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Particle-Laden Leidenfrost Droplets: Final-Stage Observations

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— Little interest has been paid to the final stage of a Leidenfrost droplet until a recent study by Celestini et al [Phys. Rev. Lett. 109, 034501 (2012)] reporting an unexpected take-off phenomenon of micrometer sized pure liquid droplets ($R_l < R < R_i$, where R_l is the take-off radius, and R_i is the critical radius above which droplets start to lose sphericity). In our study, we first report an unexpected observation on millimeter sized water Leidenfrost droplets ($R > R_i$), which behave quite differently from the previous study. While an originally micrometer sized Leidenfrost droplet takes off due to breakdown of lubrication regime, and hovers above its vapor layer until disappearing in the final stage of evaporation, an originally millimetric Leidenfrost drop is observed to hover and oscillate, taking off and falling back consecutively. We further report another interesting observation on water droplets containing micrometric glass beads. These droplets spontaneously organize and buckle together during evaporation. In addition to oscillation just like pure droplets, these particle-laden drops create an unexpected explosive shoot-up at the end of evaporation.

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