VA 4: NEPOMUC positron source and experiments

Time: Monday 15:00–16:40 Location: H 0106

Invited Talk VA 4.1 Mon 15:00 H 0106

Surface and Bulk Investigations at the High Intensity Positron Beam Facility NEPOMUC — •Christoph Hugenschmidt[1,2], Günther Dollinger[3], Werner Egger[3], Gottfried Kögel[3], Benjamin Löwe[1], Jakob Mayer[1], Philip Pikart[1,2], Christian Piochacz[1,2], Klaus Schreckenbach[1,2], Peter Sperr[3], and Martin Stadlbauer[1,2] — [1]TU Munich, Department of Physics E21, James-Franck-Strasse, 85478 Garching — [2]TU Munich, ZWE FRM II, Lichtenbergstrasse 1, 85748 Garching — [3]UniBW Munich, LRT2, Werner-Heisenberg-Weg 39, 85577 Neubiberg

NEPOMUC – the NEutron induced POsitron source MUniCh – delivers a low-energy positron beam (E = 15 - 1000 eV) of high intensity in the range between $4 \cdot 10^7$ and $5 \cdot 10^8$ moderated positrons per second. At present four experimental facilities are in operation at NEPOMUC: A coincident Doppler-broadening spectrometer (CDBS), a positron annihilation induced Auger-electron spectrometer (PAES) and an apparatus for the production of the negatively charged positronium ion Ps^-. Recently, the pulsed low-energy positron system (PLEPS) has been connected to the NEPOMUC beam line and first positron lifetime spectra were recorded within short measurement times. A positron remoderation unit, which is operated with a tungsten single crystal in back reflection geometry has been implemented in order to improve the beam brilliance. An overview of the status of the neutron induced positron source NEPOMUC at the research reactor FRM II and recent developments at the running spectrometers is given.

VA 4.2 Mon 15:40 H 0106

Gas moderation of positrons — •Benjamin Löwe[1,2], Klaus Schreckenbach[1,2], and Christoph Hugenschmidt[1,2] — [1]TU München, FRM II, Lichtenbergstr. 1, 85747 Garching — [2]TU München, Physik Department E21, James Franck Str., 85748 Garching

A variety of low energy positron experiments need an improved brilliance of the beam by means of a remoderator. Conventionally, a tungsten foil or single crystal is used as a remoderator in transmission or reflection geometry. In this project a novel remoderation unit was developed and 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. The stopping of positrons in nitrogen has already been shown by Surko et al. and is currently used to store positrons in a trap.

Positrons from the NEPOMUC source are decelerated at the entrance of the remoderation chamber to about 50 eV by an electric field and enter into the gas region (about 0.01 mbar). Due to inelastic scattering with gas molecules the positrons lose energy through different processes such as vibrational excitations, electronic excitations and ionisation. Above energies of 8 eV losses due to positronium formation occur. After thermalisation in the gas the positrons drift along the focusing electric field lines. At the exit the moderated positrons have been measured by a retarding potential analyser. The principle of the new gas remoderator and first measurements will be presented.

VA 4.3 Mon 16:00 H 0106

A new device for a pulsed positron beam at the NEPOMUC positron facility — •Christian Piochacz[1,2], Gottfried Kögel[2], Werner Egger[2], Christoph Hugenschmidt[1], Peter Sperr[2], and Günther Dollinger[2] — [1]ZWE FRM II, TU München, Lichtenbergstraße 1, 85747 Garching — [2]LRT 2, Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, 85577 Neubiberg

Positron annihilation is a highly sensitive method to study defects of atomic size. Both, the types and the concentrations of defects can be determined by positron lifetime measurements. To perform such measurements with micrometer spatial resolution, a pulsed positron beam is focused down to micrometer spot size in the Munich Scanning Positron Microscope (SPM). For a much higher event rate it is intended to operate this SPM at the high intense positron source NEPOMUC at the FRM II. Since April 2007 a remoderated positron beam of sufficient brilliance is available at NEPOMUC.

The new pulsing device must transform this dc-beam into a train of sharp pulses without losing much intensity. Therefore, a two stage pulsing concept is applied, where a pre-buncher concentrates the intensity into the nanosecond time windows of the resonant sine wave main buncher. The new device has been completed and installed at the open beam port of NEPOMUC. We present the design concepts and results from both, particle tracing simulations and first measurements.

VA 4.4 Mon 16:20 H 0106

Improvement of the CDBS at NEPOMUC - Simulations and first measurements — •Martin Stadlbauer[1,2], Christoph Hugenschmidt[1,2], and Klaus Schreckenbach[1,2] — [1]TU München, ZWE FRM-II, Lichtenbergstr. 1, D-85748 Garching — [2]TU München, Physikdepartment E21, James-Franck-Str., D-85748 Garching

Coincident Doppler broadening spectroscopy with positrons (CDBS) is a well established technique to investigate lattice defects and their chemical surrounding in solids and has been successfully implemented at the high intense positron source NEPOMUC at the research reactor FRM-II in Munich. In order to improve the existing spectrometer for measurements on materials with low positron trapping rates, it has been redesigned and improved with a cryostat for sample cooling to liquid nitrogen temperature. A recently installed brilliance enhancing remoderator facility at NEPOMUC enforced further changes at the CDBS-facility like an insulated magnetic field termination and a new lens system.

The new design of the CDBS-facility and simulations of the positron trajectories are shown and first measurements of the beam parameters at the sample position are presented. Furthermore, ion-irradiated magnesium samples have been investigated with the new CDBS-facility, since the positron trapping rate in magnesium is low and the trapping sites are shallow.