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Stable, streamlined and helical cavity formation by the impact of Leidenfrost spheres MOHAMMAD MANSOOR, KAUST USU, IVAN VAKARELSKI, KAUST, JEREMY MARSTON, Texas Tech University, TADD TRUSCOTT, Utah State University, SIGURDUR THORODDSEN, KAUST — This work reports results from an experimental study on the formation of stable-streamlined and helical cavity wakes following the free-surface impact of Leidenfrost spheres. The Leidenfrost effect encapsulates the sphere by a vapor layer to prevent any physical contact with the surrounding liquid. This phenomenon is essential for the pacification of acoustic rippling along the cavity interface to result in a stable-streamlined cavity wake. Such a streamlined configuration experiences drag coefficients an order of magnitude lower than those acting on room temperature spheres. A striking observation is the formation of helical cavities which occur for impact Reynolds numbers $Re_0 \geq 1.4 \times 10^5$ and are characterized by multiple interfacial ridges, stemming from and rotating synchronously about an evident contact line around the sphere equator. This helical configuration has $40 - 55\,\%$ smaller overall force coefficients than those obtained in the formation of stable cavity wakes.

Mohammad Mansoor
KAUST
USU

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