

## Generation and Detection of Vortex Rings in Superfluid $^4\text{He}$ at Very Low Temperature

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A vortex ring flights in a superfluid sea, propelled by quantized circulation around a vortex core. Although a vortex core is very thin, tracer particles attached to a core enable to observe the motion of a vortex ring. It is, however, very difficult by this method to study the motion of a vortex ring itself, with no effect of tracer particles. In the present work, we report the flight of vortex rings with no tracer particles, by using vibrating wires as a generator and a detector of vortex rings. A vortex-free vibrating wire enables to detect a vortex ring.<sup>1</sup>

The time of flights of vortex rings are distributed, because vortex rings flight in any directions from the generator and the detector responds only to a reachable vortex ring. By measuring the time-of-flights many times, we find that the distribution is exponential with an undetected period, which corresponds to the time of the fastest flight of a vortex ring. This result indicates that generated vortex rings are limited in size, resulting in a finite flight velocity. Increasing generation power of vortex rings modifies a simple exponential distribution, suggesting the generation of vortex clouds. These experimental results are confirmed by simulations of the generation and the detection of vortex rings.

<sup>1</sup>R. Goto, S. Fujiyama, H. Yano, M. Tsubota, *et al.*, Phys. Rev. Lett. **100**, 045301 (2008).