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Spontaneous droplet self-launching on superhydrophobic surfaces
THOMAS SCHUTZIUS, STEFAN JUNG, TANMOY MAITRA, GUSTAV GRAEBER, DIMOS POULIKAKOS, ETH-Zurich — Spontaneous removal of droplets from surfaces is of significant importance in nature and many technologies, e.g., self-cleaning surfaces. Despite progress, the understanding of phenomena leading to such behavior, combined with surface design promoting their manifestation, remains a challenge. We show how water droplets in contact with superhydrophobic surfaces in a low-pressure environment can self-remove through sudden spontaneous launching and subsequent repeated bouncing behavior. We demonstrate that this bouncing results from the combined effect of droplet vaporization, vapor flow in the surface texture, and substrate adhesion leading to a forced, underdamped, mass-spring-damper system behavior. This work is a step toward understanding inherent physical phenomena of droplet-surface interactions manifesting themselves at conditions promoting vaporization, e.g. low-pressure environments, and shows how surface texture design aware of such phenomena alone, can prohibit water retention on surfaces.

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