Abstract Submitted
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Towed-Grid Studies of Quantum Turbulence SHU-CHEN LIU, GREG LABBE, GARY G. IHAS, University of Florida — We produce Homogeneous Isotropic Quantum Turbulence (HIQT) in liquid helium at 20 mK to compare with classical experiments and theories. Specifically, in the absence of viscosity, through what path does the turbulence decay? To produce HIQT we must quickly accelerate a grid to about 1 m/s in a channel of superfluid helium, tow it for 1 cm at a nearly constant speed, and then stop it equally quickly. To avoid joule and eddy current heating of the liquid helium, a magnetically shielded superconducting linear motor has been built, guided by simulations, along with the current pulses control program written in LabView with an embedded C compiler. The simulations, design process, and the experimental data demonstrating the functioning motor will be presented. We measure the HIQT energy decay mechanism using a calorimetric technique. Recent theory suggests the decay occurs through a Kelvin-wave cascade on the vortex lines which couples the initially large turbulent eddies to the short wavelength phonon spectrum of the liquid, yielding a characteristic rate of temperature rise. Doped germanium thermometers less than 300 μm diameter immersed in the turbulent helium allow fast calorimetric measurements to be made. The decay of turbulence is detected by the rate of temperature rise in the isolated cell after the grid is pulled.

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