Session 25bA

The Delayed Interface Instability of Melting Magnetised Solid ^{3}He — 25bA1

Reyer Jochemsen[a], Erik R. Plomp[a], Richard van Rooijen[a], Hikota Akimoto[a], Giorgio Frossati[a], Wim van Saarloos[b]

[a]*Kamerlingh Onnes Laboratorium, Universiteit Leiden, P. O. Box 9504, 2300 RA Leiden, The Netherlands*
[b]*Instituut-Lorentz, Universiteit Leiden, P. O. Box 9506, 2300 RA Leiden, The Netherlands*

We report on our observations that the solid-liquid interface of highly magnetized solid ^{3}He becomes instable during melting. After the instability occurs, the liquid penetrates in the solid in the form of cellular dendrites. One-dimensional magnetic resonance imaging of the magnetization profile shows clearly the magnetization gradients in the solid and the liquid during melting, as well as enhanced magnetization at the interface. We also present an extension of the linear stability analysis, and a numerical calculation of the dispersion relation of interface deformations. Our results give agreement between experiment and theory, explaining how the magnetization gradient in the liquid initially suppresses the instability.

Ion Mobility in Liquid ^{3}He under Very High Magnetic Fields — 25bA2

Hidehiko Ishimoto

The institute for Solid State Physics, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8581, Japan

Ion mobility in normal and superfluid ^{3}He has been studied under very magnetic fields up to 15 T over the wide pressure region. In both phases, the field dependence of the positive ion mobility above 20 bar is found to exhibit a pressure dependent broad peak below 3.2 mK, followed by a large decrease at high fields. On the other hand no field dependence is observed in the negative ion. A possible origin for the anomolous behavior in the positive ion is discussed.

25bA3 Viscosity of Highly Polarized, Very Dilute ^{3}He -^{4}He Mixtures

H. Akimoto[a,b], J. S. Xia[a], D. Candela[b], W. J. Mullin[b], E. D. Adams[a], N. S. Sullivan[a]

[a] *Department of Physics and NHMFL, University of Florida, Gainesville, FL 32611 USA*
[b] *Department of Physics, University of Massachusetts, Amherst, MA 01003 USA*

We present vibrating-wire viscosity measurements on a very dilute ^{3}He-^{4}He mixture (x_3 = 150 ppm) in fields up to 14.8 T and temperatures down to 3 mK. The ^{3}He spin polarization is greater than 99% for the highest field and lowest temperature used. In these conditions, the s-wave scattering rate decreases due to a lack of quasiparticles with the minority spin state and all transport coefficients are enhanced. To minimize difficulties in measuring the hydrodynamic viscosity due to the long mean free path, we employed a novel vibrating-wire viscometer with an enlarged central section. At the lowest temperature, the hydrodynamic damping of the viscometer in a 14.8 T field was more than 10 times larger than in low fields, indicating more than 100 times increase of the viscosity due to spin polarization.

25bA4 Diffusion of Polarised ^{3}He Gas in Aerogels : Systematic NMR Studies

Geneviève Tastevin, Pierre-Jean Nacher, Jamal Choukeife

Laboratoire Kastler Brossel, E.N.S., 24 rue Lhomond, F75005 Paris, France

Polarised ^{3}He is used to non-destructively probe by NMR the structure of silica aerogels. Using laser optical pumping large spin-echo signals are obtained with small amounts of gas, even at low magnetic field. Attenuation induced by applied field gradients is measured for pressures ranging from 10 $mbar$ to 1 bar. Reduced diffusion coefficient has been observed in a 98% porosity sample grown for low temperature experiments[1]. Its pressure dependence and inhomogeneous of 1D profiles suggest a non-uniform structure of the aerogel on length scales up to tens of microns. New systematic studies are performed both on custom-made and commercial aerogels used by several research groups to study quantum fluids in confined geometries.

[1] G. Tastevin et al, J. Low Temp. Phys. 121 (2000) 773 ; G. Guillot et al, Magn. Res. Im. 19 (2001) 391