HK 19: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:45–19:00 Raum: HSZ-304

Gruppenbericht HK 19.1 Mo 16:45 HSZ-304

The neutron-proton charge-exchange amplitudes measured in the $dp \to ppn$ reaction at ANKE/COSY — •David Mchedlishvili for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany — High Energy Physics Institute, Tbilisi State University, 0186 Tbilisi, Georgia

The unpolarised differential cross section and the two deuteron tensor analysing powers A_{xx} and A_{yy} of the $\vec{d}p \to \{pp\}_s n$ charge-exchange reaction have been measured with the ANKE spectrometer at the COSY storage ring. Using deuteron beams with energies 1.2, 1.6, 1.8, and 2.27 GeV, data were obtained for small momentum transfers to a $\{pp\}_s$ system with low excitation energy. The results at the three lower energies are consistent with impulse approximation predictions based upon the current knowledge of the neutron-proton amplitudes. However, at 2.27 GeV, where these amplitudes are far more uncertain, agreement requires a reduction in the overall double-spin-flip contribution, with an especially significant effect in the longitudinal direction. These conclusions are supported by measurements of the deuteron-proton spin-correlation parameters $C_{x,x}$ and $C_{y,y}$ that were carried out in the $\vec{d}\vec{p} \to \{pp\}_s n$ reaction at 1.2 and 2.27 GeV. The values obtained for the proton analysing power A_y^p also suggest the need for a radical re-evaluation of the neutron-proton elastic scattering amplitudes at the higher energy. Such measurements can provide a valuable addition to the neutron-proton database in the charge-exchange region.

Supported by the COSY-FFE program.

HK 19.2 Mo 17:15 HSZ-304

Results for the $\vec{p}p \to pK^+\Lambda$ Reaction Measured at COSY-TOF with a Polarized Proton Beam of 2.70 GeV/c — •Florian Hauenstein for the COSY-TOF-Collaboration — Universitaet Erlangen-Nuernberg, Erlangen, Deutschland

The COSY-TOF detector setup was recently upgraded with a new tracking system including a Straw Tube Tracker (STT). This upgrade increases the reconstruction efficiency and the precision of the event reconstruction significantly. Together with the polarized beam it allows to determine the spin triplet $p\Lambda$ scattering length. Additionally the production mechanism of the $\vec{p}p \to pK^+\Lambda$ reaction can be studied from polarization observables and the Dalitz plot. The latter can also be used to determine contributions of N^* resonances.

In 2011 a measurement was performed with a polarized proton beam of 2.70 GeV/c momentum. In this talk preliminary results on the Dalitz plot, angular distributions and polarization observables will be presented. It will be shown that the $N\Sigma$ cusp effect in the reaction is less strong than in other COSY-TOF measurements at higher beam momenta. In addition the behaviour of the kaon analyzing power and Λ polarization is compared to a previous measurement at 2.95 GeV/c. The latter changes its sign at 2.70 GeV/c compare to higher beam momenta.

HK 19.3 Mo 17:30 HSZ-304

Chiral effective field theory for hyperon-nucleon interactions — •Stefan Petschauer[1], Johann Haidenbauer[2], Norbert Kaiser[1], Ulf-G. Meissner[2], and Wolfram Weise[1] — [1]Physik-Department, Technische Universität München, D-85747 Garching, Germany — [2]Institute for Advanced Simulation, Forschungszentrum Jülich, D-52425 Jülich, Germany

We calculate hyperon-nucleon interactions within the framework of chiral effective field theory. The irreducible potentials in momentum space are derived from the chiral SU(3) Lagrangian and include contributions from one- and two-meson exchange as well as contact terms up to next-to-leading order. Effects from intermediate decuplet baryons are considered as well. With these chiral baryon-baryon potentials a systematic study of hyperon-nucleon scattering and light hypernuclei is possible. Calculations for hyperon-nucleon cross sections have been performed using a regularized Lippmann-Schwinger equation and a good description of all the available data is achieved.

Work supported in part by DFG and NSFC (CRC110).

HK 19.4 Mo 17:45 HSZ-304

The ABC effect in $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ at ANKE* — •Malte Mielke, Christopher Fritzsch, Paul Goslawski, Alexander Täschner, Michael Papenbrock, Daniel Schröer, and Alfons Khoukaz for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

The ABC effect is a phenomenon which appears in double pionic fusion reactions as a low-mass enhancement in the two pion invariant mass spectrum. It has been a matter of research since many years and was lately even linked with the appearance of an exotic resonance, which should decay via two Δ baryons into the observed particles.
Complementary to the approach of other experiments it is also of high interest to investigate influences of other possible production mechanisms on the invariant mass distributions. The high momentum resolution, which is needed for this task, can be achieved with the ANKE spectrometer at the COoler SYnchrotron - COSY, where data of the reaction $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ was recorded in an excess energy range of 265 to 285 MeV. The use of kinematically complete events allows for a detailed analysis of the invariant mass distributions with respect to different involved production channels.
Recent results will be presented and discussed.
*Supported by the COSY-FFE program.

HK 19.5 Mo 18:00 HSZ-304

Investigation of the tensor analyzing power t_{20} in the reaction $\vec{\mathrm{d}}+\mathrm{p} \to {}^3\mathrm{He}+\eta$ — •Michael Papenbrock, Christopher Fritzsch, Paul Goslawski, Alfons Khoukaz, Malte Mielke, Daniel Schröer, and Alexander Täschner for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

Previous measurements on the reaction $\mathrm{d} + \mathrm{p} \to {}^3\mathrm{He} + \eta$ with the ANKE spectrometer at the COoler SYnchrotron - COSY - of the Forschungszentrum Jülich provided strong indications for the existence of a quasi-bound state of the $\eta - {}^3\mathrm{He}$ system. In order to gather more evidence for this possible quasi-bound state, measurements with a polarized deuteron beam have been performed at ANKE on the reaction $\vec{\mathrm{d}} + \mathrm{p} \to {}^3\mathrm{He} + \eta$. Hence, the investigation of the energy dependence of the tensor analyzing power t_{20} allows to study in more detail the role of the final state interaction in the strong enhancement of the total cross section.

Recent results will be presented and discussed. Furthermore, a brief outlook on the upcoming measurement on the reaction $\mathrm{p} + \mathrm{n} \to \mathrm{d} + \eta$ in the context of η-mesic nuclei will be given.

Supported by the COSY-FFE program.

HK 19.6 Mo 18:15 HSZ-304

Data analysis with the BGO-OD experiment — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institute, Universität Bonn

The new BGO-OD experiment at the ELSA accelerator facility, Bonn, consists of the highly segmented BGO calorimeter with a particle tracking magnetic spectrometer at forward angles. This allows the investigation of final states of mixed charge with nearly 4π acceptance, with very high precision at forward angles for charged particles. An extensive physics programme using an energy tagged bremsstrahlung photon beam is employing this unique setup, with measurements planned for associated strangeness, vector meson and pseudoscaler meson photoproduction.

Analysis of data from the first data taking beam time, and comparison with simulated data is presented. This includes particle momentum reconstruction with the BGO and the forward spectrometer. Highlights include a new method of K^+ identification via the time delayed decay in the BGO crystals, greatly increasing the acceptance region for K^+ and vector mesons.

HK 19.7 Mo 18:30 HSZ-304

Resonance Multiplets in the Two-Baryon System — Dibaryons revisited*. — •Heinz Clement and Mikhail Bashkanov — Physikalisches Institut der Universität Tübingen

After Jaffe's note on the possible existence of a bound six-quark system, the H-dibaryon denoting asymptotically a bound $\Lambda\Lambda$ system, numerous theoretical investigations appeared predicting a vast number of states in the system of two baryons. In the subsequent experimental hunt for dibaryons many claims have been announced, however, none survived careful experimental investigations. The interest in dibaryons revived recently, when two groups announced that lattice QCD cal-

culations provide evidence for a bound H-dibaryon. Also recently it has been noted that the double-pionic fusion reaction $pn \to d\pi^0\pi^0$ proceeds dominantly via a resonance structure observed in the total cross section at $\sqrt{s} = 2.37$ GeV with $\Gamma \approx 70$ MeV and $I(J^P) = 0(3^+)$ [1]. Since its decay proceeds dominantly via an intermediate $\Delta\Delta$ system, this putative resonance constitutes asymptotically a $\Delta\Delta$ system bound by nearly 100 MeV. In recent years also another resonance got established by SAID phase shift analyses, which resonates in the $^1D_2$ pp partial wave at $\sqrt{s} = 2.15$ GeV with $\Gamma \approx 120$ MeV. Since it resides just at the $N\Delta$ threshold, it is assumed to be a loosely bound (molecular) ΔN configuration. None of the many dibaryon predictions can predict both resonances at the proper energies – with the exception of Dyson's multiplet prediction. The consequences will be discussed.

[1] P. Adlarson et al., Phys. Rev. Lett. **106** 242302 (2011)

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HK 19.8 Mo 18:45 HSZ-304

Preliminary results from the commissioning experiment of the polarized deuterium gas target at ANKE/COSY — •Boxing Gou for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany — Institute of Modern Physics, Chinese Academy of Sciences, 509 Nanchang Road, Lanzhou, 730000, P.R.China

By using the deuteron as a quasi-free neutron target at ANKE/COSY, many important observables can be investigated in polarized nucleon-nucleon collisions. The difference between the pp and np elastic scattering amplitude can be directly measured by investigating the np charge exchange reaction. This has already been successfully studied up to a nucleon energy of 1.1 GeV by using the polarized deuteron beam incident on polarized/unpolarized hydrogen targets. Using instead a polarized deuterium cell target it would be possible to extend the charge exchange studies up to the highest COSY proton beam energy of 2.8 GeV. In order to test the performance of the polarized deuterium gas target and the feasibility of continuing the charge exchange studies, a commissioning experiment was conducted in June 2012. Nuclear reactions with large and well-known cross sections and analyzing powers that fell within the ANKE acceptance were used to measure the target vector (Q_y) and tensor (Q_{yy}) polarizations.

The physics case for using a polarized deuterium gas target at ANKE/COSY will be presented, as well as the preliminary results regarding the pn charge exchange studies.

Supported by CSC program.