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Tunneling properties of collective spin wave excitations in the supercurrent state of a spin-1 spinor BEC SHOHEI WATABE, Keio University, and CREST(JST), YUSUKE KATO, The University of Tokyo, YOJI OHASHI, Keio University, and CREST(JST) — We theoretically investigate tunneling properties of spin wave excitations through a barrier in the supercurrent state of a spin-1 BEC. In the ferromagnetic phase, we show that the transverse spin wave always exhibits perfect transmission, when the spin- wave momentum p coincides with the momentum of supercurrent q. This is quite different from the case of the Bogoliubov mode, where the so-called anomalous tunneling phenomenon always occurs when $p = 0$, unless the system is in the critical current state ($q = q_c$). In the polar phase, spin wave modes always exhibit perfect transmission when $p = 0$, as in the case of the Bogoliubov mode. However, this anomalous tunneling behaviors of spin wave modes are shown to still hold even in the critical current state, in contrast to the breakdown of the perfect transmission of the Bogoliubov mode at q_c. Only when the Gross-Pitaevskii equation for the spin-1 BEC is integrable, perfect transmission of the spin wave is absent at q_c. Using a simple *delta*-functional barrier, we also discuss similarity between the condensate wave function in the supercurrent state and the wave functions of spin wave excitations when perfect transmission occurs.

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