HK 58: Instrumentierung

Zeit: Freitag 11:00–13:00 Raum: HZ 10

HK 58.1 Fr 11:00 HZ 10

Polarimeterkonzepte für das EDM precursor experiment — •Paul Maanen — III. Physikalisches Institut B, RWTH Aachen

Die im Standardmodell vorhergesagte CP-Verletzung reicht nicht aus, um die offensichtlich existierende Materie-Antimaterie-Asymmetrie unseres Universums zu erklären. Es muss deshalb neue Physik mit zusätzlichen CP-verletzenden Effekten geben. Diese könnten sich in permanenten elektrischen Dipolmomenten von Elementarteilchen manifestieren. Die JEDI (Jülich Electric Dipole Moment Investigations) Kollaboration wurde gegründet, um auf dem $10^{-29} e \cdot$ cm-Level nach permanenten elektrischen Dipolmomenten von Hadronen (p,d,3He) zu suchen. Bei der angestrebten Methode der Messung äußert sich das elektrische Dipolmoment als Aufbau der vertikalen Polarisation des Strahls. In diesem Vortrag soll ein Konzept für ein Polarimeter zur Messung vorgestellt werden sowie die Ergebnisse erster Simulations- und Hardwarestudien gezeigt werden.

HK 58.2 Fr 11:15 HZ 10

A radiofrequency quadrupole cooler and buncher for the TRIGA-SPEC experiment — •Thomas Beyer for the TRIGA-SPEC-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg

The mass spectrometer TRIGA-TRAP and the laser spectroscopy setup TRIGA-LASER, forming the TRIGA-SPEC experiment, are installed at the research reactor TRIGA Mainz in order to perform high-precision measurements of ground state properties of short-lived neutron-rich radionuclides. Such measurements allow testing the predictive power of nuclear mass models and support astrophysical nucleosynthesis calculations. The extraction and preparation of these nuclides for both experimental branches is achieved by using an aerosol-based gas-jet system to transport them from an actinide target located inside the reactor to an external surface ionization ion source. The ion source is followed by a mass separator and a linear Paul trap, which was the cooler for emittance elimination COLETTE at MISTRAL/ISOLDE. It has been installed in Mainz and the capability of accumulating and bunching ion beams has been implemented to provide low-emittance ion pulses of 250 ns width containing up to 10^6 ions. A brief description of the upgraded linear Paul trap as well as its performance in bunching stable ions is presented.

HK 58.3 Fr 11:30 HZ 10

Aktive Methoden zur Untergrundreduktion im KATRIN-Experiment — •Jan David Behrens für die KATRIN-Kollaboration — Westfälische Wilhelms-Universität, Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrino-Experiment soll die Masse des Elektron-Antineutrinos mit einer Sensitivität von 200 meV/c^2 (90% C.L.) vermessen werden. Die Vermessung der Form des Tritium-β-Spektrums im Endpunktbereich ermöglicht eine modellunabhängige Bestimmung dieses wichtigen Parameters.

Die Energieanalyse der Zerfallselektronen erfolgt beim KATRIN-Experiment in einem elektrostatischen Spektrometer, das nach dem Prinzip des MAC-E-Filters arbeitet. Durch die Kombination von elektrischen und magnetischen Feldern können im Spektrometer unerwünschte Penningfallen zu einem erhöhten Untergrund führen.

Eine Möglichkeit zur Untergrundreduktion ist das aktive Entfernen von gespeicherten Elektronen durch die Erzeugung eines elektrischen Dipolfeldes und/oder magnetischen Pulses, um die Speicherbedingungen aufzuheben. Der Vortrag stellt beide Methoden sowie erste Resultate der erfolgreichen Messungen zur Kommissionierung des KATRIN-Haupspektrometers im Sommer 2013 vor.

Dieses Projekt wird unter dem Kennzeichen 05A11PM2 durch das BMBF gefördert.

HK 58.4 Fr 11:45 HZ 10

A Low-Energy Antiproton Detector Prototype for AFIS — •Lingxin Meng, Daniel Greenwald, Alexander Hahn, Philipp Hauptmann, Igor Konorov, Martin Losekamm, Stephan Paul, Thomas Pöschl, and Dieter Renker — Technische Universität München

Antiprotons are produced in interactions of primary cosmic rays with earth's exosphere, where a fraction of them will be confined in the geomagnetic field in the inner van Allen Belt. The antiproton-to-proton flux ratio predicted by theory is in good agreement with recent results from the South Atlantic Anomaly (SAA) published by the PAMELA collaboration. We have designed the AFIS (Antiproton Flux in Space) project in order to extend the measurable range of antiprotons towards the low-energy region. In scope of this project a small antiproton detector consisting of scintillating fibers and silicon photomultipliers is being developed as payload for a CubeSat traversing the SAA in Low Earth Orbit.

For the proof of concept we have built a prototype called "CubeZero" which completed its first test using pion and proton beams at PSI, Switzerland. Our primary goal was to investigate on the performance of tracking and Bragg peak identification in hardware and software. Analysis of detector performance based on data taken during this beam test will be presented in this talk.

This project is supported by the DFG Excellence Cluster Universe (Exc 153).

HK 58.5 Fr 12:00 HZ 10

The neutron lifetime experiment PENeLOPE — •Wolfgang Schreyer for the PENeLOPE-Collaboration — Technische Universität München, Physik Department E18

The neutron lifetime $\tau_n = 880.0 \pm 0.9$ s is an important parameter in the Standard Model of particle physics and in Big Bang cosmology. Several systematic corrections of previously published results reduced the PDG world average by several σ in the last years and call for a new experiment with complementary systematics.

The experiment PENeLOPE, currently under construction at the Physik-Department of Technische Universität München, aims to determine the neutron lifetime with a precision of 0.1 s. It will trap ultra-cold neutrons in a magneto-gravitational trap using a large superconducting magnet and will measure their lifetime by both neutron counting and online proton detection.

This presentation will give an overview over the latest developments of the experiment.

The project is supported by the Maier-Leibnitz-Laboratorium (Garching), the Deutsche Forschungsgemeinschaft and the Excellence Cluster "Origin and Structure of the Universe".

HK 58.6 Fr 12:15 HZ 10

PIPERADE: A Penning trap based isobar separator for the future low-energy facility DESIR of SPIRAL2 — •A. de Roubin[1,2], P. Ascher[1], B. Blank[2], K. Blaum[1], P. Dupré[3], M. Gerbaux[2], S. Grévy[2], H. Guérin[2], D. Lunney[3], and S. Naimi[1] — [1]MPIK, Heidelberg, Germany — [2]CENBG, Gradignan, France — [3]CSNSM, Orsay, France

Exotic nuclei currently not accessible will be delivered to the future DESIR facility for nuclear structure and astrophysics studies as well as for testing the Standard Model, using beta decay spectroscopy, laser spectroscopy and trap-based experiments. For most of the experiments, a high precision is needed and can be reached only if highly pure samples of exotic nuclei are delivered. Some particular physics cases will be presented.

PIPERADE will be a system placed upstream the DESIR hall to purify the radioactive ion beam from undesired contaminants. It will consist of a radio-frequency quadrupole to bunch and cool the beam and of a double Penning-trap system to separate the isobaric species and accumulate the ions of interest. The purified beam will then be sent to the various experiments of the low-energy DESIR facility.

The challenge for the present double Penning-trap system consists of being able to accumulate very large amounts of short-lived nuclei ($10^5 - 10^6$) while maintaining the resolving power necessary for isobar selection of at least 10^5. For this purpose, studies of space charge effects and new excitation schemes are under investigation and will be presented.

HK 58.7 Fr 12:30 HZ 10

Experimenteller Test verschiedener Phoswich-Detektor Konzepte — •B. Heiss, M. Bendel, R. Gernhäuser, W. Henning, T. Le Bleis und M. Winkel — Technische Universität München, Physik-Dept. E12, 85748 Garching

Das CALIFA-Kalorimeter wird ein wesentlicher Bestandteil des R^3B-Experiments sein, welches an der neu entstehenden Beschleuniger-

anlage FAIR (Darmstadt) aufgebaut wird. Das großvolumige Kalorimeter bestehend aus CsI(Tl)-Kristallen, welche durch Avalanche-Photodioden ausgelesen werden, soll die gesamte Targetregion einschließen.
Bei relativistischen Strahlenergien von 700AMeV erhalten gestreute Teilchen vor allem in Vorwärtsrichtung Energien von vielen 100MeV. Diese Teilchen zu stoppen erfordert einen hohen Materialaufwand, wodurch der Wirkungsquerschnitt für unerwünschte Kernreaktionen in den Szintillatorkristallen erhöht wird. Das Phoswich-Konzept bietet die Möglichkeit auch die Energie für nicht gestoppte Teilchen zu rekonstruieren. In diesem Vortrag werden verschiedene Phoswich-Konfigurationen vorgestellt und Ergebnisse mit verschiedenen Prototyp-Detektoren aus einem Experiment am CCB - IFJ PAN in Krakau mit hochenergetischen Protonen diskutiert.

HK 58.8 Fr 12:45 HZ 10

Gamma ray tracking with the AGATA demonstrator — •Benedikt Birkenbach, Herbert Hess, Lars Lewandowski, Peter Reiter, Tim Steinbach, David Schneiders, and Andreas Vogt for the AGATA-Collaboration — IKP, Universität zu Köln

The performance of the AGATA demonstrator will be discussed based on data taken from a multi-nucleon transfer experiment at the AGATA PRISMA setup at LNL (INFN, Italy). A primary ^{136}Xe beam of 1 GeV hitting a ^{238}U target was used to produce a multitude of nuclei in the vicinity of ^{136}Xe and corresponding reaction partners in the actinide region. The obtained results for in-beam gamma-ray spectroscopy allow for a critical assessment of the novel gamma ray tracking technique and comparison with standard procedure. High resolution spectroscopy of both reaction products after multi-nucleon transfer reaction in the presence of a high background from excited fission fragments is based on pulse-shape analysis (PSA) and gamma-ray tracking (GRT). The quality of the position information is crucial for the final energy resolution after Doppler correction. The impact of the calculated PSA libraries and the initial detector characterization for the PSA and GRT are summarized. Details of the achieved position and energy resolution, peak-to-background optimization are presented and illustrated with results from the neutron-transfer products in Xe and U-isotopes. Supported by the German BMBF (05P12PKFNE TP4), ENSAR-TNA03.