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The origin of star-shaped oscillations of Leidenfrost drops XIAOLEI MA, JUSTIN C. BURTON, Department of Physics, Emory University — We experimentally investigate the oscillations of Leidenfrost drops of water, liquid nitrogen, ethanol, methanol, acetone and isopropyl alcohol. The drops levitate on a cushion of evaporated vapor over a hot, curved surface which keeps the drops stationary. We observe star-shaped modes along the periphery of the drop, with mode numbers $n = 2$ to 13. The number of observed modes is sensitive to the properties of the liquid. The pressure oscillation frequency in the vapor layer under the drop is approximately twice that of the drop frequency, which is consistent with a parametric forcing mechanism [1]. However, the Rayleigh and thermal Marangoni numbers are of order 10,000, indicating that convection should play a dominating role as well. Surprisingly, we find that the wavelength and frequency of the oscillations only depend on the thickness of the liquid, which is twice the capillary length, and do not depend on the mode number, substrate temperature, or the substrate curvature. This robust behavior suggests that the wavelength for the oscillations is set by thermal convection inside the drop, and is less dependent on the flow in the vapor layer under the drop. [1] P. Brunet and J. H. Snoeijer, Eur. Phys. J. Spec. Top. 192, 207 (2011).

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