MI 9: Positron Annihilation Studies of Condensed Matter

Time: Wednesday 11:45–13:00 Location: EMH 225

Invited Talk MI 9.1 Wed 11:45 EMH 225

Experiments with the intense and brightness enhanced positron beam at NEPOMUC — •Christian Piochacz, Thomas Gigl, Niklas Grill, Markus Reiner, Samantha Zimnik, and Christoph Hugenschmidt — Heinz Maier-Leibnitz Zentrum (MLZ) and Physik Department E21, Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany

At the intense positron source NEPOMUC at the Heinz Maier-Leibnitz Zentrum (MLZ), four different spectrometers are installed permanently and one beam port is open for positron experiments provided by external users. The NEPOMUC remoderator enhances the brightness of the primary beam due to stochastic cooling of the positrons in a W(110) single crystal. Although the beam intensity is reduced to about 6 % the remoderation is a uniquely efficient technique to reduce the beam diameter and the energy spread considerably. Therefore, it is crucial for experiments with high lateral resolution and exceptional time resolution. However, there are also some experiments which are not as sensitive onto the beam quality but need as many positrons as possible. To meet the different demands of current and future experiments, the approved NEPOMUC positron remoderator was relocated and two novel beam switches were installed in order to provide the primary, high intensity beam or the remoderated, high brightness beam within short switching times. Within this contribution the NEPOMUC positron beam facility and some selected experiments are presented. Special attention is set to emphasize the benefit of the high intensity and high brightness beam, respectively.

MI 9.2 Wed 12:30 EMH 225

Characterization of High Purity Ni(100)-foils for Positron Moderation in a Novel Positron Microbeam Setup — •Thomas Gigl, Christian Piochacz, Markus Reiner, and Christoph Hugenschmidt — Heinz Maier-Leibnitz Zentrum (MLZ) and Physik Department E21, Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany

The positron beam facility NEPOMUC at the Research Neutron Source FRM II provides the worlds most intense mono-energetic positron beam with an intensity of 10^9 moderated e^+/s. The CDB spectrometer at NEPOMUC enables depth dependent and spatially resolved defect studies by using conventional doppler broadening spectroscopy (DBS), and element-specific measurements with coincident DBS. In order to investigate the near-surface region and the bulk of a sample, the positron implantation energy can be increased to 30 keV. The lateral resolution amounts to 300 μm.

For the development of a positron beam with a diameter of $<5\,\mu$m a Ni(100) foil with a thickness of 100 nm for positron re-moderation will be installed in transmission geometry in order to increase the beam brightness. In order to achieve a high yield of re-emitted moderated positrons, the Ni foil has to be annealed and surface contaminations such as carbon and oxygen have to be removed. For this purpose, temperature-dependent XPS measurements for characterizing the surface contaminations, and temperature-dependent DBS was performed to determine the annealing behaviour of the Ni foil. Financial support by BMBF (project no. 05K10WOB) is gratefully acknowledged.

MI 9.3 Wed 12:45 EMH 225

Energy modulation of a pulsed positron beam for depth dependent measurements — •Niklas Grill[1], Marcel Dickmann[2], Christian Piochacz[1], Sebastian Vohburger[1], and Christoph Hugenschmidt[1] — [1]Heinz Maier-Leibnitz Zentrum (MLZ) and Physik Department E21, Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany — [2]Institut für Angewandte Physik und Messtechnik LRT2, Fakultät für Luft- und Raumfahrttechnik, Werner-Heisenberg-Weg 39, 85577 Neubiberg, Germany

A two-stage bunching unit is used to generate a pulsed positron beam with a frequency of 5 MHz from a continuous beam generated by a ^{22}Na β^+ source. At the first stage a sawtooth-shaped signal is used to compress a large amount of the continuous beam into pulses which are short enough for the following main buncher. This utilizes a sinusoidal function at 20 MHz to ensure a high energy modulation and thus narrow pulses. Via time-dependent electromagnetic fields the potential energy of the bunches is then raised to several keV without altering the velocity of the positrons. Subsequently the positrons can be accelerated towards ground potential, thus allowing a depth resolved measurement of samples at ground potential. This is e.g. necessary for positron re-emission experiments and Positron Annihilation Auger Electron Spectroscopy measurements performed at the NEPOMUC positron beam facility. Due to the low pulsing frequency the setup can also be used to investigate materials with long positron lifetimes, thus enabling non-destructive measurements on e.g. polymers. Within this contribution, details of the setup and first lifetime measurements will be presented.