TT 22 Symposium Quantum Fluids

Time: Tuesday 15:00–17:45 Room: HSZ 304

Invited Talk

TT 22.1 Tue 15:00 HSZ 304

A-B Transition and Anisotropic Scattering in Superfluid ^{3}He in Aerogel — •Yoonseok Lee — Department of Physics, University of Florida, PO Box 118440, Gainesville, FL 32611, USA

For last 10 years, liquid ^{3}He impregnated in high porosity silica aerogel has been investigated extensively. The structure and relevent length scales of the aerogel allow us to investigate the effects of disorder on a p-wave superfluid in a systematic manner. In 98% porosity aerogel, three distinct phases have been observed experimentally. These three phases are conveniently named as A-, B-, and A_1-phase as in the bulk, although only spin structures of the superfluid phases have been identified. Especially, the verdict on the so called A-phase is by no means conclusive. However, a considerable modification in the phase diagram has been reported such as the supression of superfluid transition and a severe alteration in the A-B transition line. In this talk, we will review recent experimental results on the A-B transition in 98% aerogel including our own results and discuss the importance of anisotropic scattering provided by the strand-like structure of aerogel on the A-B transtion.

Keynote Talk

TT 22.2 Tue 15:30 HSZ 304

Quantum Turbulence in superfluid ^{3}He — •Shaun Fisher — Department of Physics, Lancaster University, Lancaster LA1 4YB, UK

For the first time, we have access to the study of turbulence in a pure superfluid, at low temperatures, without any viscous effects from the normal fluid. In such a system, turbulence takes the simple form of a tangle of quantised vortex lines having self induced motion in an ideal inviscid fluid. Of particular interest in the quantum system is how turbulence may be generated, how it evolves, and how it decays in the complete absence of viscous forces. Vortices are readily detectable in superfluid ^{3}He-B in the low temperature limit via the Andreev reflection of ballistic quasiparticle excitations. We describe recent measurements of the production and decay of quantum turbulence and compare the observations with classical expectations.

Invited Talk

TT 22.3 Tue 16:00 HSZ 304

The Transition in the Vortex Dynamics of Superfluid ^{3}He-B — •V.B. Eltsov, R. Blaauwgeers, R. de Graaf, J. Kopu, and M. Krusius — Low Temperature Laboratory, Helsinki University of Technology, FIN-02015 HUT, Finland

In recent years the field of vortex dynamics in quantum

fluids has wittnessed a flurry of important advances. In superfluid ^{3}He-B quantum turbulence has been investigated from the lowest temperatures up to $0.6\,T_c$, the temperature of the transition from turbulent dynamics at low temperatures to the superconductor-like highly dissipative dynamics at high temperatures. We have studied the evolution of vortex loops injected in vortex-free flow in a rotating cylindrical bucket of ^{3}He-B and have traced with NMR a complete path to the final lowest energy configuration of rectilinear vortex lines stretched parallel to the rotation axis. With decreasing mutual friction damping injected loops become unstable towards formation of new vortices. Depending on vortex density this process proceeds either through rapid turbulent vortex multiplication due to inter-vortex interactions or via growth and reconnection to the boundary of Kelvin wave excitations on individual vortex lines. In the final stage a bundle of vortex lines expands along the rotating column into the vortex-free regions in the form of a propagating vortex front followed by a helically twisted cluster of vortex lines.

— 15 min. break —

Keynote Talk

TT 22.4 Tue 16:45 HSZ 304

Stable textures and defects in slabs of superfluid 3He-A — •Paul Walmsley and Andrei Golov — School of Physics and Astronomy, University of Manchester, Manchester, M13 9PL, UK

We have studied, both experimentally and numerically, various stable textures of the order parameter in superfluid 3He-A in a slab geometry. These textures include continuous vortices and three different types of domain wall as well as specific textures such as the inhomogeneous textures in the centre of a disk-shaped volume where a cylindrical pipe enters the volume along its axis. Our experiments consisted of torsional oscillators, containing disk-shaped slabs of 3He-A, mounted on a rotating nuclear demagnetization cryostat. We were able to detect the response of the orbital texture to applied counterflow which when combined with numerical calculations enabled us to identify the texture present. We found that the texture depended on how it had been prepared. Oriented textures could be prepared by cooling while rotating but domain walls were always present if we cooled (or warmed from the B-phase) without rotation. We will present our measurements of flow-induced critical velocities and compare them to numerical calculations.

Keynote Talk

TT 22.5 Tue 17:15 HSZ 304

Molecular Spectroscopy in Helium Droplets at Low Temperatures — •Alkwin Slenczka — Institute for Physical and Theoretical Chemistry, Uni Regensburg, 93040 Regensburg, Germany

About a decade ago helium droplets created in a cold supersonic expansion have been established as a new matrix for molecular spectroscopy. The new expermental technique unifies advantages of matrix isolation and supersonic jet experiments. The unique advantage of ^{4}He droplets is the superfluid phase. It explains the very gentle nature of this host system which becomes apparent in rotationally fully resolved molecular spectra. We will review experimental observations revealing physical details of helium droplets and of the solvation of molecules in helium droplets which were obtained in high resolution spectra of molecules in helium droplets.