AKBP 7: Applied Physics with Accelerators

Time: Wednesday 9:30–11:00 Location: E 020

AKBP 7.1 Wed 9:30 E 020

The solid state Physics programme at ISOLDE-CERN: an important update — •Juliana Schell[1,2], Hans Hofsaess[3], Peter Schaaf[4], Lukas Eng[5], Sergiy Divinski[6], Anna Krawczuk[3], and Doru Lupascu[2] — [1]European Organization for Nuclear Research (CERN), Switzerland — [2]University of Duisburg-Essen, Germany — [3]Georg-August-Universität Göttingen, Germany — [4]TU Ilmenau, Germany — [5]Technische Universität Dresden, Germany — [6]University of Münster, Germany

ISOLDE-CERN is the worldwide reference facility for the production and delivery of radioactive ion beams of high purity. Since the late 70s the laboratory is pioneer in the use of nuclear techniques for studying local properties of materials using high-technology equipment. For instance, the brand-new ultra-high-vacuum implantation chamber called ASPIC Ion Implantation chamber (ASCII) decelerates the radioactive ion beam allowing to perform ultra-low energy ion implantations, and local measurements on the surface and interface of materials. The new MULTIPAC setup for Perturbed Angular Correlation Experiments in Multiferroic (and Magnetic) Materials simultaneously allows to measure local magnetic and ferroelectric properties of materials in magnetic fields up to 8.5 T. Last, but not least, the eMIL-Setup is an advanced emission Mössbauer spectrometer for measurements in versatile conditions of several classes of materials, thanks to the emission Magnetic Mössbauer Analyzer (eMMA) extension. This presentation introduces the new setups and discuss the possibilities of investigations on the frontiers of solid-state physics research.

AKBP 7.2 Wed 9:45 E 020

Proton Beam Based Production of a Positron Emitter by Exploiting the ^{27}Al(p,x)^{22}Na Reaction — •Lisa-Marie Krug[1], Leon Chryssos[1], Jürgen Bundesmann[2], Alina Dittwald[2], Georgios Kourkafas[2], Andrea Denker[2], and Christoph Hugenschmidt[1] — [1]Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie, Protonen für die Therapie, Hahn-Meitner-Platz 1, 14109 Berlin, Germany

Compact setups for defect spectroscopy based on positron annihilation conventionally comprise a β^+ emitter as positron source. We produced ^{22}Na sources by irradiating aluminum targets with a 68 MeV proton beam available at the cyclotron at the Helmholtz-Zentrum Berlin (HZB). The design of the target allowed the production of multiple positron sources at once as well as the analysis of the depth dependent activity of ^{22}Na, which was found to be in agreement with the simulated depth profile. In total a ^{22}Na activity of 140(23) kBq was produced, which is spread over 50 individual Al discs whereby the highest activity achieved amounts to 4.62(23) kBq. Using the activated Al discs as positron emitters intrinsically avoids wet chemical processes. The production of stronger sources is desired for positron annihilation spectroscopy experiments can easily be achieved by irradiating the target for a longer period of time. Other radionuclides among ^{7}Be, ^{48}Sc, ^{54}Mn and ^{56}Co were produced with a total activity of 70(5) kBq, but can be avoided aside from ^{7}Be by using aluminum of a higher purity.

AKBP 7.3 Wed 10:00 E 020

First thoughts on electron beam treatment at the high average power SRF photoinjector SEALab — •Tasha Spohr — Helmholtz-Zentrum Berlin, Berlin, Germany

SEALab at the Helmholtz-Zentrum Berlin (HZB) is a high average power linear accelerator designed for ERL and UED experiments.

The electron beam from the SEALab photoinjector has potential properties which could be used for electron beam irradiation of wastewater, removing PFAS and other forever chemicals.

With Access@SEALab, we want to study the cleaning process and the required beam properties. In addition, we want to design an in-air beamline to study specific questions of wastewater removal by electron beam treatment.

The process of research and simulations will be presented in this talk.

AKBP 7.4 Wed 10:15 E 020

Installation of the Future Neutron Irradiation Site at the Bonn Isochronous Cyclotron — •Maximilian Loepke, Reinhard Beck, Dieter Eversheim, and Dennis Sauerland — Helmholtz-Institut für Strahlen- und Kernphysik Bonn

The Bonn Isochronous Cyclotron provides a beam of protons, deuterons, α-particles with a kinetic energy ranging from 7 to 14 MeV per nucleon. Since 2019, a proton beam is utilized for irradiation of e.g. silicon pixel detectors for radiation hardness studies.

It is planned to extend the facility's irradiation and experimentation capabilities by providing a neutron beam in the near future. The neutrons are produced by splitting-up deuterons into protons and neutrons in a thick carbon converter. Protons are stopped in the converter whereas the neutrons' flux and angular energy distribution is optimized by a subsequent copper/tungsten collimator. After collimation, the neutron beam can be utilized for irradiation.

For the installation of the site, a CAD model of the experimental area was photogrammetrically created using the tools Meshroom and Meshlab. The collimator will be precisely aligned onto the beam axis. Beam axis determination and collimator alignment will be facilitated using a laser tracker. The beam diagnostics at the site will consist of a Secondary Electron Monitor (SEM) for non-destructive monitoring of beam current and position, a Faraday-Cup for SEM calibration and a scintillation screen for visual adjustment of the beam profile and the optics of the transfer beamline. This talk gives a detailed overview on the next steps of the installation of this irradiation site.

AKBP 7.5 Wed 10:30 E 020

Hochleistungs-Röntgenquelle für die Krebstherapie mit Mikrostrahlen — •Anton Dimroth[1], Stefan Bartzsch[2], Johanna Winter[2], Christian Petrich[2], Thomas Beiser[3], Ghaleb Natour[1] und Kurt Aulenbacher[3] — [1]ZEA-1, Forschungszentrum Jülich — [2]Klinikum rechts der Isar, TU München — [3]Institut für Kernphysik, Universität Mainz

Mikrostrahltherapie (MST) ist eine Entwicklung der Radioonkologie, die Röntgenstrahlung alternierend als Peaks hoher Dosis und Bereiche niedriger Dosis moduliert. Präklinisch zeigte die Therapie eine wesentlich bessere Verträglichkeit bei gleicher Tumorkontrolle im Vergleich zur konventionellen Strahlentherapie. Aufgrund der Abhängigkeit von Synchrotronstrahlung, gelang bislang keine klinische Anwendung.

Wir entwickeln eine Linienfokus-Röntgenröhre, die MST in klinische Studien bringen soll. Dazu müssen Dosisraten von über 100 Gy/s erreicht werden. Die größte Herausforderung ist die niedrige Effizienz von Röntgenröhren und die resultierende hohe Wärmelast auf dem Target. Konventionell bestehen rotierende Röntgentargets aus Wolfram-Molybdän-Verbindungen. Die für unsere Anwendung notwendigen hohen Rotationsgeschwindigkeiten und enormen Temperaturen erfordern allerdings andere Materialkombinationen. Wir konstruieren daher ein Röntgentarget aus Titan, das lediglich eine dünne Mantelschicht aus Molybdänlegierung und Wolfram aufweist. Die niedrigere Dichte von Titan bei hoher Hitzebeständigkeit reduziert mechanischen Spannungen. Durch Ausnutzung des Wärmekapazitätslimit verbleibt die Temperatur im Brennfleck unterhalb der Schmelztemperatur von Wolfram.

AKBP 7.6 Wed 10:45 E 020

Multiscale material characterization of palm-leaf manuscripts using SAXS and WAXS — •Laura Gallardo[1,2], Giovanni Ciotti[2,3], Mark Busch[1], Richard Kohns[1], Agnieszka Helman-Wazny[2], Sylvio Haas[2,4], and Patrick Huber[1,4,5] — [1]Institute for Materials and X-Ray Physics, Hamburg University of Technology — [2]Centre for the Study of Manuscript Cultures (CSMC), Hamburg University — [3]Department of History and Cultures, University of Bologna — [4]Deutsches Elektronen-Synchrotron DESY — [5]Institute of Surface Science, Helmholtz-Zentrum Hereon

Palm-leaf has been a very important material for the production of manuscripts in South, Central and South East Asia. In spite of the large collections preserved throughout the world, a classification of these manuscripts is only possible according to their language or their content, where the origin of the manuscripts is rarely known. This tradition has almost disappeared with the exception of a few monasteries and workshops for tourist handicrafts, where they still produce this writing support. Recent efforts have been made to document the manufacture process of the palm-leaves, finding crucial differences between the different monasteries that may help to identify the origin of the palm-leaf manuscripts (PLM) inherited from the past. In this study, we use Small and Wide Angle X-ray Scattering (SAXS and WAXS) to analyze the structural differences and similarities of palm-leaves in different stages of preparation and PLM. We aim to understand the physical changes of the leaves during the preparation process and to identify the similarities with unclassified PLM.