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Vortex Structure and Dynamics in Fermi Superfluid Gas[1]
MASAHIKO MACHIDA, CCSE, Japan Atomic Energy Agency, TOMIO KOYAMA , IMR, Tohoku Univ., YOJI OHASHI, Institute of Physics, Univ. of Tsukuba — In order to study a universal structure of the quantized vortex in Fermi superfluid Gas, we numerically calculate the generalized Bogoliubov de Gennes equation derived from the fermion-boson model and clarify how the vortex structure changes through the BCS-BEC crossover. In the numerical calculations, we concentrate on a singly quantized vortex and compare the structure for both the narrow and the broad Feshbach resonance. Numerical calculation results reveal that in the BEC regime the matter density depression at the vortex core is complete while in the BCS regime the depression at the vortex core is relatively obscure. This feature is qualitatively common for both the narrow and broad Feshbach resonances, while in profiles of the molecular boson condensate the narrow and broad cases differ. In the broad case, the profile of the molecular boson condensate is quite similar to that of the fermionic superfluid gap. In addition, we show quasi-particle spectra from BCS to BEC for both Feshbach resonance cases. The number of the low-lying quasi-particle excitations localized inside the vortex core drastically decreases as one goes to the BEC regime. This result indicates that an origin of the vortex dissipation alters between BCS and BEC.

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