MS 6: Posters II

Time: Wednesday 16:30–19:00 Location: Empore Lichthof

MS 6.1 Wed 16:30 Empore Lichthof

Entwicklung eines Gasionisationsdetektors — •Gereon Hackenberg, Alfred Dewald, Claus Müller-Gatermann, Markus Schiffer, Claus Feuerstein, Gregor Zitzer, Alexander Stolz, Stefan Heinze und Richard Altenkirch — Universität zu Köln, Institut für Kernphysik, Deutschland

Zur Spektrometrie kosmogener Nuklide wie ^{10}Be, ^{14}C und ^{26}Al, als auch Actinoide wurde ein kleiner Gasionisationsdetektor entwickelt, der zunächst bei Pu-Messungen am 6MV Tandetronbeschleuniger eingesetzt wurde. Das Detektordesign ist stark an den Ionisationsdetektor der ETH Zürich angelehnt [1]. Zur Bestimmung der elektrischen Felder innerhalb des Detektors wurden mit dem Programm SIMION detaillierte Simulationsrechnungen durchgeführt. Da zunächst keine kontinuierliche Gaszirkulation vorgesehen ist, wurde beim Bau speziell darauf geachtet, dass Verunreinigungen des Zählergases (Isobutan) durch Auswahl geeigneter Materialien möglichst klein gehalten werden, um die Standzeiten des Detektors zu maximieren. Die verwendeten Vorverstärker wurden am IKP der Universität zu Köln selbst entwickelt und gebaut. Die Detektoreigenschaften wurden mit verschiedenen Ionen wie ^{12}C bei 26MeV, ^{37}Cl bei 33MeV und ^{238}U bei 12MeV getestet. Auflösung und Resultate einer ersten Pu-Messung werden vorgestellt.

[1] A.M. Müller et al., Performance of the ETH gas ionization chamber at low energy, Nucl. Inst. Meth. B 287 (2012) 94.

MS 6.2 Wed 16:30 Empore Lichthof

Atmospheric picosecond IR laser desorption by impulsive vibrational excitation mass spectrometry (PIRL-DIVE-MS) — •Yinfei Lu[1], Cornelius L. Pieterse[1], Wesley D. Robertson[1], and R. J. Dwayne Miller[1,2] — [1]Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — [2]University of Toronto, Toronto, Canada

Desorption by impulsive vibrational excitation (DIVE), using a recently developed picosecond infrared laser (PIRL), has been shown to be an efficient and ultra-soft laser ablation method for the extraction of biomolecules from tissue and solution free of thermal and acoustic damage. DIVE ablation has been shown to efficiently extract intact and even functional proteins, protein complexes and viruses. Here we apply DIVE ablation for the development of a new extraction and ionization technique for mass spectrometry. We demonstrate the efficient production of gas phase ions of small molecules, peptides and large proteins from bulk water for ultra-high sensitivity (femto-mole) mass spectrometry using DIVE in combination with a novel mass spectrometry interface. No further ionization or nebulization methods are employed. The system is directly compared to standard electrospray ionization (ESI). Further, a nanofabricated, dynamically wetted, pico-liter chip array system for aqueous DIVE-MS is demonstrated by utilizing custom image processing base fiducial registration software for sample loading and sampling. The method represents an efficient method for ultra-high sensitivity extraction and MS detection of analytes directly from lab on chip constructions.

MS 6.3 Wed 16:30 Empore Lichthof

The Heidelberg ATTA setup for ^{39}Ar dating — •Zhongyi Feng[1], Sven Ebser[1], Anika Frölian[1], Maurus Hans[1], Lisa Ringena[1], Florian Ritterbusch[1,2], Werner Aeschbach[2], and Markus K. Oberthaler[1] — [1]Kirchhoff-Institute for Physics, Heidelberg, Germany — [2]Institute of Environmental Physics, Heidelberg, Germany

The half-life of ^{39}Ar covers a dating range from 50 to 1000 years before present and is ideal for ocean water and ice samples, but a challenge arises due to the low abundance $^{39}\mathrm{Ar}/\mathrm{Ar} = 8.23 \cdot 10^{-16}$ and the small probe volumes in the order of few liters. Atom Trap Trace Analysis (ATTA) is an ultra-sensitive counting method based on the high selectivity of many photon scattering processes in a Magneto-Optical Trap (MOT) to distinguish the rare isotope from the abundant ones. With this poster we will give a summary of the current status of the experiment and the prospects for dating water samples on a routine basis. We will specifically discuss the possible improvement of the metastable argon source performance utilizing optical pumping inferred from spectroscopic results in a cell. An improved laser setup allowing robust and reliable measurements over many hours as well as alternative cooling schemes will be presented. The smallest possible sample size is currently limited due to a contamination with ^{39}Ar enriched samples. We will present the results of our detailed studies and will discuss measurement strategies which make the dating of water samples in the order of 10 liter possible.

MS 6.4 Wed 16:30 Empore Lichthof

Implementiation of a position-sensitive detector at TRIGA-TRAP for a phase-sensitive ion cyclotron resonance measurement — •Jacques J. W. van de Laar[1,5], Klaus Blaum[2], Michael Block[1,3,4], Christoph E. Düllmann[1,3,4,5], Klaus Eberhardt[1,4], Jessica Grund[1,5], Szilard Nagy[2], Dennis Renisch[1], Fabian Schneider[1,6], and Klaus Wendt[5,6] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz, DE — [2]Max-Planck-Institut für Kernphysik, Heidelberg, DE — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, DE — [4]Helmholtz-Institut Mainz, DE — [5]PRISMA Cluster of Excellence, Johannes Gutenberg- Universität, Mainz, DE — [6]Institut für Physik, Johannes Gutenberg- Universität, Mainz, DE

Experimental data of ground-state properties of exotic nuclei are important for nuclear structure studies and can test the reliability of nuclear mass models. The TRIGA-TRAP experiment is a double Penning-trap mass spectrometer to perform high-precision measurements on long-lived transuranium isotopes and neutron-rich radionuclides at the research reactor TRIGA Mainz. A novel phase-sensitive detection technique[1] based on the projection of the radial ion motion in the Penning trap onto a position-sensitive detector, the Phase-Imaging Ion-Cyclotron-Resonance (PI-ICR) technique, will be implemented at TRIGA-TRAP. This technique provides a gain of a factor of 40 in resolving power compared to the currently used method. The current status and first results will be resented. [1] S. Eliseev et al., Appl. Phys. B 114 (2014), 107-128

MS 6.5 Wed 16:30 Empore Lichthof

High-Precision Mass Measurements with PENTATRAP — •Rima X. Schüssler[1,2], Hendrik Bekker[1], José R. Crespo López-Urrutia[1], Sergey Eliseev[1], Pavel Filianin[1], Mikhail Goncharov[1], Yuri Novikov[3], Alexander Rischka[1], Sven Sturm[1], Stefan Ulmer[4], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany — [2]Universität Heidelberg, Fakultät für Physik und Astronomie, Im Neuenheimer Feld 226, 69120 Heidelberg, Germany — [3]Petersburg Nuclear Physics Institute, 188300 Gatchina, Russia — [4]RIKEN, Ulmer Initiative Research Unit, Wako, Saitama 351-0198, Japan

The high-precision Penning-trap mass spectrometer PENTATRAP is currently being commissioned at the Max-Planck-Institut für Kernphysik, Heidelberg. PENTATRAP aims at mass-ratio measurements of single stable and long lived highly charged ions with a relative uncertainty of a few 10^{-12}. At this precision level, PENTATRAP will, for instance, contribute to electron-neutrino mass related measurements within the ECHo collaboration, which determines the de-excitation spectrum following the electron capture in ^{163}Ho. PENTATRAP will determine the mass ratios of the desired ion species through measurements of their respective cyclotron frequencies in the strong magnetic field of a Penning trap. The experimental setup consists of five Penning traps, making simultaneous storage of several ion species possible. This allows for in situ calibration and reference measurements. The current status and outlook of the experiment will be presented in the poster.

MS 6.6 Wed 16:30 Empore Lichthof

Fabrication of the 4k-Pixel Molecule Camera MOCCA and its Integration into the Cryogenic Storage Ring CSR — •L. Gamer[1], C. Enss[1], A. Fleischmann[1], L. Gastaldo[1], S. Kempf[1], C. Krantz[2], O. Novotný[2], D. Schulz[1], and A. Wolf[2] — [1]Heidelberg University — [2]MPIK Heidelberg

The Cryogenic Storage Ring at the Max Planck Institute for Nuclear Physics in Heidelberg is able to store heavy molecular ions in their rotational and vibrational ground states. In a near future electron-ion-interactions, such as the dissociative recombination, will be investigated in laboratory environment at conditions that are close to those in cold interstellar plasmas. To reconstruct the full kinematics of these processes, a position and energy sensitive coincident detection

of multiple reaction products is necessary. We recently designed and fabricated MOCCA, a 4k-pixel molecule camera based on magnetic calorimeters with a detection area of 45 mm × 45 mm segmented into 64×64 absorbers. We present the detector design and microfabrication as well as the plans for integrating MOCCA and its ^{3}He/^{4}He dilution refrigerator into CSR.