Session 22aE

Cooling Superfluid ^{3}He to the Zero-Temperature Limit **22aE1**

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The behaviour of superfluid ^{3}He in the near-zero temperature regime of negligible normal fluid density is very interesting and very simple. With the normal fluid reduced to a tenuous gas of quasiparticles, the behaviour is dominated by the properties of the condensate, and several properties, otherwise masked by the normal fluid, become observable. For example, we can track coherent spin precession of the condensate as it persist for thousands of seconds after the initial excitation. The rapid thermal response of the dilute quasiparticles gas also allows us to probe many fundamental aspects of the various condensate phases and phase boundaries. Here we discuss the special Lancaster multiple-cell techniques which can cool the superfluid to $T < 0.1\,T_c$. We also present some of our experiments to measure fundamental properties of the superfluid which actually rely on the low temperature behaviour for their accomplishment.

Operation of a Dilution Refrigerator in a Micromode **22aE2**

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Two types of a ^{3}He-^{4}He dilution refrigerator with the ^{3}He pumping out due to its condensation on a cold wall are described: a classical refrigerator with a heat exchanger and a refrigerator with a collector that allows the operation in a quasi-single cycle refrigeration. The refrigerator operated stably in both cases, when a power of 30 μW was fed to the still, i.e., at a circulation rate of ^{3}He of a few micromoles per second. In this case, the mixing chamber was cooled down to a temperature below 0.05 K.

22aE3 **Superfluidity and Quantized Vortex Studies under Rotation up to 3 (1) revolution(s) per second at down to milli (sub-milli) Kelvin Temperatures**

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Two new high-speed rotaing cryostats at the ISSP, University of Tokyo, capable of operating at mK temperatures, are currently employed for studies of superfluidity and quantized vortex states in ^{4}He and ^{3}He. A stable high-Q torsional oscillator is used for the study of superfluidity in low-density ^{4}He films adsorbed on 3-D connected porous substrates. At T_c, the critical phenomena of 3-D Bose superfluids is seen. Under rotation a new type of vortex state is observed. High-resolution NMR studies of superfluid ^{3}He, contained in capillary arrays of two different diameters, are made as a function of rotational speed. In these experiments, single vortex intrusion events as well as texural modification under rotation are clearly resolved.