TT 4: Matter at Low Temperature: Cryotechnique, Cryodetectors and Measuring Devices

Time: Monday 11:15–13:00 Location: HSZ 105

Invited Talk TT 4.1 Mon 11:15 HSZ 105

Stimulated Cooperative Dynamics in Complex Solids — •Andrea Cavalleri — Max Planck Research Group for Structural Dynamics in CFEL - Hamburg — University of Hamburg

I will discuss some of our recent activities in the area of photo-control in solids with strongly correlated electrons. Control of a solid-state phase by impulsive electronic excitation in the near-infrared, and that of vibrational resonances at THz frequencies, extends the concepts of filling control and bandwidth control to the ultrafast timescale. These concepts are well known in slowly driven, conventional phase transitions, but are rather obscure in cases where one single degree of freedom is excited far away from equilibrium. Key to our endeavors are the new technological developments of ultrafast science, and the ability to generate ultrashort pulses that cover a spectral range between ˜THz frequencies (4.4 meV) and the hard x-rays (10 keV).

TT 4.2 Mon 11:45 HSZ 105

UHV Diffractometer for Soft X-Ray Diffraction at PETRA III — •Christian Schüssler-Langeheine — II. Physikalisches Institut, Universität zu Köln

Resonant diffraction in the soft x-ray range has recently shown to be a powerful technique to study nano-scale order phenomena like charge, orbital and spin order in strongly correlated electron systems.

The XUV beamline of the new synchrotron-radiation source PETRA III in Hamburg with its energy range from 200 eV up to 3 keV will cover the most important resonances of $3d$, $4d$ and $4f$ systems and will in addition to that provide a high coherent flux. For this beamline an UHV diffractometer suited for resonant and coherent soft x-ray scattering experiments is presently being set up. The experimental possibilities provided by the instrument at that beamline will be discussed with focus on the investigation of order phenomena in strongly correlated electron systems.

Funded by the BMBF through project 05KS7PK1.

TT 4.3 Mon 12:00 HSZ 105

Low Temperature Setup for Quenching Factor Measurements of $CaWO_4$ with Neutrons — •Christian Ciemniak[1], Chiara Coppi[1], Franz von Feilitzsch[1], Achim Gütlein[1], Christian Isaila[1], Jean-Côme Lanfranchi[1], Sebastian Pfister[1], Walter Potzel[1], Sabine Roth[1], and Wolfgang Westphal[1,2] — [1]Technische Universität München, Physik-Department E15, James-Franck-Str., D-85748 — [2]Deceased

CRESST is an experiment for the direct detection of dark matter (WIMPs) via nuclear recoil measurements on a $CaWO_4$ crystal. Different quenching factors for the nuclei allow the discrimination between background and a possible signal. To measure the quenching factors at low temperatures, a neutron scattering facility has been set up at the Maier-Leibnitz-Laboratory in Garching. In 2007 a cryostat has been installed and first measurements have been performed. For further optimization and to allow flight-time measurements at a fixed scattering angle, new electronic modules are presently being installed. We report on first results and ongoing upgrades. This work has been supported by funds of the DFG (SFB/Transregio 27: Neutrinos and Beyond), the Munich Cluster of Excellence (Origin and Structure of the Universe) and the Maier-Leibnitz-Laboratorium (Garching).

TT 4.4 Mon 12:15 HSZ 105

Progress in the micro-fabrication of high resolution magnetic calorimeters for x-ray spectroscopy — •Sönke Schäfer, Andreas Pabinger, Matias Rodrigues, Nadine Bleach, Thomas Wolf, Andreas Fleischmann, Loredana Fleischmann, and Christian Enss — KIP, Uni Heidelberg, INF 227, 69120 Heidelberg

Metallic magnetic calorimeters (MMC) are energy dispersive particle detectors with high energy resolution, that are operated at temperatures below 100 mK. MMCs consist of an absorber for the particles to be detected and a paramagnetic temperature sensor in tight thermal contact. The temperature rise upon the absorption of a particle, e.g. an x-ray photon, is detected via the change of the sensor's magnetization, being monitored by a low-noise high-bandwidth dc-SQUID. The thermodynamic properties of MMCs can be calculated with confidence, allowing for a prediction of the responsivity and the noise of detectors with given geometry and, consequently, a numerical optimization of MMCs for a given application. We studied two different types of fully micro-fabricated MMCs, that were optimized for the detection of x-ray photons with energies up to 10 keV. One of which made use of a cylindrical sensor positioned in the circular loop of a dc-SQUID residing in an external magnetic field. The second was based on a planar temperature sensor, that was read-out by a meander-shaped superconducting pick-up coil, transformer-coupled to a dc-SQUID. Both detectors were characterized at a number of operating temperatures and magnetic fields. We present data of both detectors and compare their performance with each other as well as with theoretical predictions.

TT 4.5 Mon 12:30 HSZ 105

Development and Characterization of a Micro-Hall Magnetometer and its Application to Molecular Nanomagnets — •A. Sundt, J. Dreiser, and O. Waldmann — Physikalisches Institut, Universität Freiburg, D-79104 Freiburg, Germany

Micro-Hall probes have been proven to be a simple and robust tool to measure magnetization curves $m(B)$ of small magnetic clusters at low temperatures with very high sensitivity [1,2]. We are currently building up such a micro-Hall magnetometer based on a GaAs/AlGaAs 2DEG to study magnetic molecules. Our design aims at extending the temperature range to studies from 1.5 K up to room temperature and obtaining an absolute measure of the samples' magnetization with high sensitivity. In order to achieve these goals geometric as well as Hall probe parameters are considered.

[1] M. Charalambous *et al.*, Phys. Rev. B **58**, 9510 (1998).
[2] H. M. Quddusi *et al.*, Rev. Sci. Instrum. **79**, 074703 (2008).

TT 4.6 Mon 12:45 HSZ 105

Mikroverdampfer für Hochleistungs-Kryoelektronik — •Gunter Kaiser und Jürgen Klier — ILK Dresden, Bertolt-Brecht-Allee 20, D-01309 Dresden

In einem Forschungsvorhaben wurden Mikroverdampfer zur Anwendung in der Hochleistungs-Kryoelektronik entwickelt. Die Leistungsgrenzen bezüglich des Verdampfungsprozesses in den Mikrokanälen sind durch das Gleichgewicht der Druckkräfte des Bernoulli-Effekt und der Oberflächenspannung gegeben. Es wurde der Einfluss der Quer- und Längs-Dimensionen der Struktur auf deren spezifischen Kälteleistung theoretisch untersucht und experimentell überprüft. Dazu wurde ein Mikroverdampfer, bestehend aus 21 Schlitzen mit einer Länge von 2 mm und einer Querdimension von 0.2 mm x 0.2 mm realisiert. Die Messungen zeigten einen flachen Verlauf der Arbeitstemperatur des Mikroverdampfers im Kälteleistungsbereich bis 10 W, gefolgt von einem steilen Anstieg der Arbeitstemperatur für höhere Kälteleistungen durch Austrocknung der Verdampferstruktur. Die Auslegungsrechnungen prognostizierten eine maximale Kälteleistung von 7.4 W. Der Mikroverdampfer lässt sich für verschiedene kryoelektronische Anwendungen, insbesondere für die Sensorkühlung in der zerstörungsfreien Werkstoffprüfung, für biomagnetische Anwendungen und zur Kühlung supraleitender Antennen und Hochfrequenzfilter einsetzen. Außerdem ist er geeignet unter Anwendung von Kohlendioxid im geschlossenen Kreisprozess auch Hochleistungs-Laserdioden für die Materialbearbeitung und für Schweißprozesse zu kühlen. Die Arbeiten wurden durch das BMBF (FKZ: 16SV1870) gefördert.