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Out-of-Plane Self-Propulsion of Droplets on Heated Lubricant-Impregnated Surfaces. SUSMITA DASH, Indian Institute of Science, JOLET DE RUITER, Wageningen University, KRIPA VARANASI, Massachusetts Institute of Technology, SUSMITA DASH TEAM, JOLET DE RUITER TEAM, KRIPA VARANASI TEAM — The dynamics of droplets on heated surfaces is crucial for heat transfer applications such as spray cooling. Here we report on the behavior of millimetric water droplets on heated liquid impregnated surfaces (LIS) that are stable at high temperatures. Next to a gentle in-plane hopping motion, droplets can demonstrate one of two vigorous behaviors – at temperatures far below the typical Leidenfrost temperature: either a trapped gas bubble expands to "blow-up" the droplet into a thin liquid shell, or the droplet "jumps" out-of-plane. While the in-plane motion of the droplet is on the order of 10 mm/s, the droplet is propelled vertically upwards to several times its diameter at a velocity of approximately 200 mm/s. We present the mechanics underlying this behavior of droplets, which is specific to lubricant-impregnated surfaces and crucially depends on the thermodynamic state of the impregnating liquid.

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