Electronic Supplementary Material (ESI) for Soft Matter.

Oscillation and self-propulsion of Leidenfrost droplets enclosed in cylindrical cavities

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Supplementary Information S1: Estimation of droplet volume

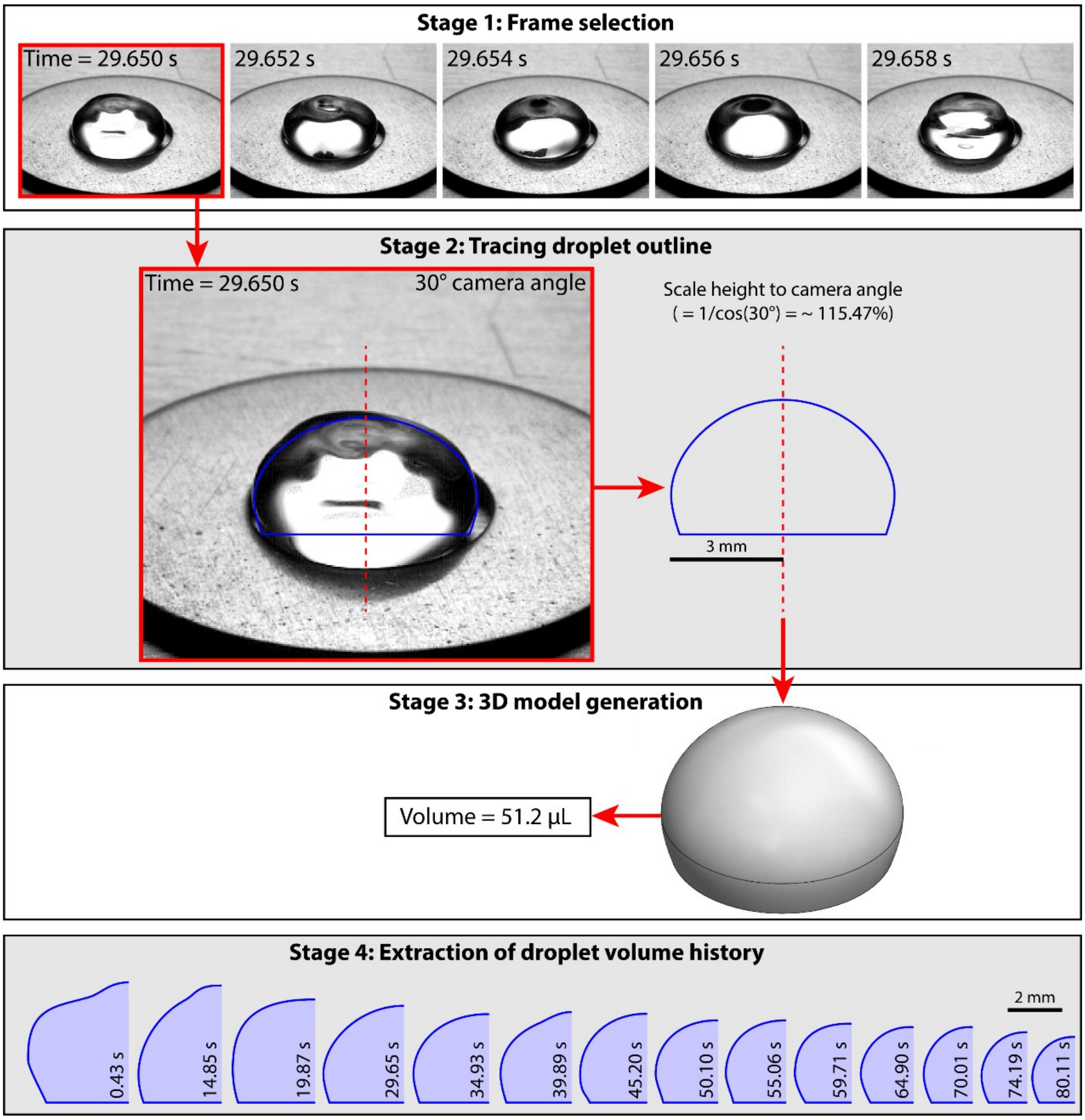

Figure S1. The method used to estimate the droplet volume.

Supplementary Information S2: Peak oscillation frequency during the first capillary wave instability mode

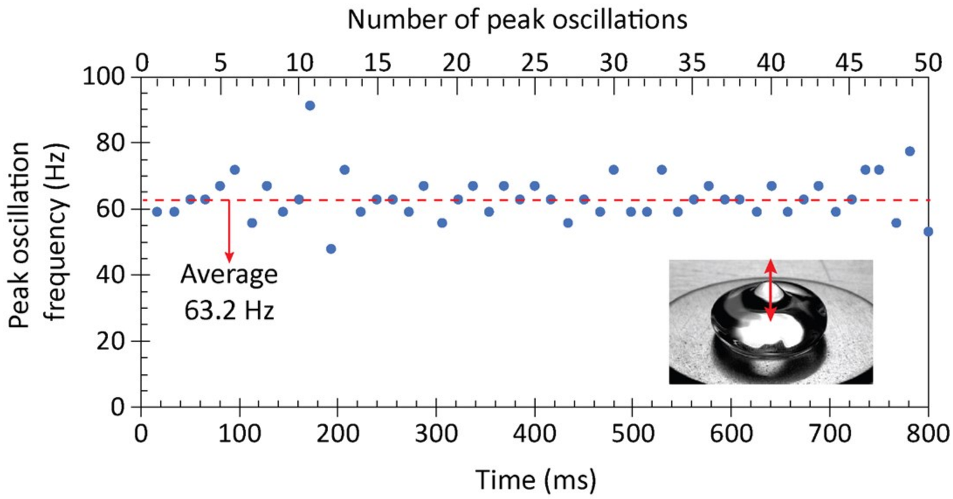

Figure S2. Peak oscillation frequency measured over an 800 ms period during the first capillary wave instability mode.

Supplementary Information S3: Dynamic variations of lobe diameter during the four-lobed mode

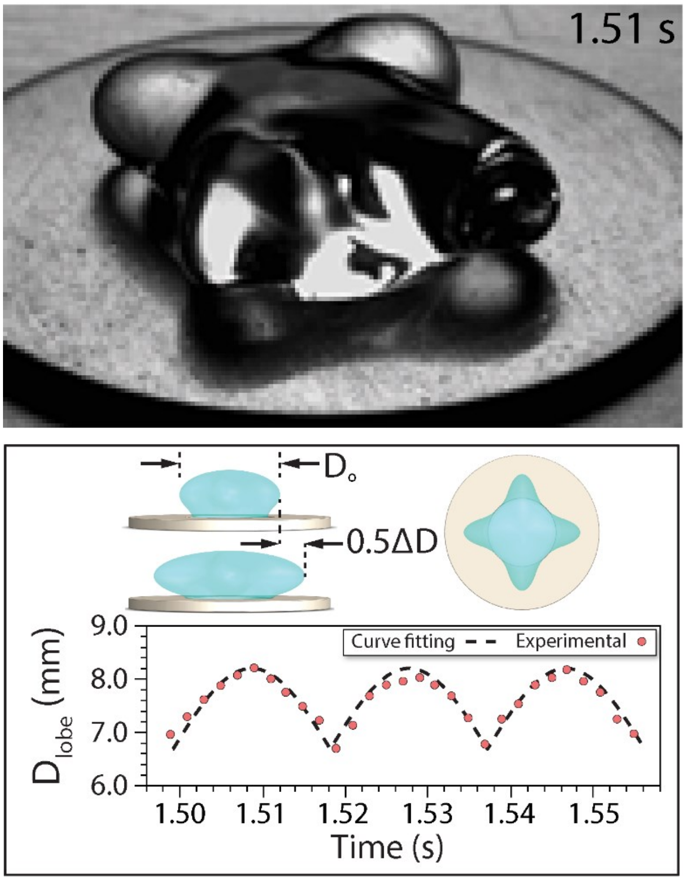

Figure S3. Dynamic variations of lobe diameter during the four-lobed mode.

Supplementary Information S4: Evolution of five-lobed dynamic mode in a circular metallic disk

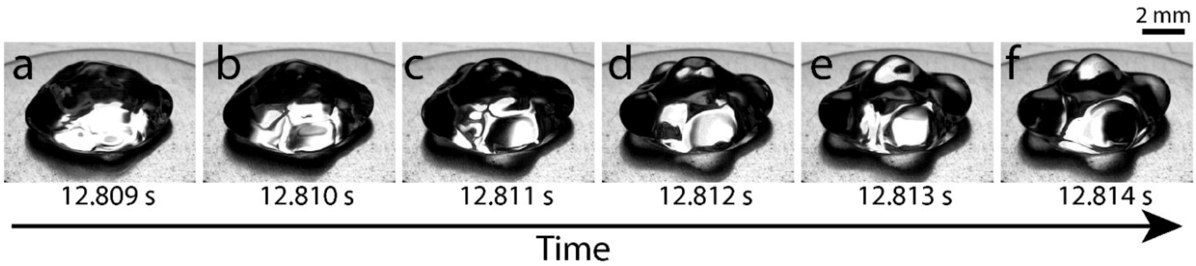

Figure S4. High-speed images showing the evolution of five-lobed droplets in a circular metal disk.

Supplementary Information S5: Dynamic variations of droplet height during the two-stage telescopic oscillation mode

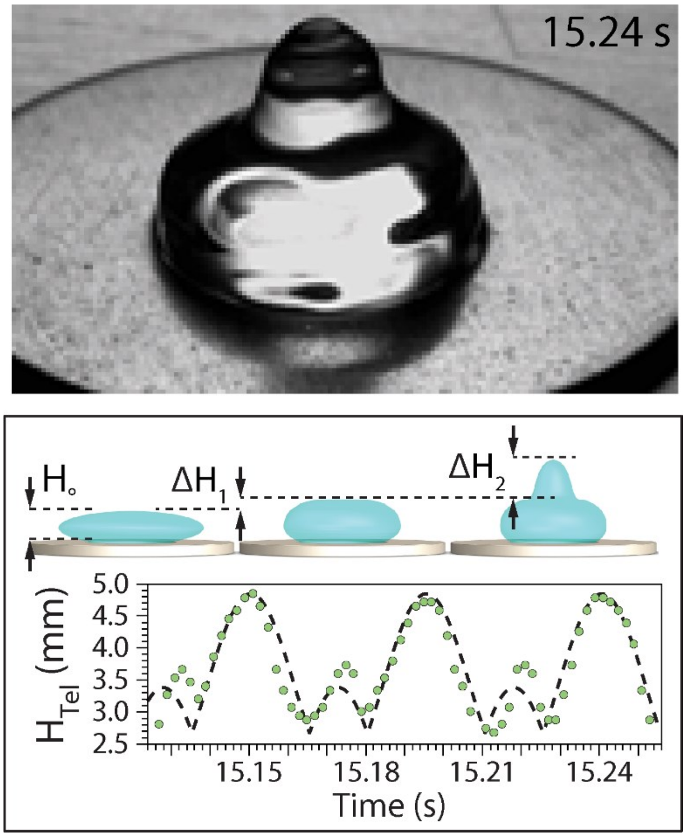

Figure S5. Dynamic variations of droplet height during the two-stage telescopic oscillation mode.

Supplementary Information S6: Analysing the dynamic variations of volume for Leidenfrost droplets enclosed in a metallic disk

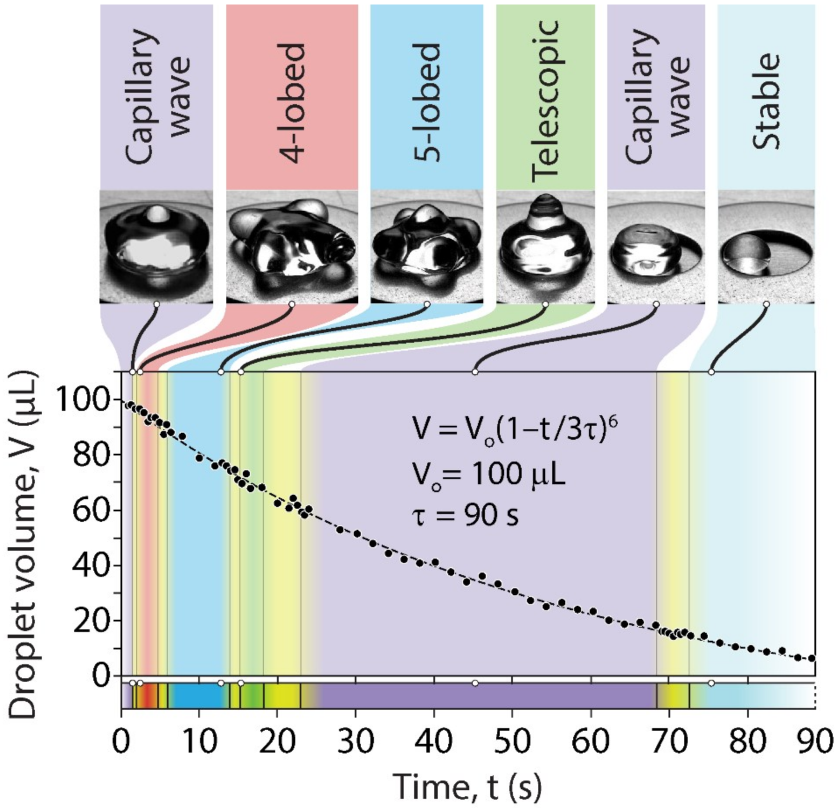

Figure S6. Analysis of dynamic variations of Leidenfrost droplets in a metallic disk. Experimental points are fitted with a symmetrical sigmoidal function.

Supplementary Information S7: Analysing the dynamic modes of Leidenfrost droplets in a metallic disk over six independent measurements

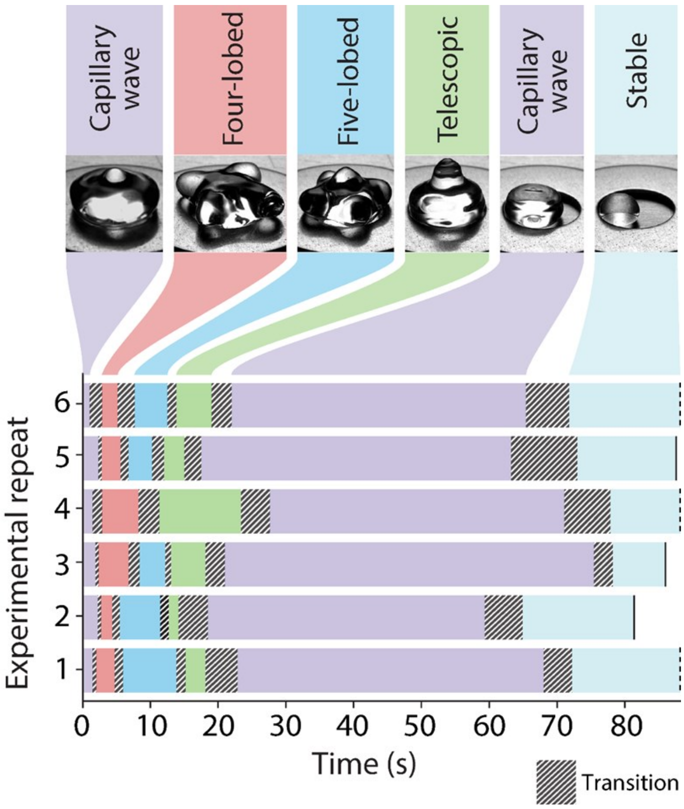

Figure S7. Comparing the dynamic modes of Leidenfrost droplets in a metallic disk over six independent measurements

Supplementary Information 8: Metallic disks with offset radial grooves

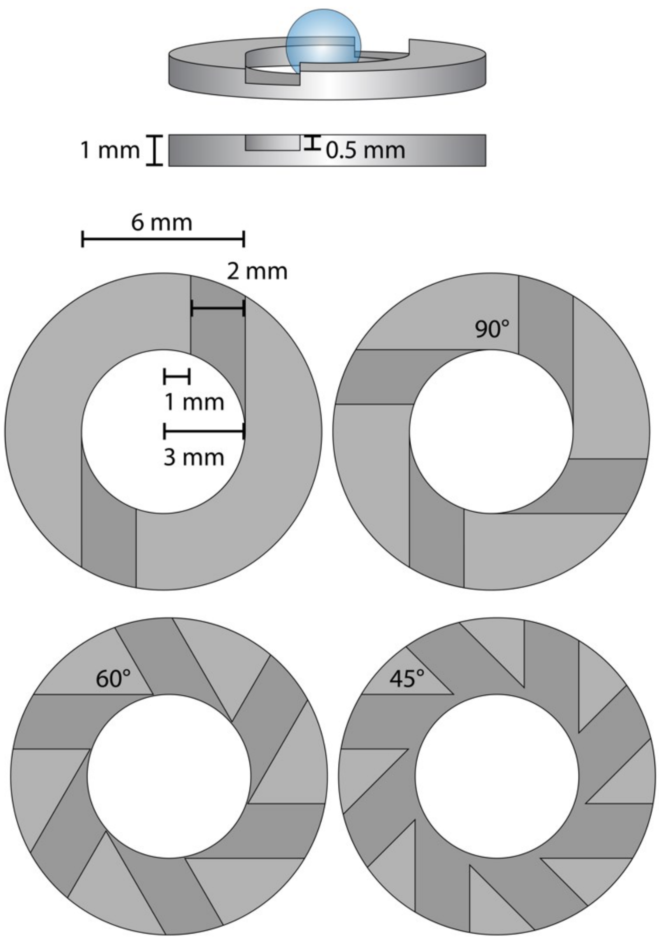

Figure S8. The detailed geometries of the metallic disks with offset radial grooves.

Supplementary Information 9: Leidenfrost droplet hovering on the top surface of the disk during its self-propulsion mode

Figure S9. Leidenfrost droplet leaning on the edge of the disk during the self-propulsion mode, which enables it to hover on the top surface of the disk.

Supplementary Information 10: Analysing the dynamic modes of Leidenfrost droplets in an upright eight-grooved disk over six independent measurements

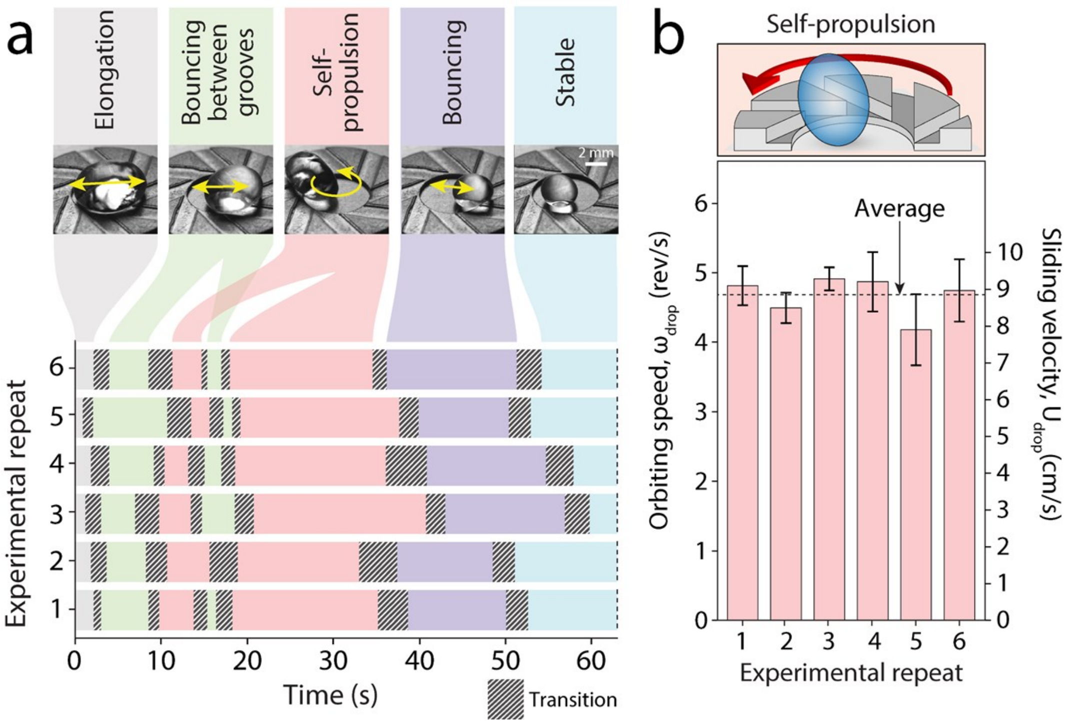

Figure S10. Comparing the dynamic modes of Leidenfrost droplets in an upright eight-grooved disk over six independent measurements: **(a)** Dynamic atlas. **(b)** The values of droplet orbiting speed and sliding velocity obtained in each experiment.

Supplementary Information 11: Overlaid images of a Leidenfrost droplet during sliding motion

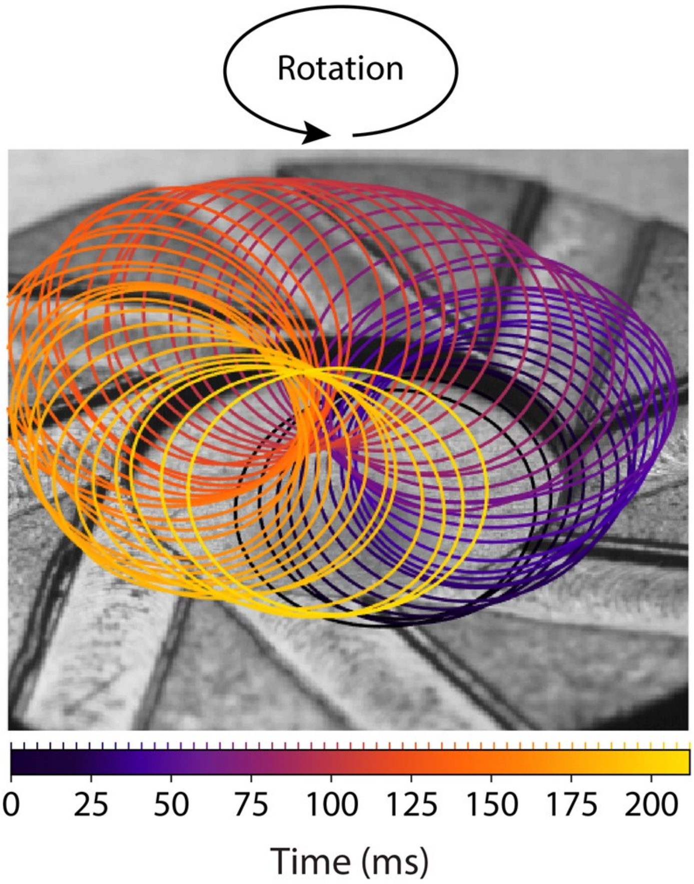

Figure S11. Sliding motion of a Leidenfrost droplet in a metallic disc with eight offset radial grooves. The droplet outlines were extracted and overlayed for every 4th frame or every 4 ms.