

An Introduction to the Recent Studies of Quantized Vortices

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A quantized vortex is a typical object in superclean quantum coherent systems, being an important keyword in the research project of our A03 group. In this talk I will discuss the characteristics of quantized vortices, especially how they are different from usual classical vortices, followed by the recent understanding and topics in superfluid 4He, superfluid 3He and atomic Bose-Einstein condensates.

Since the first discovery of quantized vortices in superfluid 4He, they have been studied mainly in the field of low temperature physics for about a half century. One of the most important topics has been quantum turbulence made by quantized vortices. This research has entered a new stage since the middle of 1990's [1], and now lots of major experimental groups in Europe study quantum turbulence. The exhausted studies in superfluid 3He have revealed many kinds of exotic quantized vortices appearing in multi-component superfluids [2]. The realization of atomic Bose-Einstein condensation in 1995 opens the new frontiers on this issue. The merits of this system are that condensates can be visualized directly and the interaction parameters can be controlled by the Feshbach resonances. The research of vortices in multi-component Bose condensates is in progress [3].

[1] M. Kobayashi and M. Tsubota, *J. Phys. Soc. Jpn.* **74**, 3248 (2005)

[2] M. Krusius, *J. Low Temp. Phys.* **91**, 233 (1993)

[3] K. Kasamatsu *et al.*, *Int. J. Mod. Phys. B* **19**, 1835 (2005)