Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Final fate of a Leidenfrost droplet: Explosion or takeoff SIJIA LYU, Tsinghua University, VARGHESE MATHAI, Brown University, YUJIE WANG, Tsinghua University, BENJAMIN SOBAC, PIERRE COLINET, Universit libre de Bruxelles, DETLEF LOHSE, University of Twente, CHAO SUN, Tsinghua University, CENTER FOR COMBUSTION ENERGY, DEPARTMENT OF ENERGY AND POWER ENGINEERING TEAM, ENGINEERING RESEARCH CENTER COLLABORATION, TIPS-FLUID PHYSICS COLLABORATION, PHYSICS OF FLUIDS & MAX PLACK CENTER COLLABORATION — When a liquid droplet is placed on a very hot solid, it levitates on its own vapor layer, a phenomenon called the Leidenfrost effect. Although the mechanisms governing the droplet's levitation have been explored, not much is known about the fate of the Leidenfrost droplet. Here we report on the final stages of evaporation of Leidenfrost droplets. While initially small droplets tend to take off, unexpectedly, the initially large ones explode with a crack sound. We interpret these in the context of unavoidable droplet contaminants, which accumulate at the droplet-air interface, resulting in reduced evaporation rate, and contact with the substrate. We validate this hypothesis by introducing controlled amounts of microparticles and reveal a universal 1/3-scaling law for the dimensionless explosion radius versus contaminant fraction. Our findings open up new opportunities for controlling the duration and rate of Leidenfrost heat transfer and propulsion by tuning the droplet's size and contamination.

Sijia Lyu
Tsinghua University

Date submitted: 23 Jul 2019 Electronic form version 1.4