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Star-shaped oscillations of Leidenfrost droplets on a curved surface XIAOLEI MA, JUAN-JOSÉ LIÉTOR-SANTOS, JUSTIN BURTON, Department of Physics, Emory University — We investigate the spontaneous oscillations of a Leidenfrost droplet, which is levitated by a cushion of evaporated vapor on a hot surface. The oscillations exhibit a star-shaped pattern determined by a standing wave along the droplet periphery, and obey a quasi-2D dispersion relation. The bowl-shaped curvature of the surface suppresses the buoyancy-driven Rayleigh-Taylor instability in the vapor layer, allowing for very large droplets with up to 13 lobes. Although droplets of a given size can theoretically contain various oscillatory modes, we observe only one mode of oscillation, so that all star-shaped droplets have nearly the same frequency regardless of size. We suspect that the origin of this mode selection is due to a parametric coupling between vertical and azimuthal oscillations of the droplet, similar to experiments of droplets on hydrophobic, vibrated surfaces [1]. In order to investigate the phenomenon further, we also measure the pressure variations beneath the droplet during quiescent and oscillatory phases.

[1] P. Brunet and J. H. Snoeijer, Eur. Phys. J. Spec. Top. 192, 207 (2011).

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