Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

The Leidenfrost Effect in Liquid Helium[1] PETER TABOREK, MATTHEW WALLACE, MICHAEL MILGIE, DAVID MALLIN, University of California, Irvine, KENNETH LANGLEY, ANDRES AGUIRRE-PABLO, SIGUDUR THORODDSEN, King Abdullah University of Science and Technology
— We present the results of our investigation of the Leidenfrost effect in liquid helium droplets impacting on a solid dry surface in an optical cryostat at temperatures between 3.5 K and 5.2 K at saturated vapor pressure. We use high-speed video to image the impacting drops and record the minimum temperature difference Delta T necessary to levitate the drops, and also to observe the lifetime, changing radius, and termination of levitation. The Delta T needed to levitate the drops is much smaller than has been predicted by previous authors examining film boiling in helium, requiring only 1-70 mK for levitation. We observe that the Leidenfrost onset temperature TL is a function of the ambient temperature and runs approximately parallel to the vapor pressure curve, with a lower Delta T needed to levitate the drop at higher temperatures. We compare our results to previous models for TL, and we calculate the vapor film thickness to be 700-1250 nm, much thinner than for experiments with conventional fluids. We observe that helium drops levitate over both a warmer solid surface and a warmer thin layer of liquid helium.

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Date submitted: 31 Jul 2019 Electronic form version 1.4