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Study of Grid Turbulence in Superfluid He^4 in a Large Square Channel[1] JIHEE YANG, GARY G. IHAS, University of Florida, WILLIAM F. VINEN, University of Birmingham — Studying quantum turbulence in superfluid helium can lead us to a deeper understanding in classical turbulence. We study grid-generated turbulence in liquid helium in the temperature range 1.4 K-2.1 K for homogeneous and isotropic turbulence (HIT). Using a conventional second sound attenuation method, the decay of vorticity (ω) is observed in a long, square cross-section channel. Theories assume that energy is injected on the scale of the grid mesh size, and predict that when the energy containing eddies are growing, the vorticity decays as $\omega \sim t^{-11/10}$ or $\omega \sim t^{-17/14}$. When they saturate at the channel size, the vorticity begins decaying as $\omega \sim t^{-3/2}$. Previous experiments have been performed in 1 cm^2 square channels, with a limited range of mesh sizes[2]. We have used a larger channel and various mesh sizes to investigate grid mesh size effects and decay before saturation. A novel phase and amplitude locked feedback system ensures fast, stable attenuation data without disturbances from temperature fluctuations.

[1]US NSF DMR #1007937 and EPSRC EP /H04762X/1.
[2]M. R. Smith, R. J. Donnelly, N. Goldenfeld, and W. F. Vinen, Phys. Rev. Lett. 71, 2583 (1993).; S. R. Stalp, Ph.D. dissertation, University of Oregon 1998.; L. Munday, Ph.D. dissertation, Lancaster University 2014.

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