HK 37: Instrumentation IX

Zeit: Mittwoch 14:00–16:00 Raum: S1/01 A3

Gruppenbericht HK 37.1 Mi 14:00 S1/01 A3

New developments of the Recoil Distance Doppler-Shift method — •Christoph Fransen, Andrey Blazhev, Thomas Braunroth, Alfred Dewald, Alina Goldkuhle, Jan Jolie, Julia Litzinger, Claus Mueller-Gatermann, Dorothea Woelk, and Karl-Oskar Zell — Institut für Kernphysik, Universität zu Köln

The recoil distance Doppler-shift (RDDS) method is a very valuable technique for measuring lifetimes of excited nuclear states in the picosecond range to deduce absolute transition strengths between nuclear excitations independent on the reaction mechanism. Dedicated plunger devices were built by our group for measurements with this method for a broad range of beam energies ranging from few MeV/u up to relativistic energies of the order of 100 MeV/u. Those were designed to match the constraints defined by state-of-the art γ-ray spectrometers like AGATA, Galileo, Gammasphere. Here we give an overview about recent experiments of our group to determine transition strengths from level lifetimes in exotic nuclei where also recoil separators or mass spectrographs were used for an identification of the recoiling reaction products. The aim is to learn about phenomena like shape phase coexistence in exotic regions and the evolution of the shell structure far from the valley of stability. We will also review new plunger devices that are developed by our group for future experimental campaigns with stable and radioactive beams in different energy regimes, e.g., a plunger for HIE-ISOLDE. Supported by the BMBF, Grant No. 05P15PKFNA and 05P15PKCIA and the DFG, Grant No. DE 1516/3-1.

HK 37.2 Mi 14:30 S1/01 A3

A versatile cold pulsed neutron beam facility for particle physics at the ESS: ANNI — •Camille Theroine[1], Hartmut Abele[2], Gertrud Konrad[2,3], Bastian Märkisch[1], Ulrich Schmidt[4], and Torsten Soldner[5] — [1]Physik Department, TU München, Germany — [2]Atominstitut, TU Wien, Austria — [3]Stefan Meyer Institute, Wien, Austria — [4]Physikalisches Institut, Universität Heidelberg, Germany — [5]Institut Laue-Langevin, Grenoble, France

Particle Physics with neutrons performs sensitive tests of the Standard Model and searches for new interactions and symmetries. State-of-the-art high precision measurements require to combine well-designed instrumentation with a powerful neutron source.

In this prospect, the unique capabilities of the European Spallation Source (Lund, Sweden), namely the high peak flux and the inherent time structure of the neutron beam, will permit to push the frontiers of precision experiments. For instance, this source offers the possibility to resolve and separate beam-related systematic effects at full statistics, in parallel to data taking.

In order to exploit these possibilities we propose a new facility as part of the ESS instrument suite: ANNI. ANNI is optimized to study neutron decay, hadronic parity violation, and electromagnetic properties of the neutron and will outperform existing facilities by at least one order of magnitude. In this presentation, the scientific case, the concept and the expected performance of ANNI will be discussed.

HK 37.3 Mi 14:45 S1/01 A3

Extending direct mass measurements in the region of the heaviest elements at SHIPTRAP — •Francesca Giacoppo for the SHIPTRAP-Collaboration — GSI, Darmstadt — Helmholtz Institut Mainz

Penning-trap mass spectrometry allows direct measurements of atomic masses with high precision. This technique is especially suitable to investigate the nuclear structure evolution of radioactive nuclides through binding energies.

The heaviest elements investigated so far in pioneering experiments with the SHIPTRAP setup at GSI, Darmstadt, have been nobelium and lawrencium [1,2]. The existence of such heavy nuclei is closely connected to the nuclear shell effects that stabilize them against spontaneous fission. The direct measurement of the masses of $^{252-255}$No and ^{255,256}Lr has allowed mapping the evolution of the deformed subshell closure along N=152. In order to extend such studies to heavier and more exotic nuclides, the efficiency and sensitivity of the SHIPTRAP setup has to be further increased.

In this talk, an overview of the related developments will be presented. In particular, the online commissioning of a cryogenic buffer gas-stopping cell with improved efficiency will be reported [3].

[1] M. Block et al.,Nature 463 (2010) 785.
[2] E. Minaya Ramirez et al., Science 337 (6099) (2012) 1207.
[3] C. Droese et al., Nucl. Instr. Meth. Sec. B 338 (2014) 126.

HK 37.4 Mi 15:00 S1/01 A3

ALIVE - Collinear Laser Spectroscopy as a tool to measure high voltages with ppm accuracy — Phillip Imgram, Kristian König, •Jörg Krämer, Bernhard Maass, Ratajczyk Tim, Johannes Ullmann, and Wilfried Nörtershäuser — Institut für Kernphysik, Technische Universität Darmstadt

Whenever beams of charged particles are involved in a nuclear physics experiment, also high voltages are involved. In some cases the limited accuracy of high voltage measurements directly spoils the relevance of experimental data. Measuring high voltages with the best-possible accuracy is therefore essential. Collinear laser spectroscopy has become a standard technique for the determination of nuclear charge radii, spins, and magnetic moments. While this technique involves the Doppler shift of the incident laser frequency in the ion's rest frame it is sensitive to the ion velocity and hence, the high voltage applied to accelerate the ions. We want to make use of this feature by determining the high voltage with very high accuracy employing a well-known atomic system and a pump/probe scheme. Accuracies of the order of 1 ppm are feasible. We will present the current status of the setup and the results of test measurements with Ca^+ ions.

HK 37.5 Mi 15:15 S1/01 A3

Detector of the BGO-OD experiment* — •Jürgen Hannappel — Physikalisches Institut, Universität Bonn

In the framework of an international collaboration the BGO-OD experiment is set up at the accelerator facility ELSA in Bonn.

It aims at systematic investigation of nonstrange and strange meson photoproduction, in particular t-channel processes at low momentum transfer. The setup uniquely combines a central almost 4π acceptance BGO crystal calorimeter with a large aperture forward magnetic spectrometer providing good detection of both neutral and charged particles, complementary to other setups like CB, LEPS or CLAS.

In the previous year (2015) substantial data sets have been taken. The performance of the various detectors is discussed based on these data.

* Supported by the DFG (SFB/TR-16)

HK 37.6 Mi 15:30 S1/01 A3

Further development of NEPTUN photon tagging facility — •Dmytro Symochko, Michaela Arnould, Thomas Aumann, Martin Baumann, Norbert Pietralla, Heiko Scheit, Diego Semmler, and Christopher Walz — Institut für Kernphysik, Darmstadt, Germany

The low-energy photon tagging facility NEPTUN at the superconducting Darmstadt linear accelerator (SDALINAC) has been constructed with the aim to study

the photoabsorption cross section of the nuclei in the energy regions of Pygmy Dipole and Giant Dipole Resonances. Recently it went through the series of commissioning runs, which proved the concept and the ability of NEPTUN to tag the discreet nuclear states. Also, based on the results of the commissioning, major upgrade was developed to optimize the setup. Upgraded tagger will be able to operate with 60 MeV electron beam and will have extended focal plane with energy bite of more than 10 MeV. After completion of upgrade it will be possible to perform total dipole response measurement in the energy region 5-35 MeV for one target using only 2-3 settings of the spectrometer. Presentation will focus on the analysis results of commissioning runs and details of the proposed upgrade plan.

Supported by DFG (SFB 634).

HK 37.7 Mi 15:45 S1/01 A3

Bestimmung der Elektronenpolarisation für das A4-Experiment — •Yoshio Imai[1], David Balaguer Ríos[1], Sebastian Baunack[1], Luigi Capozza[1], Jürgen Diefenbach[1], Boris Gläser[1], Jeong-Han Lee[1,2], Frank Maas[1,3,4], Maria Carmen Mora Espí[1], Ernst Schilling[1], Dietrich von Harrach[1] und Christoph Weinrich[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität, Johann-Joachim-Becher-Weg 45, 55128

Mainz — [2]jetzt Institute for Basic Science, Yuseong-daero 1689-gil, Yuseong-gu, Daejeon, Korea, 305-811 — [3]Helmholtz-Institut Mainz, Johann-Joachim-Becher-Weg 36, 55128 Mainz — [4]PRISMA Cluster of Excellence, Johannes Gutenberg-Universität, 55099 Mainz

Das A4-Experiment am MAMI-Elektronenbeschleuniger der Universität Mainz untersucht die Nukleonstruktur durch Messung von Einzelspinasymmetrien in der elastischen Elektron-Nukleon-Streuung unter Verwendung polarisierter Elektronenstrahlen. Da somit eine genaue Kenntnis der Strahlpolarisation für die Interpretation der Meßergebnisse erforderlich ist, wurde ein Compton-Rückstreu-Polarimeter aufgebaut, mit dem erstmals das internal-cavity-Konzept zur Erhöhung der Luminosität trotz geringer Strahlströme umgesetzt wurde. Hiermit ist eine deutliche Reduktion des Polarisationsbeitrags zur Gesamtunsicherheit der A4-Meßergebnisse gelungen. Dieser Beitrag wird auf die spezifischen Herausforderungen dieser Bauweise eingehen und die damit erzielten Resultate vorstellen.