HK 13: Hadron Structure and Spectroscopy I

Time: Monday 16:30–19:00 Location: H-ZO 20

HK 13.1 Mo 16:30 H-ZO 20

Hyperon reconstruction and analysis — •Roman Dzhygadlo[1], Albrecht Gillitzer[2], and Jim Ritman[2] for the PANDA-Collaboration — [1]Universität Bonn — [2]Forschungszentrum Jülich

The hyperon excitation spectrum is still poorly known. This is particularly the case for the Ξ and the Ω spectrum. The knowledge on nucleon resonances is mainly based on the πN channel were as little is known on their coupling to ΛK or ΣK final states. In order to improve this situation, simulation and analysis studies were performed to reconstruct hyperons in the PANDA (Λ, Ξ) and in the COSY-TOF (Λ, Σ) experiments. In the simulations a Straw Tube Tracking (STT) subdetector was used. In the PANDA experiment a STT detector is the baseline option for the Central Tracker, the COSY-TOF experiment has recently been upgraded with a STT detector. The analysis for COSY-TOF was performed within the COSY-TOF simulation-analysis software, for PANDA the PANDAROOT framework was used. In both cases the hyperons were reconstructed with real track and vertex finders. The resulting hyperon invariant mass distribution and the obtained reconstruction efficiency will be shown. The achieved signal-to-background level for different background channels will be discussed.

Supported in part by Forschungszentrum Jülich

HK 13.2 Mo 16:45 H-ZO 20

Energy dependence of the cross section for $pp \to \{pp\}_s\gamma$ at intermediate energies — •Dmitry Tsirkov, Tatyana Azaryan, Sergey Dymov, Vladimir Komarov, Anatoly Kulikov, Vladimir Kurbatov, George Macharashvili, and Yury Uzikov for the ANKE-Collaboration — Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, 141980 Dubna, Russia

The fundamental reaction $pp \to \{pp\}_s\gamma$, where $\{pp\}_s$ is a proton pair with excitation energy of $E_{pp} < 3\,\mathrm{MeV}$, has been observed with the ANKE spectrometer at COSY-Jülich. This is equivalent to photodisintegration of a free $^1S_0$ diproton for photon energies $E_\gamma \approx T_p/2$. Previously only photodisintegration of a diproton bound within a nucleus has been observed. The integral cross section of the reaction was calculated in the range of c. m. angles $0° < \theta_{pp} < 20°$ for proton beam energies of $T_p = 0.353,\ 0.500,\ 0.550,\ 0.625\,\mathrm{GeV}$, as well as upper limits for 0.318 and 0.800 GeV. The energy dependence obtained shows clear bump around $T_p = 0.550\,\mathrm{GeV}$, which may reflect the influence of the Δ(1232) excitation, even though this channel is suppressed compared to the similar $np \to \gamma d$ reaction. The results of the research might help to understand the underlying dynamics of the short range NN interaction, since quantum numbers for the $pp \to \{pp\}_s\gamma$ reaction differ from those of the extensively studied deuteron photodisintegration.

Supported by the COSY-FFE program.

HK 13.3 Mo 17:00 H-ZO 20

Status of the Analysis of Double Pion Production in Proton-Proton Collisions — •Tamer Tolba and James Ritman for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

Pion production, especially double pion production, in proton-proton collisions is one of the sources of information on the nucleon-nucleon (NN) interaction and on nucleon resonance properties.
The mechanisms for double pion production in proton-proton collisions are strongly momentum dependent and are dominated by baryon resonance intermediate states.
In this work, the WASA-at-COSY facility is used to measure double pion production at a proton beam kinetic energy of 1400 MeV.
The status of the analysis will be presented.

Supported by BMBF and Wallenberg Foundation.

HK 13.4 Mo 17:15 H-ZO 20

Analysis of the $pp \to \Lambda pK^+$ Reaction at $T_p = 2.26$ GeV * — •Katharina Ehrhardt, Heinz Clement, Evgueny Doroshkevich, Arthur Erhardt, and Gerhard J. Wagner for the COSY-TOF-Collaboration — Physikalisches Institut der Universität Tübingen

Our effort to contribute to the pentaquark search [1] with a precision measurement resulted also in a high-statistics measurement of the $pp \to \Lambda pK^+$ reaction at $T_p = 2.26$ GeV as a by-product. In the two-particle invariant masses these data cover the kinematical ranges of $N^* \to \Lambda K^+$ decays including the P11(1710) resonance decay. Our analysis focusses on structures in the Dalitz plots, which would be indicative of the excitation of strange and non-strange baryon resonances decaying into pK^+ and ΛK^+ channels, respectively as well as of possible dibaryon resonances in the Λp system. With regard to the latter we also investigate the K^+ missing mass spectrum for possible signals of a $\Lambda p\pi^0$ resonance and a ppK^- bound system discussed in connection with recent FINUDA results.

First results of the analysis will be presented.

[1] M. Abdel-Bary et al., Phys.Lett. **B 649** (2007) 252

* supported by BMBF, COSY-FFE, DFG (Eur. Graduate School)

HK 13.5 Mo 17:30 H-ZO 20

Studium der Λ(1405) Resonanz mit HADES — •Eliane Epple, Alexander Schmah und Laura Fabbietti — Technische Universität München

Die Kenntnis der Struktur der Λ(1405)-Resonanz ist ausschlaggebend für ein besseres Verständniss der $\bar{K}N$-Wechselwirkung und damit wichtig für die Vorhersage von möglichen kaonischen Bindungszuständen. Das HADES Spektrometer am Schwerionensynchrotron der Gesellschaft für Schwerionenforschung in Darmstadt hat sich neben der e^+/e^- Identifikation auch für die Messung von Hadronen etabliert [1]. Insbesondere der Nachweis von geladenen Kaonen konnte in Schwerionenreaktionen mit gutem Signal zu Untergrund Verhältnis aufgezeigt werden [2]. Die entwickelten Methoden werden nun, unter anderem, für die Rekonstruktion der Λ(1405) Resonanz in der Reaktion $p + p \to \Lambda(1405) + p + K^+$ verwendet. Eine gemessene Statistik von $1.2 \cdot 10^9$ p+p Reaktionen bei einer kinetischen Strahlenergie von 3.5 GeV ermöglicht die exklusive Rekonstruktion durch missing mass und invariant mass Techniken in dem Zerfallskanal $\Lambda(1405) \to \Sigma^0\pi^0$.
Umfangreiche Simulationen zur Bestimmung der Akzeptanzen und Rekonstruktionseffizienzen sowie erste vorläufige Ergebnisse der Datenanalyse werden vorgestellt.
Diese Arbeit wird durch die HGF sowie durch das Exzellence Cluster Universe unterstützt.
[1] PhD thesis Alexander Schmah, TU Darmstadt, 2008
[2] Diploma thesis Manuel Lorenz, Johann Wolfgang Goethe-Universität Frankfurt, 2008

HK 13.6 Mo 17:45 H-ZO 20

Baryon Form Factors in the Chiral Quark-Soliton Model — •Tim Ledwig[1], Antonio Silva[2], and Marc Vanderhaeghen[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Mainz, Germany — [2]Centro de Fisica Computacional, Universidade de Coimbra, Coimbra, Portugal

We investigate the form factors of the vector and axial-vector current between baryon states in the SU(3) chiral quark-soliton model. This relativistic model has only four parameters from which three are determined in the meson-sector whereas only one remains for the whole baryon-sector. One advantage of this model is therefore that various observables of all ground-state baryons can be investigated in the same scheme by having fixed only once these parameters.

Results are given for the electromagnetic form factors of the Δ(1232) as well as for the magnetic moments of the decuplet baryons. Special interest is given to the Δ electric quadrupole form factor. We take linear 1/Nc and strange quark mass corrections into account. In addition we discuss also form factors of the semileptonic hyperon decays and properties of the pentaquark Θ^+.

HK 13.7 Mo 18:00 H-ZO 20

Measurement of the neutron electric form factor in the reaction $^3\vec{\mathrm{He}}(\vec{e}, e'n)pp$ — •Björn Sören Schlimme for the A1-Collaboration — Institut für Kernphysik, Universität Mainz, J.-J.-Becher-Weg 45, D-55099 Mainz

The neutron electric form factor G_{en} was measured in a double polarization experiment at $Q^2 = 1.58\,(\mathrm{GeV/c})^2$. The 1.5 GeV polarized electron beam was provided by the new accelerator stage of the Mainz Mikrotron, MAMI-C. A polarized ^{3}He gas target served as an effective polarized neutron target with freely adjustable polarization orientation. The scattered electrons were detected by a magnetic spectrometer in coincidence with the knocked out neutrons detected in a nucleon

detector. Beam helicity asymmetries are sensitive to $G_{\rm en}$ for a neutron polarization perpendicular to the momentum transfer. Asymmetries for parallel orientation are dominated by $G_{\rm mn}$ and can be used for a reduction of systematic errors. Perpendicular and parallel asymmetries were measured to provide a measurement of $G_{\rm en}/G_{\rm mn}$. Employing the results of existing absolute $G_{\rm mn}$ measurements, $G_{\rm en}$ can be extracted. The experimental setup and preliminary results will be shown.

HK 13.8 Mo 18:15 H-ZO 20

New narrow nucleon N*(1685) — Vyacheslav Kuznetsov[1] and •Maxim Polyakov[2] — [1]Kyungpook National University, 702-701, Daegu, Republic of Korea — [2]Institut für Theoretische Physik II, Ruhr-Universität Bochum, 44780 Bochum

We argue that the existence of a new narrow (Gamma <25 MeV) nucleon resonance N*(1685) is strongly supported by recent data on eta-photoproduction off the nucleon. The resonance has much stronger photo-coupling to the neutron than to the proton. This nucleon resonance is a good candidate for the non-strange member of the exotic anti-decouplet of baryons – the partner of the pentaquark Theta+. All up to date known properties of new N*(1685) are summarized.

HK 13.9 Mo 18:30 H-ZO 20

The mass of the Δ resonance in a finite volume: fourth-order calculations — •Dominik Hoja[1,2], Véronique Bernard[3], Ulf-G. Meissner[1,2,4], and Akaki Rusetsky[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn — [2]Bethe Center for Theoretical Physics, Universität Bonn — [3]Université Louis Pasteur, Laboratoire de Physique Théorique — [4]Institut für Kernphysik und Jülich Center for Hadron Physics, Forschungszentrum Jülich

The self-energy of the Δ resonance in a finite volume is calculated by using chiral effective field theory with explicit spin-3/2 fields. The calculations are performed up-to-and-including fourth order in the small scale expansion and yield an explicit parameterization of the energy spectrum of the interacting πN pair in a finite box in terms of both the quark mass and the box size L. We show that finite-volume corrections are sizable at small quark masses. The values of certain low-energy constants are extracted from fitting to the available data in lattice QCD.

Work supported in part by DFG (TR 16).

HK 13.10 Mo 18:45 H-ZO 20

The Bound State Approach and Hyperfine Splitting for Heavy Baryons — •Egidijus Norvaisas, Darius Jurciukonis, and Vidas Regelskis — VU Institute of Theoretical Physics and Astronomy, Vilnius, Lithuania

We consider the Skyrme model in the bound state approach for the unitary fields U(**x**,t) belonging to a irreducible representation (λ,μ) of the SU(3) group. The bounded meson field is expanded pertubatively. Therefore model Lagrangian brakes into two parts corresponding soliton and meson field with soliton field in the background. We treat soliton field quantum mechanically *ab initio* and leave chiral symmetry group $\mathrm{SU(2)_R} \otimes \mathrm{SU(2)_L}$ explicit unbroken. Due to the canonical quantization of the soliton we get different spin and isospin of soliton. Noncommutativity of quantum variables leads to quantum soliton stabilizing term. This term depends on the representation (λ,μ) and lowers soliton mass. The symmetry breaking and Wess-Zumino terms play a crucial role for the bounded field and also depend on representation. We find semiclassical Hamiltonian describing bounds states in the background of the quantum soliton. The representation (λ,μ) influences the explicit expression of Hamiltonian and can be interpreted as a new discrete phenomenological parameter of the model. The calculations are done for the spectra of the strange, charm and bottom baryons, where they are treated as a bound states of quantum soliton and appropriate flavor meson.