Vortex Emission from Quantum Turbulence Generated in Superfluid ^{4}He

H. Yano

Graduate School of Science, Osaka City University, Japan

Motions of an object immersed in superfluid helium would be only expected to cause superflows around the object; however, motions with a high velocity can generate quantum turbulence in many cases, even at very low temperatures. In experiments, quantized vortices nucleate during cooling through the superfluid transition, remaining attached to surfaces of an helium container and an immersed object. An oscillating object with attached vortices, therefore, generates quantum turbulence and emits vortex rings continuously, by stretching the attached vortices in relative superflows and forming vortex tangles [1].
In the present work, we report the vortex emissions from quantum turbulence generated continuously in superfluid ^{4}He [2]. We used three vibrating wires: two vortex-attached wires for turbulence generation and a vortex-free wire for vortex ring detection, located in parallel with each other. The vortex-free vibrating wire is made of a thin superconducting wire with smooth surfaces [1]. Using this setup, we have investigated time-of-flights of emitted vortex rings. Firstly, we confirmed the characteristics of the vortex detection. The velocities of detected vortex rings are limited to the velocity of the detector wire. Secondly, we have investigated the emission rates of vortex rings for two detector velocities. Vortex rings with lower velocities emit radially from the turbulence, though the emissions seem to be rather anisotropic at higher velocities. Thus the vortex detection using a vortex-free vibrating wire is an efficient way to explore vortex emissions from quantum turbulence.

1. R. Goto, S. Fujiyama, H. Yano, M. Tsubota, *et al.*, Phys. Rev. Lett. **100**, 045301 (2008).
2. Y. Nago, H. Yano, *et al.*, Phys. Rev. B **87**, 024511 (2013).

Section: VT - Vortices and turbulence

Keywords: vortex ring, quantum turbulence, superfluid ^{4}He

INVITED PAPER