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Visualization of liquid Helium flows generated by an oscillating rectangular cylinder

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For the first time, a cylinder of rectangular cross section, performing quasi-harmonic oscillations in liquid helium, was employed for the experimental study of the dynamics of macroscopic vortex structures shed at the sharp edges of the obstacle. The flow of liquid helium was visualized by the motions of small, solidified deuterium particles, dispersed in the experimental cell and illuminated by a thin laser sheet. The particle positions were captured by a camera and the videos were processed in order to obtain their trajectories and velocities. A new scalar quantity was defined to properly characterize the magnitude of macroscopic vortices, both in He I, a classical viscous fluid, and He II, a fluid displaying superfluidity. We show that, at lower values of the relevant Reynolds number, the flows in He I and He II display a significant quantitative difference. This effect can be assigned to different length scales that limit coherent vortical structures in He I and He II. At large Reynolds numbers, the flows appeared instead to be similar, which agrees with the current understanding of quantum flows, at large enough length scales.

We acknowledge that this work represents a modified version of the bachelor thesis of the author, submitted at the Faculty of Mathematics and Physics, Charles University in Prague. Additionally, the results were published [1] and presented in both domestic and foreign conferences.

[1] D. Duda, P. Švančara, M. La Mantia, M. Rotter, and L. Skrbek: *Phys. Rev. B* **92**, 064519 (2015)

Sekce

Fyzika kondenzovaných látek

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