Observations of vortex emissions from superfluid ^{4}He turbulence at high temperatures

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An immersed object with high velocity oscillations can generate a quantum turbulence in superfluid ^{4}He, even at very low temperatures. The continuously generated turbulence would emit many vortex rings with a self-induced velocity inversely proportional to a ring size from a turbulent region corresponding to an oscillating region. Time-of-flight measurements of vortex rings, therefore, are an efficient technique to explore the quantum turbulence with respect to vortex emissions. In the present work, we investigate vortex emissions from quantum turbulence in superfluid ^{4}He at high temperatures, by using three vibrating wires as a turbulence generator and vortex detectors. Two detector wires were mounted around a generator wire: one in parallel and the other in perpendicular to the oscillation direction of the generator. Time-of-flights of vortex rings show an exponential distribution with a non-detection period t_0 and a mean detection period t_1. The non-detection period includes a generation time of a fully developed turbulence and a time-of-flight of a vortex ring [1]. At high temperatures, non-superfluid component as a viscid fluid may dissipate quantized vortices in the superfluid, resulting that only large sizes of rings are reachable to a detector. Using this method, we will report the anisotropy of vortex emissions and a turbulent region with respect to both sizes and detection rates of reachable vortex rings.

1. Y. Nago, A. Nishijima, H. Kubo, T. Ogawa, K. Obara, H. Yano, O. Ishikawa, and T. Hata: Phys. Rev. B 87, 024511 (2013).

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