TT 27: SC: Fe-based Superconductors - LiFeAs

Time: Tuesday 14:00–15:30 Location: HSZ 304

TT 27.1 Tue 14:00 HSZ 304

Nuclear Magnetic Resonance study of pure and Ni/Co doped LiFeAs — •Hans-Joachim Grafe, Seung-Ho Baek, Franziska Hammerath, Uwe Gräfe, Yannic Utz, Luminita Harnagea, Claudia Nacke, Saicharan Aswartham, Sabine Wurmehl, and Bernd Büchner — Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany

We present Nuclear Magnetic and Nuclear Quadrupole Resonance (NMR/NQR) measurements on pure, Ni and Co doped LiFeAs single crystals. The parent compound LiFeAs exhibits unconventional superconductivity with a transition temperature of about 17 K. Unlike other Fe based superconductors, where superconductivity is induced or stabilized by Co or Ni doping, replacement of Fe by these elements leads to a suppression of the superconducting transition temperature in LiFeAs. In case of Ni doping, a bulk magnetic order is induced below about 160 K. In contrast, for Co doping, the superconducting transition temperature is only reduced, but no magnetic order is observed. We discuss the nature and the origin of this magnetic order and its relation to unconventional superconductivity in pure LiFeAs.

TT 27.2 Tue 14:15 HSZ 304

Influence of doping on the physical properties of LiFeAs — •Luminita Harnagea[1], Claudia Nacke[1], Igor Morozov[1,2], Dirk Bombor[1], Anne Bachmann[1], Uwe Gräfe[1], Yannic Utz[1], Mahmoud Abdel-Hafiez[1], Seung-Ho Baek[1], Ulrike Stockert[1,3], Rüdiger Klingeler[1,4], Anja U.B. Wolter[1], Hans-Joachim Grafe[1], Christian Hess[1], Sabine Wurmehl[1], and Bernd Büchner[1] — [1]Institute for Solid State Research, IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany — [2]Moscow State University, Moscow 119991, Russia — [3]MPI for Chemical Physics of Solids, D-01187 Dresden, Germany — [4]Kirchhoff Institute for Physics, Heidelberg University, D-69120 Heidelberg, Germany

Single crystals of $LiFe_{1-x}M_xAs$ (M = Cr, Rh, Ni) were grown using the self-flux method. The parent compound LiFeAs is an unconventional superconductor with a transition temperature of about 17 K. Upon doping on the Fe site with Rh, Ni or Cr the superconductivity is suppressed, which is reflected in different physical properties. This observation is in contrast to the effect of doping in the NaFeAs homologous and in other Fe-based superconductor families, where the superconductivity is induced or/and stabilized by replacing Fe either by Rh or Ni.

TT 27.3 Tue 14:30 HSZ 304

Suppressed superconductivity in charge doped $Li(Fe_{1-x}Co_x)As$ single crystals — •Saicharan Aswartham[1], Günter Behr[1], Luminita Harnagea[1], Dirk Bombor[1], Igor V. Morozov[1,2], Anne Bachmann[1], Christian Hess[1], Sabine Wurmehl[1], and Bernd Büchner[1] — [1]Leibniz Institute for Solid State and Materials Research, D 01069 Dresden, Germany — [2]Moscow State University, Moscow 119991, Russia

Single crystals of the new unconventional superconductor $LiFe_{1-x}Co_xAs$ with x =0, 0.025, 0.05 were grown by a new approach using the self-flux technique. Superconducting properties have been studied by means of temperature dependent resistivity and magnetic susceptibility. The superconducting transition temperature was found to decrease upon Co-doping at the Fe site. Charge doping in LiFeAs supresses superconductivity, in contrast to the effects of charge doping in other Fe-As compounds, where charge doping supresses the spin density wave and establishes superconductivity. We present crystal growth and superconducting properties of $LiFe_{1-x}Co_xAs$.

TT 27.4 Tue 14:45 HSZ 304

Theory for Magnetism and Triplet Superconductivity in LiFeAs — Philip Brydon[1], •Maria Daghofer[2], Carsten Timm[1], and Jeroen van den Brink[2] — [1]Institut für Theoretische Physik, TU Dresden — [2]IFW Dresden

Superconducting pnictides are spin-singlet superconductors, where superconductivity is found near an antiferromagnetic (AF) phase. The AF order is believed to be largely driven by Fermi surface nesting. The band structure of LiFeAs, which does not have to be doped to become superconducting, differs from the other pnictides by two distinct features; it shows poorer nesting and has hole pockets that are much more shallow than he electron pockets. We incorporate these specific features into a three-band model and study the resulting magnetic order and pairing instabilities. We find that they are markedly different from the results for models with better nesting. The magnetic susceptibility shows a peculiar ring-shaped feature around $(0,0)$ instead of peaks at $(\pi,0)$ and $(0,\pi)$, as one would expect in the AF phase. These "almost FM" fluctuations are found to promote triplet superconductivity with a p-wave symmetry.

TT 27.5 Tue 15:00 HSZ 304

Quasiparticle interference of superconducting LiFeAs — •Torben Hänke, Steffen Sykora, Ronny Schlegel, Danny Baumann, Sabine Wurmehl, Igor Morozov, Luminita Harnagea, Christian Hess, Jeroen van den Brink, and Bernd Büchner — IFW Dresden, Institute for Solid State Research, P.O. Box 270116, D-01171 Dresden, Germany

We performed scanning tunneling spectroscopy measurements on the iron pnictide superconductor LiFeAs in the superconducting state. After cleavage of the crystal, we observe atomically flat surfaces which contain several defects in the field of view (FOV) of about 20×20 nm^2. Already in topographic images, pronounced spatial modulations of the integral density of states are present, which are particular strong in the vicinity of the defects. We recorded full $\mathrm{d}I/\mathrm{d}V(V)$ spectroscopy maps to determining the energy dependent quasiparticle interference in the FOV. The Fourier transform of the $\mathrm{d}I/\mathrm{d}V$ maps exhibits a rich structure which has a strong resemblance of constant energy cuts through the experimental band structure. We will compare the experimental data with theoretically calculated quasiparticle interference using a realistic three-band model which is consistent with recent ARPES experiments.

TT 27.6 Tue 15:15 HSZ 304

Transport properties of LiFeAs — •Gerhard Kolland[1], Oliver Heyer[1], Stephanie Orbe[1], Volodymyr Zabolotnyy[2], Daniil Evtushinsky[2], Sergiy Borisenko[2], Igor Morozov[2], Luminita Harnagea[2], Sabine Wurmehl[2], Christian Hess[2], Bernd Büchner[2], and Thomas Lorenz[1] — [1]II. Physikalisches Institut, Universität zu Köln, Germany — [2]Leibniz-Institute for Solid State Research, IFW-Dresden, Germany

LiFeAs is unique among the broad family of FeAs-based superconductors, because it is the only stoichiometric compound that is superconducting at a rather large $T_c \simeq 18\,\mathrm{K}$ under ambient conditions. We studied electrical and thermal transport on high-quality single crystals. The low-temperature resistivity shows quadratic temperature dependence above T_c giving evidence for strong electron-electron scattering, while there is a tendency towards saturation around room temperature. The Hall constant is negative and changes with temperature, what most probably arises from a van Hove singularity close to the Fermi energy in one of the holelike bands. From the anisotropic magnetic-feld dependence of T_c we extrapolate the correlation lengths ξ_i and derive a moderate anisotropy $\xi_a/\xi_c \simeq 2.2$. The thermal conductivity κ shows a shoulder below T_c. This feature is strongly suppressed by an applied magnetic field whereas below 1 K the thermal conductivity increases with increasing field.

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