TT 55: Correlated Electrons: Quantum-Critical Phenomena - Experiment II

Time: Wednesday 11:15–12:30 Location: HSZ 204

TT 55.1 Wed 11:15 HSZ 204

Electronic structure investigations in β-LuAlB$_4$ — •Pascal Reiss[1], Sven Friedemann[1], Michael Sutherland[1], Swee K. Goh[2], Kentaro Kuga[3], Eoin O'Farrell[3], Hisatomo Harima[4], Satoru Nakatsuji[3], and F. Malte Grosche[1] — [1]Cavendish Laboratory, University of Cambridge, Cambridge, CB3 0HE, United Kingdom — [2]Chinese University of Hong Kong, Shatin, N.T., Hong Kong — [3]Institute for Solid State Physics, University of Tokyo, Kashiwa 277-8581, Japan — [4]Kobe University, Kobe 657-8501, Japan

The β-phase of YbAlB$_4$ is the first Yb based heavy fermion compound which features both superconductivity and quantum critical behaviour without the need of tuning by magnetic field, pressure or doping [1]. Quantum oscillation (QO) measurements can help decide whether at low temperature the relevant 4f states in YbAlB$_4$ form a band and contribute to the Fermi surface, or whether they should be regarded as localised [2]. Here, we use β-LuAlB$_4$ as a reference compound: both compounds have the same crystal structure, and Lu features a full 4f shell, which prevents the f-states from contributing to the Fermi surface volume. We present QO measurements on β-LuAlB$_4$ and compare them to detailed calculations based on LDA-DFT. Whereas our calculations agree in detail with the observed frequencies and their angular dependence in β-LuAlB$_4$, they differ significantly from the QO spectra observed in β-YbAlB$_4$. These findings strongly suggest itinerant 4f electron character in YbAlB$_4$ further supporting the conclusions reported in [2].

[1] S. Nakatsuji et al, Nature Phys. **4**, 603 (2008)
[2] E.C.T. O'Farrell et al, PRL 102, 216402 (2009)

TT 55.2 Wed 11:30 HSZ 204

Spin dynamics in the Haldane compound SrNi$_2$V$_2$O$_8$ — Vladimir Gnezdilov[1,2], •Peter Lemmens[1], Anup Kumar Bera[3], ATM Nazmul Islam[3] und Bella Lake[3] — [1]TU-BS, Braunschweig — [2]ILTPE NAS, Ukraine — [3]HZBME, Helmholtz-Zentrum, Berlin

We present a Raman scattering study of the quasi-one-dimensional Haldane chain compound SrNi$_2$V$_2$O$_8$. In contrast to simple expectations, complex temperature-dependent magnetic excitations exist. Our observations provide strong evidence that SrNi$_2$V$_2$O$_8$ is indeed close to the phase boundary that separates a spin-liquid and an Ising-like ordered state on the Sakai-Takahashi phase diagram.

TT 55.3 Wed 11:45 HSZ 204

Anisotropy and quantum criticality in CeTi$_{1-x}$V$_x$Ge$_3$ single crystals — •Wolfram Kittler[1], Veronika Fritsch[1], Paul C. Canfield[2], and Hilbert v. Löhneysen[1] — [1]Karlsruhe Institute of Technology (KIT), 76131 Karlsruhe, Germany — [2]Ames Laboratory, US DOE, and Dept. of Physics and Astronomy, Iowa State University, Ames, IA 50011, USA

CeTiGe$_3$ is a heavy-fermion ferromagnet with the Curie-temperature $T_C \approx 14$ K [1]. It crystallizes in a hexagonal structure with space group P63/mmc. The magnetic moments are located at the Ce sites pointing along the c-axis [2]. Partial substitution of Ti by V leads to a suppression of T_C toward zero. Thus CeTi$_{1-x}$V$_x$Ge$_3$ seems to be one of the few ferromagnetic systems that can be driven to a quantum critical point at a critical V concentration $x_c \approx 0.38$.
We will present detailed measurements of magnetization, electrical resistivity and specific heat on flux-grown single crystals showing the highly anisotropic Ising-like magnetism in this system. Furthermore we will demonstrate signatures of non-Fermi-liquid behavior when approaching the critical concentration.

[1] P. Manfrinetti et al., Sol. State Comm. **135** (2005) 444
[2] W. Kittler et al., Phys. Rev. B **88** (2013) 165123

TT 55.4 Wed 12:00 HSZ 204

Binary Cr-Ge systems close to a magnetic quantum critical point — •Katharina Weber, Marcus Peter Schmidt, Walter Schnelle, Michael Baenitz, Helge Rosner, and Christoph Geibel — Max Planck Institute for Chemical Physics of Solids, Dresden

Systems close to the transition between a magnetic-ordered (MO) and a paramagnetic (PM) ground state are of strong interest, because some very peculiar phenomena, like unconventional superconductivity, quantum critical points, and non-Fermi liquids haven been observed in connection with such transitions. While quite a lot of research has been devoted to compounds based on late transition metals, as Fe or Cu, only limited work has been published on Cr-based systems. Here we present a deeper investigation of CrGe and Cr$_{11}$Ge$_8$. Previous studies indicate both compounds to be close to a magnetic instability, but information on physical properties were limited. CrGe single crystals were grown by vapor phase transport, while polycrystalline Cr$_{11}$Ge$_8$ was prepared by arc melting and subsequent annealing. Physical properties were studied by means of susceptibility χ(T), resistivity, and specific heat measurements. Both compounds show a Curie-Weiss behavior at high temperatures, with sizeable effective moments of about $2\mu_B$/Cr. CrGe presents a broad, but clear maximum in χ(T) at about 60 K, while in Cr$_{11}$Ge$_8$ χ(T) increases continuously down to low T. This suggest both compounds to be in the PM regime, Cr$_{11}$Ge$_8$ being extremely close to the transition to a MO state, while CrGe is slightly further away. The Sommerfeld coefficients are quite large for 3d systems, of the order of 20 mJ/K^2 mol-Cr, supporting strong correlations.

TT 55.5 Wed 12:15 HSZ 204

Thermoelectric properties at a Quantum Phase Transition in Mn$_{1-x}$Fe$_x$Si — Marlies Gangl[1], •Anna Kusmartseva[1,2], Marco Halder[1], Andreas Bauer[1], and Christian Pfleiderer[1] — [1]Technische Universität München, Physik Department E21, Garching, Germany — [2]Loughborough University, Physics Department, Loughborough, UK

MnSi is a B20 transition metal compound that has been traditionally a model system to study helical modulation in magnetism and weak itinerant ferromagnetism. In particular, the behaviour to different transition metal doping with Fe, Co as well as studies under pressure had been of vast interest to the research community.

Here we present resistivity, thermopower and thermal conductivity on high-quality Fe-doped single crystals of MnSi over a wide range in temperatures from 2 to 300K under magnetic fields up to 14T. The growth and purity of the single crystals Mn$_{1-x}$Fe$_x$Si was investigated previously in detail [1]. We report the appearance of Non-Fermi Liquid behaviour in the resistivity of doped Mn1-xFexSi samples and discuss how these results relate to the respective measurements of thermopower and thermal conductivity. Comparisons and parallels to studies reported under pressure are also made [2,3].

[1] A. Bauer, A. Neubauer, C. Franz, W. Muenzer, M. Garst, and C. Pfleiderer, Phys. Rev. B, 82, 57011 (2010)
[2] J.-G. Cheng, F. Zhou, J.-S. Zhou, and J.B. Goodenough, Phys. Rev. B, 82, 214402 (2010)
[3] S. Arsenjevic, C. Petrovic, L. Forro, and A. Akrap, Euro. Phys. Lett., 103, 57015 (2013)