MAR07-2006-000418

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Pure quantum turbulence in superfluid ^{3}He.

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Turbulence in classical fluids has far reaching technological implications but is poorly understood. A better understanding might be gained from studying turbulence in quantum systems. In a pure superfluid (at low temperatures), there is no viscosity and vortex lines are quantised. Quantum turbulence consists of a tangle of quantised vortex lines which interact via their self induced flow. We have recently developed techniques for detecting quantum turbulence in superfluid ^{3}He-B in the low temperature limit. We find that the transition to turbulence from a moving grid occurs by the entanglement of emitted vortex rings. At low grid velocities, ballistic vortex rings are emitted which become entangled at higher grid velocities leading to turbulence. The quantum turbulence decays in a manner very similar to classical turbulence, suggesting that energy is transferred down a broad range of length scales. The decay mechanism, in the absence of any normal fluid, is a very interesting, and currently unsolved, theoretical problem. Experimentally, it appears that the quantum of circulation plays the role of viscosity in governing the decay rate. We hope to gain more detailed information by measuring fluctuations in the turbulent flow field. We discuss current and future experiments.