VA 1: Large instruments for science

Time: Monday 9:30–11:15 Location: H9

Invited Talk VA 1.1 Mon 9:30 H9

KATRIN: Fertigung und erste Vakuumtests des UHV-Hauptspektrometers — •Joachim Wolf — Universität Karlsruhe IEKP, Postfach 3640,76021 Karlsruhe

Die Skala der absoluten Neutrinomassen ist von fundamentaler Bedeutung für die Kosmologie und die Astroteilchenphysik. Das KArlsruhe TRItium Neutrinomassenexperiment (KATRIN) hat sich zum Ziel gesetzt, die Neutrinomasse mit einer Sensitivität von $m_\nu < 0,2$ eV/c^2 (90%CL) zu messen. Dazu wird das Energiespektrum der β-Elektronen aus einer fensterlosen gasförmigen Tritiumquelle hoher Luminosität mit einem hochauflösenden System aus zwei elektrostatischen Retardierungsspektrometern (MAC-E-Filter) gemessen. Dieser Vortrag beschreibt die Fertigung und erste Vakuumtests des UHV-Hauptspektrometers. Mit einem Volumen von 1250 m^3, einer inneren Oberfläche von 650 m^2 und einem angestrebten Druck von 10^{-11} $mbar$ zählt das Hauptspektrometer zu den grössten Ultrahochvakuumtanks der Welt. Der 24 m lange und 10 m durchmessende Vakuumtank wurde im November 2006 im Forschungszentrum Karlsruhe angeliefert, wo er zur Zeit für die Endabnahme vorbereitet wird. Teilweise gefördert vom BMBF unter den Förderkennzeichen 05CK5VKA/5, 05CK5REA/0, 05CK5PMA/0 und 05CK5UMA/3

VA 1.2 Mon 10:15 H9

Status of the Positron Beam Facility NEPOMUC and Positron Experiments at FRM II — •Christoph Hugenschmidt[1,2], Thomas Brunner[1], Benjamin Löwe[1], Jakob Mayer[1], Philip Pikart[1], Christian Piochacz[1,2], Martin Stadlbauer[1,2], and Klaus Schreckenbach[1,2] — [1]Physik Department E 21, James-Franck-Strasse, 85748 Garching, Germany — [2]ZWE FRMII, Technische Universität München, Lichtenbergstrasse 1, 85747 Garching, Germany

A low-energy positron beam of highest intensity is available at the neutron induced positron source NEPOMUC of the Munich research reactor Heinz Maier-Leibnitz FRM II. The energy dependent positron yield of the primary beam is in the range between $4 \cdot 10^7$ and $5 \cdot 10^8$ moderated positrons per second. Experiments have been performed for the regeneration of the platinum moderation foils of the in-pile positron source after degradation in order to improve the long-term stability of the beam intensity.

An overview of the present status of NEPOMUCs instrumentation is presented: (i) the coincident Doppler broadening spectrometer (CDBS) for defect spectroscopy, (ii) the apparatus for the analysis of positron annihilation induced Auger electron spectroscopy (PAES) for surface studies and (iii) a facility for the production of the negatively charged Positronium ion. Within this presentation future developments of the positron beam facility, the extension of the existing spectrometers and novel positron instrumentation will be discussed.

VA 1.3 Mon 10:30 H9

Novel remoderation device for brightness enhancement of the reactor based positron beam at the FRM-II — •Christian Piochacz[1,2,3], Gottfried Kögel[3], Christoph Hugenschmidt[1,2], Klaus Schreckenbach[1,2], and Günther Dollinger[3] — [1]TU München, Physik-Department E21, James-Franck-Strasse, 85748 D-Garching — [2]ZWE FRM2, Lichtenbergstr. 1, 85747 D-Garching — [3]UniBw München, Institut für Angewandte Physik und Messtechnik LRT2, Werner-Heisenberg-Weg 39, D-85577 Neubiberg

In order to enhance the brightness of the positron beam produced by the Nepomuc source, a positron remoderator was developed. This remoderation device has been installed at the first accessible point of the beam facility and first measurements have been done in order to obtain the efficiency of the setup and the quality of the remoderated beam. The remoderator is built up in reflection geometry: positrons from the source are focused onto a W(100) single crystal where they are thermalized and diffuse back to the surface. Due to the negative workfunction of tungsten the positrons can leave the solid with a sharp energy of 3 ± 0.03 eV and with a small angular divergence of ± 0.1 eV. In contrast to existing remoderators used in table top experiments the presented setup is designed to accept a beam with a greater phase space volume, which is typical for positron sources at large scale facilities. An overview of the assembly will be given and first measurements will be presented.

VA 1.4 Mon 10:45 H9

Gas moderation of positrons — •Benjamin Löwe, Klaus Schreckenbach, and Christoph Hugenschmidt — Physik Department E21 und FRM II, TU München, Lichtenbergstr. 1, 85747 Garching

A variety of low energy positron experiments need an improved brilliance of the beam by means of a remoderator. Conventionally a tungsten single crystal is used as a remoderator in transmission or reflection geometry. In this project a novel remoderation unit is developed and is presently tested at the positron beam facility NEPOMUC at the FRM II. This remoderation is based on inelastic positron scattering and the drift of positrons in a suitable gas.

Positrons of an energy of approximately 500 eV from NEPOMUC are decelerated at the entrance of the remoderation chamber to about 50 eV by an electric field and enter into the gas region (about 1 mbar). They are stopped in the gas, drift along the focusing electric field lines and are accelerated into the UHV region at the exit. By differential pumping the pressure in front and behind the chamber must be as low as possible in order to avoid positron losses by positron-atom collisions at higher energies. Later on it is planned to couple the device to a positron trap.

VA 1.5 Mon 11:00 H9

New options for MIRA at the FRM-II — •Robert Georgii[1,2], Nicolas Arend[1], Peter Böni[2], and Reinhard Schwikowski[1,2] — [1]Forschungsneutronenquelle Heinz Maier-Leibnitz, TU München, 85747 Garching — [2]Physik-Department E21, TU München, 85747 Garching

MIRA is a versatile instrument for very cold neutrons (VCN) using neutrons with a wavelength $\lambda > 8$ Å. The flux at the sample position is $5 \cdot 10^5$ neutrons/(cm^2 s) unpolarised. It is situated at the cold neutron guide NL6b in the neutron guide hall of the FRM-II. As the instrument set-up can be changed quickly, MIRA is ideally suited as a testing platform for realizing new instrumental set-ups and ideas. In particular, MIRA is unique in its possibilities of combining different neutron scattering methods as:

- Polarized or non-polarized reflectometry.
- Sperical Polarimetry
- Polarized or non-polarized small angle scattering (SANS).
- Classical NRSE (Neutron Resonance Spin Echo) setup as well as using the MIEZE principle.

A new polarising multilayer monochromator was taken into operation. This allows now full polarisation analysis, 3D-polarimetry and MIEZE measurements. Selected experiments using these new otions will be presented here.