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**Macroscopic Quantum states at Ultra-low Temperature**

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New anisotropic states of superfluid 3He have been studied at ultra-low temperatures. They are similar to those in the superconducting compound UPt3. I will discuss and compare three unconventional superconducting/superfluid materials for which measurements of physical properties indicate unconventional order parameter symmetries, most importantly chiral symmetry and broken time reversal symmetry. These are in evidence in high quality single crystals of the f-wave superconductor, UPt3; the p-wave superfluid, 3He; and 3He in highly porous silica aerogel.[1] All of these systems have multiple thermodynamic phases, with different order parameter structure. In this context, theoretical predictions indicate that anisotropic quasiparticle scattering favors stability of anisotropic quantum states.[2] We have shown that this is the case for chiral states of superfluid 3He confined to uniformly anisotropic silica aerogel,[3] and evident in the recently discovered orbital-flop phase. This is also apparent in UPt3 and can be attributed to anisotropic impurities associated with prism-plane stacking faults.

References

1. W.P. Halperin et al. Physics Today 71, No. 11, 30 (2018).

2. E.V. Thuneberg et al. Phys. Rev. Lett. 80, 2861 (1998).

3. J. Pollanen et al., Nature Physics 8, 317 (2012).

4. A.M. Zimmerman et al., Phys. Rev. Lett. 121, 255303 (2018).

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