# VA 2 Quanten, Neutronen und Positronen

Zeit: Montag 10:40–13:00 Raum: TU E20

## Hauptvortrag

VA 2.1 Mo 10:40 TU E20

**Lots of whirl about the vacuum? A quantitative experiment on the Casimir force.** — •Maarten DeKieviet — Physikalisches Institut, Universität Heidelberg, 69120 Heidelberg

The existence of electromagnetic vacuum fluctuations manifests itself most impressively in the Casimir force, a stochastic and feeble force, so hard to measure properly, that it was considered to be solely of academic interest for a long time. With the current revolution in nano-technology, however, there is a rising, yet even economic need for a quantitative understanding.

I will present an experiment, in which the Casimir-Polder force between a single atom and the surface of a solid was determined quantitatively. It is based on the Atomic Beam Spin Echo method, developed in Heidelberg. This technique will be introduced and its high resolving power shown in some simple scattering experiments. Subsequently, I will discuss the physical origin of the phenomenon of quantum reflection and show that it depends very sensitively on the long-range details of the attractive atom-surface interaction. Utilizing quantum reflection as a tool, we have been able to identify the C4- (Casimir) and C3-branches (van der Waals) for different types of surfaces.

Theoretical relevance of these experiments is addressed in particular with respect to temperature dependency and non-Newtonian gravity. Finally, I will discuss how we may put the quantum field to work by specifically modifying the Casimir interaction through the nano-crafting of surfaces.

VA 2.2 Mo 11:20 TU E20

**MIRA - A flexible instrument for long wave length neutrons** — •Georgii Robert[1], Wagensonner Heinz[1], Mühlbauer Sebastian[1], and Böni Peter[2] — [1]ZWE FRM-II, TUM, Lichtenbergstr.1, 85747 Garching — [2]E21, Physik-Department, TUM, James-Franckstr, 85747 Garching

MIRA, the beam line for very cold neutrons at the FRM-II is operational since September 2004. It provides a beam of cold neutrons ( 7Å$< \lambda <$ 30Å). Additionally a polarised neutron beam with polarisation analysis is available. The instrument has several different operation modes. Currently it can be used as a reflectometer and as a SANS machine. A spin echo-option for these modes is under construction. The instrument is also ideally suited as a testing platform for new experimental set-ups as it is constructed in a modular way allowing for quick configuration changes.

Here the instrument together with first measurements will be presented. A reflectivity study, SANS measurements on MnSi and measurements on the magnetic vortices lattice in Nb will be discussed.

VA 2.3 Mo 11:40 TU E20

**The structure powder diffractometer (SPODI) at the FRM-II: status and applications** — •Michael Schlapp[1,2], Markus Hölzel[1,2], Ralph Gilles[1], Bernhard Krimmer[1], Hans Boysen[3], and Hartmut Fuess[2] — [1]TU München, ZWE-FRM-II, Lichtenbergstr. 1, 85748 Garching — [2]TU Darmstadt, Petersenstr. 23, 64287 Darmstadt — [3]Ludwig-Maximilians-Universität München, Theresienstr. 41, 80333 München

The new Structure POwder DIffractometer SPODI was built up and taken into operation at the neutron source FRM-II. This diffractometer is equipped with several unique components which distinguish it from other powder diffractometers : a 14.5 m long neutron guide coated with supermirrors, a vertically focussing Ge(551) waferstack monochromator with a take-off angle of 155 ° and 300 mm high position sensitive 3He-counter tubes. Due to the exceptional geometrical features, the SPODI is equipped with a small-angle scattering apparatus, which extends the accessible range of the scattering vector down to Q=0.003 Å-1. First experiments made during the calibration and alignment phase of the structure powder diffractometer show very promising results. In this contribution we present the current status of the instrument as well as an outlook to possible experiments at the structure powder diffractometer SPODI.

VA 2.4 Mo 12:00 TU E20

**The Materials Science Reflectometer MatSci-R at FRM-II** — •Rühm Adrian — MPI für Metallforschung, Stuttgart

The Max Planck Society is operating a neutron reflectometer for Materials Science at the new research reactor FRM-II in Garching. The horizontal standard geometry of the instrument makes it suitable for reflectometry and grazing incidence scattering studies of free liquid surfaces. The reflectometer can be used for polarized neutron reflectometry and off-specular scattering to investigate magnetic materials, e.g. magnetic multilayers. The instrument will make intense use of the novel spin-echo resolved grazing incidence scattering (SERGIS) technique for the study of off-specular scattering. This technique exploits the neutron spin to obtain high q-resolution without collimation of the incident beam, thus making it possible to explore q-ranges which would otherwise be too weak in scattering intensity to be studied. As a special novel feature the neutron reflectometer also provides a so far unique add-on X-ray reflectometer which allows to routinely conduct in-situ neutron/X-ray contrast studies.

VA 2.5 Mo 12:20 TU E20

**Positron remoderation device for brightness enhancement of the reactor based positron beam at the FRM-II** — •C. Piochacz[1], C. Hugenschmidt[1,2], K. Schreckenbach[1,2], and B. Strasser[2] — [1]TUM, Lehrstuhl für Experimentalphysik E21, James-Frank-Str., 85747 Garching — [2]ZWE FRM2, Lichtenbergstr. 1, 85747 Garching

Recently, the positron beam facility NEPOMUC was set into operation at the new research reactor FRM-II in Garching. In order to enhance the brightness of the beam a positron remoderation apparatus was developed. The remoderator is build up in transmission geometry: positrons from the source are focused on to a 0.1 $\mu$m thin mono-crystalline W-foil where they thermalize and diffuse to the back side of the foil. At the surface, low energy positrons ($\sim$ 3 eV) leave the foil with a small angular divergency. The focusing is magnetically achieved by adiabatic beam compressing with a water-cooled copper coil. It is expected to reach a magnetic field of about 280 mT resulting in a beam diameter of less than 1 mm. The energy distribution and the angular spread of the remoderated beam as well as the moderation efficiency is measured. An overview of the the assembly will be given and first measurements will be presented.

VA 2.6 Mo 12:40 TU E20

**First Positron Experiments at NEPOMUC** — •Christoph Hugenschmidt, Klaus Schreckenbach, Martin Stadlbauer, and Benno Strasser — ZWE FRM II, Technische Universität München, 85747 Garching, Germany

In summer 2004 the in-pile positron source NEPOMUC (Neutron Induced Positron Source Munich) of the new Munich research reactor FRM-II was set into operation at the nominal reactor power of 20 MW. Intensity and positron beam profile measurements were preformed at 30 eV and 1 keV respectively. For this purpose, NaI-scintillators detect the 511 keV $\gamma$-radiation of positrons that annihilate at a removable target in the beam line. The beam profile is determined with a micro channel plate detector and a CCD-camera.

In the present arrangement of NEPOMUCs instrumentation the monoenergetic positron beam is magnetically guided to a coincident Doppler broadening (CDB) facility and to a PAES (positron induced Auger electron spectroscopy) analysis chamber. First experiments on alloys were performed in order to show the abilities of these new facilities. An overview of the positron beam facility is given and first experimental results are presented.