

HK 7: Instrumentierung I

Zeit: Montag 16:30–18:45

Raum: JUR B

Gruppenbericht

HK 7.1 Mo 16:30 JUR B

Production of a beam of tensor-polarized deuterons using a carbon target — ●HELLMUT SEYFARTH¹, RALF ENGELS¹, FRANK RATHMANN¹, HANS STRÖHER¹, VLADIMIR BARYSHEVSKY², ANATOLI ROUBA², CARSTEN DÜWEKE^{3,4}, REINHARD EMMERICH^{3,5}, ASTRID IMIG^{3,6}, KIRILL GRIGORYEV^{1,7}, MAXIM MIKIRTYCHIANTS^{1,7}, and ALEXANDER VASILYEV⁷ — ¹IKP, FZ Jülich, 52425 Jülich, Germany — ²Res. Inst. Nucl. Probl., 220050 Minsk, Belarus — ³IKP, Universität zu Köln, 50937 Köln — ⁴now AREVA NP GmbH, 91058 Erlangen, Germany — ⁵now TU München, Phys. Dpt. E18, 85748 Garching, Germany — ⁶now Brookhaven Nat. Lab., Upton, NY 11973, USA — ⁷Petersburg Nucl. Phys. Inst., 188300 Gatchina, Russia

An initially unpolarized beam of deuterons is found to acquire tensor polarization after traversing a foil of spinless target nuclei. The experiment was performed with unpolarized deuteron beams of 9.5 to 18.7 MeV from the Köln tandem accelerator. The polarization of the beam behind graphite targets of areal densities between 36 and 188 mg/cm² was measured with a polarimeter based on the $d + {}^3\text{He} \rightarrow p + {}^4\text{He}$ reaction. This effect, called nuclear spin dichroism, has been predicted theoretically, albeit resulting in small values of p_{zz} of the order of 0.01 for energies around 10 MeV. The observed polarization, however, reaches a value as large as $p_{zz} = -0.28 \pm 0.03$ for an initial beam energy of 14.8 MeV and a 129 mg/cm² target. The results, which allow one to produce tensor-polarized deuterons with $p_{zz} \approx -0.30$ (or $+0.25$) from an initially unpolarized beam using graphite targets of appropriate thickness, are presented and discussed.

HK 7.2 Mo 17:00 JUR B

Velocity determination of hydrogen clusters at a high density cluster-jet target — ●ALEXANDER TÄSCHNER, ALFONS KHOUKAZ, ESPERANZA KÖHLER, HANS-WERNER ORTJOHANN, and TOBIAS RAUSMANN — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster

The prototype of the cluster-jet target station for PANDA has been built up at the University of Münster. This setup allows for systematic studies on the production of high density cluster-jet beams and their properties. One important parameter which determines the performance of targets for internal storage ring experiments is the target thickness. In case of the cluster-jet targets the target thickness is closely related to the mean velocity of the clusters. In this contribution we will present a technique developed for the determination of the velocity spectra of clusters. Results obtained with this method will be shown and compared to different gas dynamic models for the gas flow through the nozzle of the cluster source. Furthermore we will present first results of an extension of this technique which allows for the determination of the mass spectra of clusters.

Supported by EU (FP6 and FP7) and BMBF (06MS253I and 06MS9149I).

HK 7.3 Mo 17:15 JUR B

The cluster-jet target for the PANDA experiment — ●ESPERANZA KÖHLER, ALFONS KHOUKAZ, HANS-WERNER ORTJOHANN, TOBIAS RAUSMANN, and ALEXANDER TÄSCHNER — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster

An internal cluster-jet target will be one of the two alternatively usable target stations for the planned PANDA experiment at the future antiproton accelerator HESR at FAIR. Beside several advantages such a target facility allows for high densities at the interaction point which can be adjusted continuously during operation. Since main emphasis will be put on elementary antiproton-nucleon interactions, hydrogen and deuterium are of highest interest as target material.

The prototype of this cluster target generator has been built up and set into operation successfully at the University Münster. In order to obtain information about the performance of this device as realistic as possible, a complete vacuum system in PANDA geometry has been installed, including a scattering chamber at the position of the later interaction point at PANDA as well as a beam dump system. Recent measurements proved the full compatibility with the PANDA requirements and resulted in highest hydrogen cluster target beam densities at the interaction point, i.e. 2 m behind the nozzle. The design concept of the cluster generator and the achieved performance will be presented.

Supported by EU (FP6 and FP7) and BMBF (06MS253I and 06MS9149I).

HK 7.4 Mo 17:30 JUR B

Messung elektronischer Relaxationszeiten in dynamisch polarisierten Festkörpertargets mittels gepulster NMR — ●CHRISTIAN HESS, ALEXANDER BERLIN, JONAS HERICK, WERNER MEYER, ERIC RADTKE, GERHARD REICHERZ und SEBASTIAN SCHRAUF — Institut für Experimentalphysik I AG, Ruhr-Universität Bochum

An polarisierten Festkörpertargets werden hohe Polarisationswerte mit Hilfe der Dynamischen Nukleonenpolarisation (DNP) erzielt. Dabei werden die Nukleonen über ein paramagnetisches Elektronensystem polarisiert, welches durch Dotierung in das Targetmaterial eingebracht wird und bei DNP-typischen Bedingungen von $T = 1\text{ K}$ und $B = 2.5\text{ T}$ nahezu vollständig polarisiert ist. Neben der ESR-Linienbreite ist die Spin-Gitter Relaxationszeit der paramagnetischen Zentren eine wichtige Kenngröße, die maßgeblich die Effektivität des DNP-Prozesses beeinflusst, und bislang kaum erforscht ist.

Zur Bestimmung dieser Relaxationszeit wird ein Verfahren eingesetzt, welches mit Hilfe eines gepulstes NMR-System arbeitet und den Relaxationsprozess über die von der Elektronenpolarisation abhängige Verschiebung der NMR-Linie nachweist. Neben der Vorstellung des Messverfahrens werden erste Ergebnisse von TEMPO- und Trityl-dotierten Butanolproben präsentiert.

HK 7.5 Mo 17:45 JUR B

First double polarized photoproduction on a ${}^3\text{He}$ target at MAMI — ●JOCHEN KRIMMER¹, JUERGEN AHRENS¹, PATRICIA AGUAR-BARTOLOMÉ¹, HANS-JUERGEN ARENDS¹, WERNER HEIL², SERGEI KARPUK², PAOLO PEDRONI³, and ZAHIR SALHI² for the A2-Collaboration — ¹Institut für Kernphysik, Universität Mainz — ²Institut für Physik, Universität Mainz — ³INFN, Sezione di Pavia, Italy

The use of a polarized ${}^3\text{He}$ target for a double polarized photoproduction experiment, compared to existing data on the deuteron, gives a complementary and more direct access to the neutron, due to the spin structure of ${}^3\text{He}$.

A first experiment with a polarized ${}^3\text{He}$ target has been performed in July 2009 at the tagged photon facility of the MAMI accelerator. Polarized ${}^3\text{He}$ has been provided by a polarizer based on the principle of metastability exchange optical pumping. Inside the Crystal Ball detector a solenoid generated a homogeneous magnetic holding field for the target cell filled with the polarized gas. Due to the lack of space inside the detector, polarimetry has been performed outside the detector on the upstream side. A remote controlled polarization measurement has been realized via an automatic transport system which moved the target cell between the two positions.

In this talk the experimental setup and its performance under beam conditions will be given, as well as the status of data analysis.

HK 7.6 Mo 18:00 JUR B

Entwicklung eines NMR-Moduls zur Polarisationsmessung in Festkörpertargets — ●SEBASTIAN SCHRAUF, ALEXANDER BERLIN, JONAS HERICK, CHRISTIAN HESS, DANIEL KAMMER, SONJA KUNKEL, WERNER MEYER, ERIC RADTKE, GERHARD REICHERZ und PATRICK ZYLKA — Institut für Experimentalphysik I AG 1, Ruhr-Universität Bochum

Das Liverpool Q-Meter, entwickelt um 1980, stellt ein etabliertes Werkzeug zur Polarisationsmessung in Festkörpern mittels NMR-Technik dar. Seine Vorteile sind ein Aufbau, der die meisten für die Messung erforderlichen elektronischen Komponenten in sich vereint, und ein für diese Leistung kompaktes Design. Da dieses NMR-Modul kommerziell nicht mehr verfügbar ist, soll es neu entwickelt werden, speziell im Hinblick auf die Hochfrequenzkomponenten wie Leistungsverstärker oder das zentrale Element, den Diodenringmischer. Hierfür wird ein Layout favorisiert, das aus getrennten Hochfrequenz- und Niederfrequenzeinheiten besteht, um ein flexibles Gerät für Polarisationsmessungen in verschiedenen Anwendungsbereichen zu bieten.

HK 7.7 Mo 18:15 JUR B

Polarisationsbestimmung mittels gepulster NMR — ●JONAS

HERICK, DANIEL KAMMER, ALEXANDER BERLIN, CHRISTIAN HESS, SONJA KUNDEL, WERNER MEYER, ERIC RADTKE, GERHARD REICHERZ, SEBASTIAN SCHRAUF und PATRICK ZYLKA — Institut für Experimentalphysik I AG, Ruhr-Universität Bochum

Das Continuous-Wave-Verfahren stellt eine etablierte Methode zur Polarisations- und Relaxationszeitbestimmung von Festkörpertargets dar. Es besteht jedoch auch die Möglichkeit der Messung mittels gepulster NMR, welche bereits in vielen anderen wissenschaftlichen Bereichen verwendet wird. Sie bietet gegenüber der cw-NMR den Vorteil einer kürzeren Messdauer, sowie die Aufnahme des kompletten Spektrums durch eine einzige Messung.

HK 7.8 Mo 18:30 JUR B

Construction and test of a transverse superconducting holding magnet — •HENRY GUSTAVO ORTEGA SPINA, ANDREAS THOMAS, and HANS-JÜRGEN ARENDS for the A2-Collaboration — In-

stitut für Kernphysik, Universität Mainz

As the resonances in the nucleon excitation spectrum are broad and overlapping, more information than that available from simple unpolarized cross sections is required in order to disentangle them. To this end, experiments with polarized targets and beams are essential in order to study the nucleon internal structure in depth. The additional information is then obtained from the polarization observables in the differential cross section of pseudoscalar meson photoproduction.

The development of the frozen spin target technique has provided the possibility to use a polarized target in combination with 4pi-detector systems. An internal superconducting holding magnet for transverse polarization has been constructed and tested. It will be employed in the Mainz Frozen Spin Target, which will be used in the near future for scattering experiments at the MAMI accelerator facility in combination with the Crystal Ball-TAPS detector setup.