Session 22bE

Measuring Nuclear Magnetization in Strong Magnetic Fields **22bE1**

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^{27}Al nuclear spin magnetization has been measured in magnetic fields up to 10 T, by use of a capacitive Faraday magnetometer installed in a dilution refrigerator. The sample employed in the experiment was an $Al_{0.98}Si_{0.02}$ alloy, prepared from high purity (6N) elements. The Si doping was essential in suppressing the de Haas-van Alphen oscillations of conduction electrons. Magnetic force acting on the sample was detected by a force-sensing parallel plate capacitor. Field gradient of 8 T/m was generated independently of central fields, by use of a special superconducting solenoid equipped with gradient coils. Fine Curie law was observed at temperatures below 1 K down to $\sim$50 mK in magnetic fields ranging from 2 T to 10 T, with the Curie constant in good agreement with the calculated value. The measurement opens a new route towards primary thermometry in low temperature and high magnetic field region.

Current sensing noise thermometry from 4.2 K to below 1 mK using a DC SQUID preamplifier **22bE2**

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We are using a DC SQUID to perform current sensing noise thermometry, by measuring the thermal noise currents in a resistor cut from copper foil. The temperature is obtained from the Nyquist formula. This is a practical thermometer for use from 4.2 K to below 1 mK, with a percentage precision independent of temperature. Using a 0.34 mΩ resistor, the thermometer had an amplifier noise temperature $T_{\rm N}$ of 8 μK. A precision of 1.5% was obtained in 200 s. The thermometer was in good agreement with the PLTS-2000 ^{3}He melting curve scale down to 4.5 mK. It can be used to significantly below 1 mK, and the performance down to the lowest temperatures will be discussed.

22bE3 High resolution scanning probe microscopy at low temperatures and high magnetic fields

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Reduced surface mobility of species and minimised thermal drift are well known to be key advantages of LT SPM. Beside STM, full AFM capabilty gives access to physical phenoma in insulators, magnetic materials and many others. A complete UHV and high magnetic field compatible system design will be presented considering important design criteria for sample/sensor exchange and 3D coarse positioning. Furthermore, an effective isolation against external vibrations is another major aspect that will be discussed. Recent MFM results at high magnetic fields and high resolution STM measurements will be reported.

22bE4 A Millikelvin T-Scale in High Magnetic Fields based on ^{3}He Melting Pressure

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We propose a new millikelvin temperature scale (3.5 mK $\leq T \leq 250$ mK), which can be used in high magnetic fields ($B \leq 14$ T), based on the melting pressure of ^{3}He. The melting pressure in magnetic fields was measured with a ^{3}He melting curve thermometer (MCT) located in zero-field with the least temperature gradient. The scale is defined by an equation which gives a pressure decrease due to application of B at fixed T. The estimated accuracies are $\pm 0.1\%$ and $\pm 0.4\%$ above and below 10 mK, respectively, besides uncertainties in zero-field ^{3}He MC T-scales we stand for. It is useful to calibrate other more easily handled thermometers such as RuO resistance thermometers *in situ of high fields.*