TT 7.60 Mon 14:00 P1

Enhancement of the vortex pinning in superconducting MgB_2 films — •Anatolie Sidorenko[1,2,3], Vladimir Zdravkov[1,2], Christian Leierer[2], Andreas Heinrich[2], Siegfried Horn[2], Reinhard Tidecks[2], Achim Wixforth[2], Thomas Koch[3,4], and Thomas Schimmel[3,4] — [1]IAP, LISES, ASM, Kishinev, Moldova — [2]IP, Universität Augsburg, Germany — [3]AP, Universität Karlsruhe, Germany — [4]INT, Forschungszentrum Karlsruhe, Germany

Superconducting MgB_2 films have extremely high critical current density, up to $j_c \sim 10^7/cm^2$ at 15 K in zero magnetic field what makes this novel superconductor very attractive for technical applications. But magnesium diboride exhibits a rapid loss of the current carrying capabilities in strong magnetic fields, caused by thermomagnetic instabilities leading to a rapid decrease of the activation energy for magnetic flux motion for $U_0(B)$ in fields of $B > 1$ Tesla. There are two possible ways to solve the problem of the too low pinning force for high magnetic fields: a) by covering the MgB_2 film with an electronicly isolated highly thermoconducting metallic layer to prevent thermomagnetic instabilities; b) by embedding artificial pinning centers within the film to increase the pinning force and thus the activation barrier for thermally activated flux flow. In the present work we report about the results of our experiments where we used both ways: a) coating of the MgB_2 film with Cu-layers ($0.3\mu m - 1.0\mu m$ thick) for thermo stabilization; b) the adsorption of ferromagnet nanoparticles (10nm - 50nm Fe and Ni particles) on the surface of the MgB_2 film.

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Granularity and Spontaneous Vortex State for the Weakly Ferromagnetic Superconductor $RuSr_2GdCu_2O_8$ — •Thomas P. Papageorgiou[1], Ennio Casini[2], Hans F. Braun[2], Thomas Herrmannsdörfer[1], Andrea D. Bianchi[1], and J. Wosnitza[1] — [1]Hochfeld-Magnetlabor Dresden, Forschungszentrum Rossendorf, D-01314 Dresden, Germany — [2]Physikalisches Institut, Universität Bayreuth, D-95440 Bayreuth, Germany

In the high-T_c cuprate $RuSr_2GdCu_2O_8$ (Ru1212) weak ferromagnetism ($T_N^{Ru} \simeq 130$ K) coexists with superconductivity ($T_{c,onset} \simeq 50$ K). This rises the interesting question concerning the formation of a spontaneous vortex state (SVS) in the case that the internal magnetic field is greater than the first critical field H_{c1}. Recently, the formation of a SVS has been proposed for Ru1212 after the phase diagram for this compound was constructed from dc-magnetization and resistance measurements [1]. We show, by a comparison of resistance with ac-susceptibility and dc-magnetization measurements, where both the intra- and inter-granular superconducting transition are obvious, that the granular nature of the investigated samples has to be carefully considered in the investigations of possible SVS formation. A particular SVS with vortices pinned in the intergrain area is much more likely. Single crystals would be required to unambiguously demonstrate the formation or non-formation of a spontaneous vortex state in bulk Ru1212.

[1] C. Y. Yang, B. C. Chang, H. C. Ku, Y. Y. Hsu, cond-mat/0507014

TT 7.62 Mon 14:00 P1

Evidences for Flux Line Termination Inside of a Highly Anisotropic Superconductor: A Magnetic Force Microscopy Study — •Ung Hwan Pi[1], Alexander Schwarz[1], Marcus Liebmann[2], Zheong Gu Khim[3], Dong Ho Kim[4], and Roland Wiesendanger[1] — [1]University of Hamburg, IAP, Jungiusstr. 11, 20355 Hamburg — [2]Present Address: RWTH Aachen, Department of Physics, 52056 Aachen — [3]School of Physics, SNU, Seoul 151-742, South Korea — [4]Dept. of Physics, Yeungnam University, Kyungsan, South Korea

In highly anisotropic layered superconductors like $Bi_2Sr_2CaCu_2O_{8+\delta}$, the Josephson coupling between each layer is so weak that the phase coherence in c-direction is negligible and the termination of the flux line inside the sample is not forbidden by topology of the phase. Mints *et al.*[1] have reported in a theoretical study that the termination of the flux line inside the sample is energetically favorable for small enough samples. Our magnetic force microscopy study performed on the $Bi_2Sr_2CaCu_2O_{8+\delta}$ single crystal showed some evidences supporting this prediction. Since all flux lines have single flux quantum, they should exhibit the same contrast. However, we could observe a somewhat weaker contrast at several flux lines near an antiphase boundary. Two weak-contrast flux lines sometimes merged into one flux line with a stronger contrast. These weak magnetic contrasts are possible candidates for flux lines terminating beneath the sample surface.

[1] G. Mints *et al.* Phys. Rev. B **61**, 1623 (2000).

TT 7.63 Mon 14:00 P1

The transverse sound propagation in the superfluid helium inside carbon nanotube — •Vilchynskyi Stanislav and Tkachenko Olena — Kiev national Taras Shevchenko university

In the present work it was shown that it is possible of the propagation of the transverse quantized sound in superfluid helium inside carbon nanotube. This sound are caused of the geometrical parameters of the helium system and dynamical characteristic of the vortex thread in superfluid helium

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Study the dependence between the pair interaction potential in the Bose liquid ^{4}He and and quasiparticle spectrum of superfluid ^{4}He at $T = 0$ — •Vitaliy Bardic and Stanislav Vilchynskyi — Kiev national Taras Shevchenko university

As well known the multiparticle collective effects in the Bose liquid lead to an essential renormalization of the pair interaction between atoms of superfluid helium. Self-consistent numerical calculations of the boson self-energy, polarization operator, pair order parameter, and quasiparticle spectrum of superfluid ^{4}He at $T = 0$, involving an iteration scheme with the single fitting parameter—the value of the repulsion potential at $r = 0$, have allowed us to find conditions for the theoretical spectrum $E(p)$ to coincide with the experimentally observed elementary excitation spectrum in ^{4}He. It is shown that the roton minimum in the quasiparticle spectrum $E(p)$, which corresponds to a maximum in the structural formfactor $S(q)$ of a Bose liquid, is directly associated with the first negative minimum of the Fourier component of the renormalized potential $\tilde{V(p)}$ of the pair interaction between bosons.

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The Kinetics Asymmetry of the BCC-HCP Phase Transition in Solid Helium-4 — •Yegor Vekhov, Nikolay Mikhin, Andrey Polev, Eduard Rudavskii, and Alexandr Birchenko — B.Verkin Institute for Low Temperature Physics and Engineering, 47 Lenin Ave., Kharkov 61103 , UKRAINE

The subject of research is a solid helium-4. Samples were made by blocking capillary technique. The kinetics of the BCC-HCP structure phase transition was investigated by precise pressure measurement under constant value. The precision of pressure measurement is about 3 mbar and of temperature one is about 5 mK. During step wise temperature changes, within one phase (BCC or HCP), pressure change is described by one-exponential time dependence. During step wise cooling of the sample from the BCC region to the HCP it was found the pressure, at first, is decreasing to the extent of thermal compression of the overcooling BCC phase then, after some delay (5-500 s), the pressure is relaxing once again that is accompanied by a heat generation. The second stage of the pressure relaxation is described by superposition of two exponential dependences with short time constant (1-3 s - directly the BCC-HCP transition) and with long time constant (5-10 s - the relaxation process of defects which were formed during lattice rebuilding). During the inverse HCP-BCC phase transition the delay is practically not observed that can be explained by less BCC nucleation energy [1,2].

[1] T.A.Johnson and C.Elbaum, J. Low Temp.Phys., 107, 317 (1997). [2] Y.Okuda, H.Fujii, Y.Okumura, and H.Mackana, J. Low Temp.Phys., 121, 725 (2000).

TT 7.66 Mon 14:00 P1

Light scattering on an N-component Bose-Einstein condensate in an optical lattice — •Oleksandr Fialko, Christopher Moseley, and Klaus Ziegler — Universität Augsburg, Universitätsstr. 1,D-86135 Augsburg, Germany

We consider an N-component system of strongly interacting bosons in an optical lattice. On each lattice site a boson can occupy one of N different states. Tunneling is possible between neighboring lattice sites and different states. For this model we calculate the static structure factor and the density-density correlation function, both for zero and finite temperatures,in the limit $N \to \infty$ and in a $1/N$ expansion to study the properties of the BEC and the Mott-insulating phase.