Dynamics of Solid Deuterium Particles in Quantum Turbulence Generated in Thermal Counterflow

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Quantum turbulence in thermal counterflow of superfluid ^{4}He is investigated by visualization at length scales ℓ_{exp} ranging about two orders of magnitude across the mean distance ℓ between quantized vortices. The Lagrangian dynamics of solid deuterium particles of size $d \approx \ell/10$ is studied by using the particle image velocimetry and particle tracking velocimetry techniques. It is shown that the normalized probability distributions of the particle velocity and acceleration in the direction perpendicular to the counterflow velocity change from the power-law shapes typical of quantum turbulence, at $\ell_{\mathrm{exp}} < \ell$, to forms similar to those obtained for classical turbulent flows, at $\ell_{\mathrm{exp}} \approx \ell$.[1,2] Additionally, preliminary results on the dynamics of particles in thermal counterflow past a circular cylinder are discussed, focusing on the occurrence of macroscopic vortical structures in quantum turbulence and on the thermal counterflow generated by a heated cylinder.
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