

Ultra-low Temperature Mobility of Electron Bubbles Formed below the Free Surface of Superfluid $^3\text{He-B}$

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As a topological nature of the spin-triplet Balian-Werthamer (BW) superfluid state, superfluid $^3\text{He-B}$ phase has zero-gap surface bound states at its surfaces^{1,2}. These surface bound states show Majorana nature when a surface has the perfect specularly. The free surface of liquid ^3He is ideal surface with the specular reflection of quasiparticles, and therefore the surface bound states formed there might support the Majorana nature.

Here we report the results of the mobility measurements of electron bubbles trapped below the free surface of superfluid $^3\text{He-B}$ phase down to $250\ \mu\text{K}$, with the aim of detecting surface bound states. The measured mobility shows the rapid increase below the transition temperature with decreasing temperature, because of the significant reduction of the scattering rate with quasiparticles in the bulk. We also measured the mobilities at several different distances from the surface in a range from 20 to 60 nm, but all data show the same temperature dependence. This indicates that the Majorana surface bound states have a little effect on the mobility of a bubble in the investigated temperature range.

¹ A. P. Schnyder *et al.*, Phys. Rev. B **78**, 195125 (2008).

² S. B. Chung and S.-C. Zhang, Phys. Rev. Lett. **103**, 235301 (2009).