

Direct Detection of Chirality in Superfluid $^3\text{He-A}$

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We report direct detection of chirality in superfluid $^3\text{He-A}$ by a novel, intrinsic Magnus force^{1,2} experienced by a moving ion. When an ion moves in a plane perpendicular to the l vector, it may experience the intrinsic Magnus force in the direction perpendicular to both its velocity and l , as a result of the skew scattering of quasiparticles by the ion^{1,2}. We detected the intrinsic Magnus force by transport measurements of negative ions, or electron bubbles, trapped below a free surface of superfluid ^3He at a depth about 30 nm. At the surface, l aligns normal to the surface uniformly, and the ions moving along the surface is therefore subjected to the intrinsic Magnus force. We observed transverse current associated with the intrinsic Magnus force. The transverse current shows two types of temperature dependences, which are equal in magnitude but opposite in sign. These two correspond to the two chiralities, i.e., l pointing either upward or downward. The observation of the two chiralities at different cooling runs suggests that either chirality is selected at the superfluid transition upon cooling.

1. R. H. Salmelin *et al.*, Phys. Rev. Lett. **63**, 868 (1989).

2. R. H. Salmelin and M. M. Salomaa, Phys. Rev. B **41**, 4142 (1990).

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