Order parameter texture transition in superfluid ^{3}He-B in aerogel

A. M. Zimmerman, J. I. A. Li, J. Pollanen, C. A. Collett, W. J. Gannon, and W. P. Halperin

Northwestern University

The order parameter of ^{3}He-B is characterized by a relative rotation of the spin and orbital coordinates about a vector $\hat{n}$. Magnetic field $\vec{H}$ and sample boundaries compete to orient $\hat{n}$, resulting in textures observable in experiments. In bulk ^{3}He-B, both the Brinkman-Smith mode (BS) in the texture where the field orients $\hat{n} \parallel \vec{H}$, and a wall-oriented texture (WT), where the competing effect of the boundaries orients $\hat{n}$ at 63.4^o to $\vec{H}$, have been observed.[1,2] In NMR experiments on ^{3}He-B in 98% porosity aerogel, we have observed an abrupt transition between these two textures. We performed experiments on cylindrical aerogel samples characterized to be homogeneous and isotropic, with cylinder axis $\hat{z}$. In isotropic aerogel with $\hat{z} \perp \vec{H}$ we observe BS to be stable down to 1.1 mK. After introducing anisotropy into the sample by elastic mechanical compression ($\approx 20\%$) along $\hat{z}$, we observe a field-independent textural transition from BS to WT at $\approx$ 1.9 mK. In contrast, reorienting the anisotropic sample $\hat{z} \parallel \vec{H}$, we again find a field-independent transition, but now with BS below 1.9 mK and WT at higher temperatures. The lack of dependence of the transition temperature on both magnetic field and sample orientation indicates that aerogel anisotropy plays a dominant role in determining the texture stability in ^{3}He-B.

1. Hakonen , P. J. *et al.* (1989). "NMR and Axial Magnetic Field Textures in Stationary and Rotating Superfluid ^{3}He-B". J. Low Temp. Phys., 76, 225.
2. Ahonen, A. I. *et al.* (1976). "NMR Experiments on the Superfluid Phases of ^{3}He in Restricted Geometries". J. Low Temp. Phys., 25, 421.

Section: QF - Quantum Fluids

Keywords: ^{3}He, aerogel, anisotropy