TT 31: Correlated Electrons: Quantum-Critical Phenomena 2

Time: Wednesday 15:00–16:15 Location: H 3010

TT 31.1 Wed 15:00 H 3010

Ferromagnetic quantum phase transition in $Sr_{1-x}Ca_xRuO_3$ thin films — •Melanie Schneider, Vasily Moshnyaga, Sebastian Esser, and Philipp Gegenwart — Georg-August Universität-Goettingen, Friedrich-Hund-Platz 1, 37077 Goettingen, Germany

The $Sr_{1-x}Ca_xRuO_3$ series recently received a lot of attention because of a continuous evolution from itinerant electron magnetism towards a paramagnetic metallic state. We focus on the region near the quantum phase transition at x=0.7. Using metal-organic aerosol deposition, we have grown high-quality epitaxial thin films. For pure $CaRuO_3$ (x=1), grown on $NdGaO_3$, the residual resistivity ratio (RRR) approaches 55, i.e. the highest value reported up to now. Pronounced non-Fermi liquid effects are observed in the temperature dependence of the electrical resistivity, which could be suppressed by the application of large magnetic fields.

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TT 31.2 Wed 15:15 H 3010

Thermodynamics of Phase Formation and Heavy Quasiparticles in $Sr_3Ru_2O_7$ — •Andreas W. Rost[1], Santiago A. Grigera[1,2], Jan A.N. Bruin[1], Robin S. Perry[3], Demian Tian[1], Sri Raghu[4], Steve A. Kivelson[5], and Andrew P. Mackenzie[1] — [1]SUPA, School of Physics and Astronomy, University of St Andrews, St Andrews KY169SS, UK — [2]Instituto de Física de Líquidos y Sistemas Biológicos, UNLP-CONICET, La Plata 1900, Argentina — [3]SUPA, School of Physics, University of Edinburgh, Mayfield Road, Edinburgh EH93JZ, UK — [4]Department of Physics and Astronomy, Rice University, Houston, Texas, 77005, USA — [5]Department of Physics, Stanford University, Stanford, California, 94305, USA

The itinerant metamagnet $Sr_3Ru_2O_7$ has motivated a wide range of experimental and theoretical work in recent years because of the discovery of an unusual low temperature phase which is forming in the vicinity of a proposed quantum critical point. A major challenge is the investigation of the thermodynamic properties of both this unusual phase and the fluctuations associated with the quantum critical point. Here we will report on new specific heat measurements extending previous work to the wider phase diagram. Our results shed light on two important aspects of the system. First we will discuss the entropic details of the formation of heavy quasiparticles as a function of temperature in this compound relevant for a wide class of materials. Secondly we will present thermodynamic evidence for the anomalous low temperature phase forming directly out of the critical high temperature phase.

TT 31.3 Wed 15:30 H 3010

Crystal Growth and Magnetic Order of Ni-doped CePdAl — •Veronika Fritsch[1], Sarah Woitschach[2], Oliver Stockert[2], and Hilbert v. Löhneysen[1,3] — [1]Karlsruher Institut für Technologie, Physikalisches Institut, 76131 Karlsruhe, Germany — [2]Max-Planck-Institut für Chemische Physik feste Stoffe, 01187 Dresden, Germany — [3]Karlsruher Institut für Technologie, Institut für Festkörperphysik, 76344 Karlsruhe, Germany

CePdAl is a stoichiometric, antiferromagnetic compound, which can be tuned to a quantum critical point (QCP) by hydrostatic [1] or chemical pressure [2]. The latter can be achieved by substituting Ni for Pd. Neutron-scattering experiments [3] pointed towards a partial frustration of the Ce moments in CePdAl, making this system a promising candidate for investigating the influence of frustration on quantum criticality. We have grown large single crystals of $CePd_{1-x}Ni_xAl$ by the Czochralski method. The samples were characterized by x-ray powder diffraction, atomic absorption spectroscopy and x-ray Laue diffraction. Magnetization measurements of undoped CePdAl display a strong magnetic anisotropy, which is preserved in the Ni-doped compounds, where the magnetic order is suppressed. Neutron-diffraction experiments indicate that short-range correlations are present well above the Néel temperature T_N. Below T_N one third of the Ce moments displays short-range order only, confirming the frustration in this system.

[1] T. Goto *et al.*, J. Phys. Chem. of Solids **63**, 1159 (2002)
[2] Y. Isikawa *et al.*, J. Phys. Soc. Jpn. **65**, 117 (1996)
[3] A. Dönni *et al.*, J. Phys.: Condens. Matter **8**, 11213 (1996)

TT 31.4 Wed 15:45 H 3010

Spin excitations in CePdAl — •S. Woitschach[1], O. Stockert[1], M. Koza[2], V. Fritsch[3], H. v. Löhneysen[3], and F. Steglich[1] — [1]Max-Planck-Institut CPfS, Dresden, Germany — [2]Institut Laue-Langevin, Grenoble, France — [3]Karlsruher Institut für Technologie, Physikalisches Institut, Karlsruhe, Germany

The heavy-fermion compound CePdAl orders antiferromagnetically below the Néel temperature $T_N = 2.7$ K. Heat capacity measurements reveal a Kondo temperature of $T_K \approx 5$ K. Magnetic order can be continuously suppressed by Ni doping on the Pd site or application of hydrostatic pressure and a quantum critical point is approached. Moreover, as inferred from neutron scattering, geometrical frustration is present in CePdAl. So far, no detailed microscopic measurements have been published on the crystalline electric field (CEF) excitations in CePdAl. Here, we report on our inelastic neutron scattering on CePdAl powder samples to study the characteristic energy scales. The measurements yield the CEF excitations and the quasielastic spin fluctuations. Two excited CEF levels have been detected at ≈ 240 K and > 400 K. The results are compared to the thermodynamic measurements.

TT 31.5 Wed 16:00 H 3010

Quantum Phase transitions in $CeTi_{1-x}V_xGe_3$ — •Wolfram Kittler[1], Veronika Fritsch[1], Frank Weber[2], and Hilbert Löhneysen[1,2] — [1]Karlsruher Institut für Technologie, Physikalisches Institut, 76131 Karlsruhe, Germany — [2]Karlsruher Institut für Technologie, Institut für Festkörperphysik, 76021 Karlsruhe, Germany

$CeTiGe_3$ is a low-temperature ferromagnet with a $T_c \approx 14$ K. It crystallizes in a hexagonal structure with space group P63/mmc. The magnetic moments are located at the Ce atoms and point along the c-axis. T_c can be driven to $T_c = 0$ by V doping on the Ti sites. Thus $CeTi_{1-x}V_xGe_3$ seems to be one of the few ferromagnetic systems that can be driven to a quantum critical point where $T_c = 0$ by concentration tuning, in this case at $x_c \approx 0.35$.

The magnetic structure of pure $CeTiGe_3$ was determined in detail by powder neutron diffraction. Physical properties of the doped system were investigated with specific-heat, magnetization and resistivity measurements in order to determine the $T_c(x) \sim |x - x_c|^p$ dependence in detail. Our data are comparible with an exponent $p = 3/4$ expected for a three-dimensional ferromagnet. However $p = 1$ is also possible.