HK 55: Beschleuniger und Anwendungen kernphysikalischer Methoden

Zeit: Freitag 11:00–13:00 Raum: HZ 5

HK 55.1 Fr 11:00 HZ 5

Measurements of neutron-induced reactions in inverse kinematics — •Rene Reifarth[1] and Yuri A. Litvinov[2,3] — [1]Goethe-Universität Frankfurt am Main, Max-von-Laue-Str.1, 60438 Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany — [3]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany

Neutron capture cross sections of unstable isotopes are important for neutron-induced nucleosynthesis as well as for technological applications. A combination of a radioactive beam facility, an ion storage ring and a high flux reactor would allow a direct measurement of neutron induced reactions over a wide energy range on isotopes with half lives down to minutes.

HK 55.2 Fr 11:15 HZ 5

Vermessung von Strahlparametern mittels elastischer Proton-Deuteron-Streuung — •Nils Hempelmann für die JEDI-Kollaboration — RWTH Aachen, III. Physikalisches Institut B

Die Messung des elektrischen Dipolmoments (EDM) von Hadronen bietet eine Möglichkeit zur Suche nach neuer Physik jenseits des Standardmodells. EDMs geladener Hadronen können an Speicherringen bestimmt werden. Um systematische Fehler zu minimieren, ist eine genaue Vermessung des Strahlprofils notwendig. Ziel dieser Arbeit ist die Entwicklung einer Methode zur Rekonstruktion der Position und des Transversalimpulses eines einfallenden Teilchens im Strahl. Die Teilchen werden elastisch gestreut und die Spuren beider auslaufenden Teilchen vermessen. Über die bekannte Kinematik kann auf das Strahlprofil geschlossen werden. Das Verfahren wurde anhand eines Datensatzes erprobt, der 2010 mit einem Siliziumspurdetektor am Cooler Synchrotron (COSY) in Jülich aufgenommen wurde. Im Vortrag wird die Limitierung dieser Methode aufgrund von Vielfachstreuung diskutiert.

HK 55.3 Fr 11:30 HZ 5

Studies of systematic limitations in the EDM searches at storage rings — •Artem Saleev for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

Future experiments on search for the EDM of protons and deuterons at COSY will make use of the E/B- fields to drive the EDM-induced spin precession. One of the options is the so-called radiofrequency Wien-filter. It excerts zero Lorentz force on the beam, is EDM-transparent, but rotates the magnetic moment (MDM) of the beam particles by which it generates the frequency modulation of the spin tune. This modulation causes a coupling to the EDM precession in the constant motional electric field in the ring and the buildup of the EDM signal under the resonance condition.

The troubling issue is that, alongside with the radial motional E-field, the so-called imperfection, radial and longitudinal B-fileds from the magnet misalignments abound in the ring. The Wien-filter frequency modulation of the spin tune couples the MDM to the imperfection magnetic fields in precisely the same manner as the EDM couples to the motional electric field in the ring and the imperfection magnetic fields emerge as one of the principal sources of the systematic background to the EDM signal. Upon half a century of experimentation with neutrons, the upper bound of the neutron EDM is at the level of almost 10^{-12} of the neutron MDM. This indicates a challenge one faces in disentangling the true EDM signal from the MDM induced signal and the compensation for imperfection fields.

HK 55.4 Fr 11:45 HZ 5

A Development of BPM for P-LINAC at FAIR — •Mohammed Almalki[1], Oliver Kester[1], Peter Forck[1], Wolfgang Kaufmann[1], Thomas Sieber[1], Piotr Kowina[1], Wolfgang Vinzenz[1], Claire Simon[2], Dejan Tinta[3], Rok Hrovatin[3], Promoz Lemut[3], and Christoph Krueger[1] — [1]GSI, Darmstadt — [2]CEA/DSM/IRFU — [3]Instrumentation Technologies, Solkan, Slovenia

Four-fold button Beam Position Monitor (BPM) has been developed for the planned Proton LINAC at the FAIR facility. These monitors will be installed at 14 locations along the LINAC and four of them will be mounted only about 40 mm upstream of the CH cavities. A BPM prototype will be fabricated to evaluate the rf power at the BPM location as generated by cavity excitation as well as to test different options in the mechanical design. For the read-out electronics, the I/Q digital signal processing will be implemented to derive the transverse beam position and the beam phase. This contribution presents the status of the BPM development and focuses on the mechanical design and the optimization of the button pick-ups. The development progress of digital signal processing system will be discussed as well.

HK 55.5 Fr 12:00 HZ 5

Simulations of the high energy beam transport section (HEBT) at FRANZ — •Ole Hinrichs, Christine Claessens, Manuel Heilmann, Oliver Meusel, Daniel Noll, Rene Reifarth, Stefan Schmidt, Malte Schwarz, and Kerstin Sonnabend — Goethe-Universität Frankfurt

The Frankfurt Neutron Source at the Stern-Gerlach-Zentrum (FRANZ) currently under construction will deliver a proton beam of up to 20 mA constant current with energies between 1.8 MeV and 2.2 MeV. This facility aims at exploring proton- and neutron-induced reactions of astrophysical interest. The high proton flux is well suited for studying nuclear reactions related to the nucleosynthesis of the p-nuclei, which might yield hints on the physics of type Ia supernovae. Furthermore, FRANZ will offer the opportunity to measure radiative neutron capture reactions for unstable branch point nuclei of the s-process.

We will present the current status of the beam line up to the BaF_2 calorimeter. This contribution will focus on simulations to optimise beam transport and phase space distribution with respect to an optimised beam spot size.

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HK 55.6 Fr 12:15 HZ 5

Alpha Spectroscopy — Felix Krueger, •Heinrich Wilsenach, and Kai Zuber — IKTP TU-Dresden, Dresden, Germany

Alpha decays from long living isotopes are one of the limiting backgrounds for experiments searching for rare decays with stringent background constrains, such as neutrinoless double beta decay experiments. It is thus very important to accurately measure the half-lifes of these decays, in order to properly model their background contribution. Therefore, it is important to be able to measure half-lifes from alpha decays of the order of 1×10^{15} yr. A measurement of such a long lived decay imposes, however, a series of challenges, where the correct discrimination between background and true signal is critical. There is also a more general interest in such long living half-life measurements, as their value depends crucially on the underlying nuclear model.

This work proposes a setup to measure long lived alpha decays, based on the design of the Frisch-Grid ionisation chamber. It will be shown that the proposed design provides a good separation of signal and background events. It will also be demonstrated that, with pulse shape analysis, it is possible to constrain the source position of the decay, further improving the quality of the data. A discussion of the characterisation of the detector will also be presented as well as some results obtained with calibration sources.

HK 55.7 Fr 12:30 HZ 5

CHANDA and ERINDA: Joint European programs for research on safety of nuclear facilities and waste reduction — •Roland Beyer[1,2], Eckart Grosse[2], Roland Hannaske[1,2], Arnd R. Junghans[1], and Toni Kögler[1,2] — [1]Institut für Strahlenphysik, Helmholtz Zentrum DD-Rossendorf, 01328 Dresden — [2]Institut für Kern- und Teilchenphysik, TU Dresden, 01069 Dresden

In spite of the planned termination of the German nuclear power program neutron beam facilities in Germany can contribute considerably to research studies on the reduction of hazards due to nuclear waste. Transnational research programs support EU groups who want to carry out projects at the new tof set-up nELBE at HZDR, the calibrated n-flux at PTB and the FRANZ accelerator under construction at Frankfurt. Vice versa various facilities in the EU offer beams for transmutation and safety related studies with neutrons to German scientists under support by ERINDA (2011-2013) and CHANDA (2014-2017; solving challenges in nuclear data for the safety of European nuclear facilities). For work in that field scientific visits are also fostered to

improve the exchange of experience between the partners (13 and in future about 35 from 18 countries). Plans for new projects as well as results obtained so far will be discussed, and special emphasis will be given to the present research performed at nELBE on neutron scattering and absorption.

HK 55.8 Fr 12:45 HZ 5

Sensitivity of future liquid xenon experiments to the detection of double-beta decays of xenon — •Jan Thurn — IKTP TU Dresden

Dark searches are one of the most active fields of physics in the recent years. A new generation of experiments using liquid xenon as active medium are currently under investigation to further increase the sensitivity. These will exceed the present limit of 1 t active mass. This development will allow to reach unprecedented sensitivities not only for dark matter searches, but also for half-life measurements of long living isotopes of xenon.

Xenon itself has three candidates for double-beta decay, but only the 2nbb decay of ^{136}Xe has been measured with a half-life of $T_{1/2} = (2.38 \pm 0.11 \pm 0.05) \times 10^{21}$ yr. In this talk studies of sensitivities for the detection of the yet unobserved remaining double beta decay modes of xenon by this new generation of experiments will be presented. A particular emphasis on the sensitivity for a measurement of the half-life of ^{134}Xe will be performed, assuming different background models.