HK 8: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:30–19:00 Raum: RW 1

Gruppenbericht HK 8.1 Mo 16:30 RW 1

Hadron Spectroscopy with COMPASS — •Boris Grube for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. One primary goal is the search for new hadronic states, in particular exotic mesons and glueballs using hadron beams.

Its large acceptance, high resolution, and high-rate capability make the COMPASS experiment an excellent device to study the spectrum of light-quark mesons in diffractive and central production up to masses of about 2.5 GeV/c^2. In addition COMPASS is able to measure final states with charged as well as neutral particles, so that resonances can be studied in different reactions and decay channels.

A significant spin-exotic $J^{PC} = 1^{-+}$ resonance consistent with the controversial $\pi_1(1600)$ was seen already in the 2004 pilot-run data in $\pi^-\pi^+\pi^-$ final states diffractively produced by a 190 GeV/c π^- beam. During 2008 and 2009 COMPASS took a data sample about 100 times larger using negative and positive hadron beams on H_2, Ni, and Pb targets. We will give an overview of the first results from this data set that cover a variety of channels. In particular the talk will focus on the search for spin-exotic mesons in diffractively produced 3π, $\eta'\pi$, and possibly 5π final states and the analysis of central-production reactions in order to study glueballs in the scalar sector.

HK 8.2 Mo 17:00 RW 1

Resonanzen der Systeme $\pi^-\eta$ und $\pi^-\eta'$ in der Reaktion $\pi^- p \to \pi^-\eta^{(\prime)} p_{\text{slow}}$ bei COMPASS — •Tobias Schlüter, Wolfgang Dünnweber und Martin Faessler für die COMPASS-Kollaboration — Ludwig-Maximilians-Universität, München

Wir beschreiben Partialwellenanalysen der Systeme $\pi\eta$ und $\pi\eta'$, erzeugt in Wechselwirkungen eines π^--Strahls (190 GeV) mit einem Wasserstofftarget. Die Daten wurden von COMPASS 2008 aufgezeichnet, wobei auf ein langsames Rückstoßproton ($|t| \gtrsim 0,1\,\text{GeV}^2$) getriggert wurde. Wir vergleichen Analysen der $\pi\eta$- und $\pi\eta'$-Daten. Signifikante Beiträge können dem in der D-Welle beobachteten $a_2(1320)$ und dem in der G-Welle beobachteten $a_4(2040)$ zugeordnet werden. Wir untersuchen den Einfluss nichtresonanter Produktionsmechanismen. Schließlich behandeln wir die Möglichkeit einer resonanten Interpretation der P-Welle, deren neutraler Isospinpartner die einem Quark-Antiquark-System nicht zugänglichen („exotischen“) Quantenzahlen $J^{PC} = 1^{-+}$ besäße.

HK 8.3 Mo 17:15 RW 1

Spin-exotic search in the $\rho\pi$ decay channel: First results on $\pi^-\pi^0\pi^0$ in comparison to $\pi^-\pi^+\pi^-$ final states (diffractively produced on proton) — •Frank Nerling for the COMPASS-Collaboration — Universität Freiburg, Physikalisches Institut

The COMPASS experiment at the CERN SPS features good charged particle tracking and coverage by electromagnetic calorimetry, and our data provide excellent opportunity for simultaneous observation of new states in two different decay modes within the same experiment. The existence of the spin-exotic $\pi_1(1600)$ resonance in the $\rho\pi$ decay channel is studied for the first time in COMPASS in both decay modes of the diffractively produced $(3\pi)^-$ system: $\pi^- p \to \pi^-\pi^+\pi^- p$ and $\pi^- p \to \pi^-\pi^0\pi^0 p$. A preliminary partial-wave analysis performed on the 2008 proton target data allows for a first conclusive comparison of both $(3\pi)^-$ decay modes not only for main waves but also for small ones. We find the neutral versus charged mode results in excellent agreement with expectations from isospin symmetry. Both, the intensities and the relative phases to well-known resonances, are consistent for the neutral and the charged decay modes of the $(3\pi)^-$ system. The status on the search for the spin-exotic $\pi_1(1600)$ resonance produced on a proton target is discussed.

HK 8.4 Mo 17:30 RW 1

Search for Resonances in the Diffractively Produced 5 Pion System at COMPASS — •Sebastian Neubert for the COMPASS-Collaboration — Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN SPS, which investigates the structure and spectroscopy of hadrons. Diffractive dissociation of pions on nuclear and liquid hydrogen targets provides clean access to light meson resonances. Owing to the large acceptance and high resolution, COMPASS can measure exclusive multi-particle final states containing both neutral and charged particles with unprecedented accuracy. Events with 5 charged pions in the final state populate the mass region around and beyond 2 GeV/c^2, where many interesting candidates for mesonic resonances have been discussed in the past, but still need further experimental investigation. In this talk, we will report on the progress of the development of a partial wave analysis for this complex final state and discuss first results.

HK 8.5 Mo 17:45 RW 1

Analysis of diffractive dissociation of exclusive $K^-\pi^+\pi^-$ events in the high energetic hadron beam of the COMPASS-experiment — •Prometeusz Jasinski[1] and for the COMPASS Collaboration[2] — [1]Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz — [2]CERN

The COMPASS experiment at CERN took data with a 190 GeV/c hadron beam hitting a liquid hydrogen target in the years 2008 and 2009. The main purpose is the study of the light meson spectrum in the context of non-pertubative QCD.

The negative hadron beam contains mainly pions but also a small fraction of about 2.5% of kaons, giving access to production mechanisms of isospin 1/2 resonances. One of the channels of interest is diffractively produced resonances decaying into the K^- π^+ π^- final state. I will discuss the data selection and quality studies for this channel. The invariant mass spectra show already the well known resonances as the $K_1(1270)$ $K_1(1400)$ and the $K_2(1770)$. To disentangle all contributing resonances, techniques of mass-indendent partial wave analysis are applied. Most important results are discussed.

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HK 8.6 Mo 18:00 RW 1

Meson Production in Antiproton-Nucleus Interactions — •Stefanie Lourenco[1], Jan Haas[1], Horst Lenske[1], Thorsten Steinert[1], and Slawomir Wycech[2] — [1]Institut für Theoretische Physik, Universität Gießen — [2]National Center for Nuclear Studies, Hoza 69, 00-681, Warsaw, Poland

With the upcoming FAIR@GSI facility a variety of new antimatter-experiments become accessible. An interesting case is to study properties of exotic nuclei by using antiprotons for spectroscopy. The main part of the interaction is the strong annihilation, which leads to various possible particles produced in the exit channel. For the initial state $\bar{p}$A interaction we use an optical potential in t-ρ approximation, where the NN t-matrix taken from Juelich or Paris approach is folded with microscopical densities obtained from self-consistent Hartree-Fock Bogoliubov (HFB) calculations. Presently we focus on two meson production, namely pions. The final state interaction between the produced pions and the residual nucleus is taken into account by an optical potential of Kisslinger-type with additional higher resonances extensions. Results for elastic scattering, antiprotonic atoms and particle production on Ni isotopes are presented.

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HK 8.7 Mo 18:15 RW 1

proposal for a revisit of antiproton nucleus collision experiment with PANDA — •Yue Ma and Frank Maas — Helmholtz Institute Mainz

By the 1980s, a series of experiments have been performed around the world(CERN, KEK and BNL) to study the antiproton nucleus interaction. However, considerable ambiguities still exist regarding to the real part of antiproton nucleus potential. For example, elastic antiproton nucleus scattering shows a small attractive potential of 30 MeV while recent antiprotonic analysis favors a value of 110 MeV. Recently, a theoretical investigation based on GiBUU transportation model has been carried out, which demonstrates the possibility of the existence of an attractive potential about 150 MeV. Based on this result, the same group suggests the existence of a cold compressed phase of normal nucleus due to the attraction from a embedded antiproton. This talk will outline the motivation of a revisit of antiproton nucleus collision experiment with modern detector, PANDA, at FAIR facility. Extractions of

interested physical variables will be illustrated and improvements compared with previous experiments will be emphasized.

HK 8.8 Mo 18:30 RW 1

Feasibility Study of a Transversely Polarized Target in Panda — •Bertalan Feher — Helmholtz Institut Mainz

PANDA (Antiproton Annihilation at Darmstadt) is a key project at the Facility for Antiproton and Ion Research (FAIR), i. e. an accelerator facility currently under construction at GSI Darmstadt. PANDA is a state of the art detector for antiproton-proton fixed target experiments. A transversely polarized target in PANDA allows the determination of the electromagnetic time-like form factors with unprecedented accuracy and the first-time extraction of the imaginary part from the latter. The measurement of this will open a new window for investigating the nucleon structure.

A transversely polarized target in PANDA implies that the longitudinal magnetic flux density applied by the PANDA-solenoid has to be shielded. A numerical simulation of the shielding with a Bi-2212 superconducting tube was performed.

HK 8.9 Mo 18:45 RW 1

Simulations for the measurement of $\bar{p}p \to e^+e^-\pi^0$ with PANDA in the TDA approach — •Maria Carmen Mora Espi for the PANDA-Collaboration — Helmholtz Institut Mainz, Mainz, Germany

Transition Distribution Amplitudes (TDA) describe the transition between a baryon and a meson state. They are useful to calculate the cross section of hard exclusive processes. The cross section of $\bar{p}p \to e^+e^-\pi^0$ has been calculated for small values of the momentum transfer t and high total center of mass energy W^2 using the TDA approach. Simulations of $\bar{p}p \to e^+e^-\pi^0$ have been done to study the feasibility of measurement of this cross section with PANDA. The main background channel $\bar{p}p \to \pi^+\pi^-\pi^0$ has been taken into account.