# Session 23aA

### Evidence for a Second Order B to A Phase Transition in Superfluid $3$He in Low Density Silica Aerogels **23aA1**

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CW-NMR studies of superfluid $^3$He in 99.4porosity silica aerogels show similar phase diagrams, with an equal spin pairing (ESP) A-like state stable near $T_c$, and a B-like phase stable at lower temperatures. On cooling through $T_{ca}$, the sample magnetization and frequency shift show substantial supercooling, with discontinuous changes to B-like behavior seen at about 0.8 $T_{ca}$. On warming, both the frequency shift and magnetization change continuously as the sample enters the ESP state, suggesting that this phase transition must be second order, with the components of the order parameter varying smoothly across the transition.

### Pulsed NMR experiments in superfluid $^3He$ confined in aerogel **23aA2**

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We have performed pulsed NMR experiments in both B- and overcooled A-like phases of superfluid $^3He$ confined within 98% aerogel. The tipping angle dependencies of spin precession frequency in B-like phase of superfluid $^3He$ in aerogel are found to be quite different for the case of pure $^3He$ and for the cell preplated with $^4He$. The most interesting result of the experiment with $^4He$ preplated aerogel is the observation of a sharp increase of the frequency shift for the tipping angles greater than 104° as it expected to be for the B-phase structure of the order parameter. The dependence of the frequency versus the tipping angle in overcooled A-like phase is similar for both pure and $^4He$ preplated aerogel.

### 23aA3 Viscoelastic theory of liquid $^3$He in aerogel

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The impurity scattering effect on sound propagation properties of liquid $^3$He in aerogel is studied from the aspect of the viscoelastic model. We describe liquid $^3$He as a viscoelastic medium and aerogel as an elastic body. Since impurity scattering does not conserve the $^3$He-quasiparticle momentum, it causes friction between liquid and aerogel. The motions of the two systems are coupled with each other through the friction. We give the dispersion relations of both longitudinal and transverse sounds by solving the coupled equations of motion.

### 23aA4 Co-existing Bose and Fermi Superfluid Mixtures in Aerogel

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We have observed superfluidity in both the $^4$He rich and $^3$He rich components of helium mixtures confined in porous silica aerogel. By investigating mixtures with $^4$He fractions ranging from 3% to 90% we have established the occurrence of simultaneous Bose and Fermi superfluidity in this strongly inhomogeneous system. A positive frequency shift in the $^4$He superfluid slow mode as the sample is cooled below the $^3$He superfluid transition temperature indicates a strong coupling between the two superfluid components. The $^3$He $T_c$ is quite insensitive to the $^4$He fraction in the mixture, suggesting that $T_c$ is determined mainly by the $^3$He rich phase in the largest voids. `\MakeFrametrue`