New Boundary Phenomena of Liquid ^{3}He in Aerogel Contacting with Superfluid ^{3}He-B

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It is well understood that superfluid ^{3}He state can be described as spin triplet p-wave BCS-like condensate. Liquid ^{3}He is very pure material at low temperatures because small amount of other atoms, which behave as impurities at higher temperatures, are absorbed on the experimental cell wall. Aerogel, which is composed of thin silica strands, actually behaves as impurity in both liquid ^{3}He and superfluid ^{3}He. Impurity effect is that superfluidity of liquid ^{3}He is largely suppressed in aerogel, i.e. suppressions of both superfluid transition temperature and superfluid component. We can tune the pressure and the temperature such that there is normal liquid in aerogel and superfluid B phase just outside aerogel as bulk liquid. Near aerogel boundary, it is proposed that a proximity effect becomes significant so that p-wave Cooper pairs are destroyed by impurity scattering and s-wave Cooper pairs appear inside aerogel[1]. To conserve the antisymmetric property of Fermi particles, the frequency part of the pair wave function has odd property. We have investigated the appearance of such nobel Cooper pairs with odd frequency symmetry. Recently we observed the increase of magnetization from very near the boundary at low temperatures below T/T_c=0.2 and no increase of it far from the boundary. These observation are well explained by the theoretical calculation based on nobel Cooper pairs with odd frequency.

1.S. Higashitani *et al.*, JLTP **155**, 83-97, 2009

Section: QF - Quantum Fluids

Keywords: superfluid ^{3}He, proximity effect, aerogel, odd frequency Cooper pairs, spin triplet s-wave