show by high speed imaging in a front and side-view configuration how instabilities develop on the deforming liquid sheet, which eventually results in the drop breaking-up in smaller fragments. We characterize this fragmentation process and its dependence on the laser pulse properties.

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