HK 32: Hadron Structure and Spectroscopy V

Zeit: Mittwoch 14:00–16:00 Raum: S1/01 A4

Gruppenbericht HK 32.1 Mi 14:00 S1/01 A4

Hadron Spectroscopy with COMPASS — •Boris Grube — 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. The two-stage spectrometer has a good acceptance for charged as well as neutral particles over a wide kinematic range and is thus able to measure a wide range of reactions. Light mesons are studied with negative (mostly π^-) and positive (p, π^+) hadron beams with a momentum of 190 GeV/c. Their spectrum is investigated in various final states produced in diffractive dissociation or in central-production reactions. The COMPASS data not only allow for measuring the properties of known resonances with high precision, but also for searching for new states. Among these is a new resonance-like signal, the $a_1(1420)$, with unusual properties. In addition, the resonance content of the partial wave with spin-exotic $J^{PC} = 1^{-+}$ quantum numbers, which are forbidden for quark-antiquark states, is of particular interest.

This work was supported by the BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universität und der Technischen Universität München.

HK 32.2 Mi 14:30 S1/01 A4

Extraction of resonance parameters of light mesons in diffractively produced $\pi^-\pi^+\pi^-$ final states at COMPASS — •Stefan Wallner[1] and Compass Collaboration[2] — [1]TU München E18 — [2]Cern

The COMPASS experiment studies the spectrum of hadrons and has acquired a large data sample of diffractively produced $\pi^-\pi^+\pi^-$ final states using a 190 GeV pion beam on a hydrogen target. The size of the data set permits us to perform a partial-wave analysis in bins of the squared four-momentum transfer t' from the beam to the target with the largest wave set used so far consisting of 88 waves.

Based on this partial-wave decomposition, resonance parameters are extracted by disentangling resonant and non-resonant parts of selected partial-wave amplitudes in resonance-model fits. The additional information obtained from the division of the data into bins of t', allows for a better separation of resonant and non-resonant parts, as they exhibit different t' dependences. Using this approach, the masses and widths of π_J- and a_J-like meson resonances have been extracted by simultaneously fitting a subset of selected partial waves. We will present this powerful analysis scheme and a selection of results.

HK 32.3 Mi 14:45 S1/01 A4

Light Meson Decays in `CLAS` and `CLAS12` — •Michael Kunkel — Forschungszentrum Jülich — CLAS Collaboration

Photoproduction experiments with the CEBAF Large Acceptance Spectrometer (`CLAS`) at the Thomas Jefferson National Facility produce data sets with competitive statistics of light mesons. With these data sets, measurements of transition form factors for η, ω, and η' mesons via conversion decays can be performed using the invariant mass distribution of the final state dileptons. Tests of fundamental symmetries and information on the light quark mass difference can be performed using a Dalitz plot analysis of the meson decay. An overview of preliminary results, from existing `CLAS` data, and future prospects within the newly upgraded `CLAS12` apparatus are given.

HK 32.4 Mi 15:00 S1/01 A4

Search for the rare π^0 decay into 3 photons at MAMI — •Jennifer Wettig and Wolfgang Gradl for the A2-Collaboration — Institut für Kernphysik, Universität Mainz

The rare decay of the neutral π^0 meson into 3 photons presents a unique possibility for a search of new, C-violating forces beyond the standard model. $\pi^0 \to 3\gamma$ is effectively forbidden by charge conjugation invariance and one SM estimate for this branching ratio is 10^{-31}.

This presentation will show a feasibility study for a future experiment at the tagged photon facility of MAMI (Glasgow Tagger) using Crystal Ball/TAPS detector setup together with particle identification detector (PID) and multi-wire proportional chambers (MWPCs). The CB detector is a high resolution spectrometer specifically designed to detect neutral final states and therefore well-suited for this task.

Supported by DFG under contract CRC1044 and excellence cluster PRISMA.

HK 32.5 Mi 15:15 S1/01 A4

Status of the analysis of the $\eta' \to \omega\gamma$ relative branching ratio — •Andreas Neiser and Wolfgang Gradl for the A2-Collaboration — Institut für Kernphysik, Universität Mainz

The A2 collaboration at the electron accelerator MAMI in Mainz uses energy-tagged photons to produce light mesons off the nucleon. In 2014, three dedicated beamtimes for the production of η' mesons off unpolarized protons yielded a data sample of $\approx 6 \times 10^6$ η' mesons within an incident photon energy range $E_\gamma = 1.42 \ldots 1.58\,\text{GeV}$.

The A2 detector system mainly consists of the 4π calorimeter Crystal Ball and the TAPS calorimeter in forward direction, which are ideally suited to detect neutral final states in the given energy range.

We present the status of the analysis for the relative branching ratio of the pseudoscalar-vector-gamma decay $\eta' \to \omega\gamma$ to the reference channel $\eta' \to 2\gamma$. We show the extraction of the value based on Monte Carlo studies and give estimates of the expected uncertainties of our measurement. The result serves as an input to effective field theories of the strong interaction, especially concerning η-η'-mixing and the consistent inclusion of vector mesons.

This work is supported by DFG under contract SFB1044.

HK 32.6 Mi 15:30 S1/01 A4

Zeitabhängige Dalitz-Diagramm-Analyse des Zerfalls $D^0 \to K_S\pi^+\pi^-$ zur Messung von D^0–$\bar{D}^0$-Mischung am $\overline{\text{P}}$ANDA-Experiment — •Andreas Pitka[1] und Kai-Thomas Brinkmann[2] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]II. Physikalisches Institut, Justus-Liebig-Universität Gießen

Die derzeit genauesten Messungen von D^0–$\bar{D}^0$-Mischung verwenden eine zeitabhängige Dalitz-Diagramm-Analyse des Zerfalls $D^0 \to K_S\pi^+\pi^-$. Hierbei wird genutzt, dass der Flavorinhalt des physikalischen D^0-Zustandes aufgrund der Mischung im D^0–$\bar{D}^0$-System zeitlich oszilliert, was zu einer Variation der relativen Stärke doppelt Cabibbo-unterdrückter bzw. Cabibbo-bevorzugter Resonanzen innerhalb der Dreikörperamplitude führt. Mithilfe von Monte-Carlo-Daten des Simulationsframeworks PandaRoot wird die Anwendbarkeit dieses Verfahrens am $\overline{\text{P}}$ANDA-Experiment überprüft. Neben der Auflösbarkeit der Amplitudenstruktur des Dreikörperzerfalls wird gezeigt, mit welcher Genauigkeit die Mischungsparameter x und y nach 150 Tagen Datennahme extrahiert werden können. Zur Parametrisierung der Dreikörperamplitude dient hierbei ein realistisches Modell unter Verwendung des K-Matrix-Formalismus und der LASS-Amplitudenform zur Beschreibung der $\pi\pi$ bzw. Kπ S-Welle; die im Verhältnis zur mittleren D^0-Lebensdauer nicht vernachlässigbare Auflösung der Zerfallszeit wird durch eine analytische Faltung der Dreikörperamplitude mit der Auflösungsfunktion der Zerfallszeit berücksichtigt.

HK 32.7 Mi 15:45 S1/01 A4

Feasibility study of the $\bar{p}p \to D_s^- D_{s0}^*(2317)$ process with $\overline{\text{P}}$ANDA — •Elisabetta Prencipe[1], Albrecht Gillitzer[1], James Ritman[1], and Klaus Goetzen[2] — [1]Forschungszentrum Jülich IKP1, Jülich (DE) — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt (DE)

Charm spectroscopy has recently gained renewed attention, due to confirmations and new observations published by LHCb. Despite of the excellent performance of the CERN experiments, still limitations exist, that do not allow to perform the measurement of the width (Γ) of narrow states with $\Gamma \leq 1$ MeV. The measurement of the $D_{s0}^*(2317)$ and the $D_{s1}(2460)$ width is a crucial point to discriminate among theoretical models, and to reveal their nature. One of the major advantage of the future $\overline{\text{P}}$ANDA experiment at FAIR is the excellent momentum beam resolution of about $\Delta p/p{=}5{\times}10^{-5}$, allowing energy scans with an energy resolution down to $\Delta E \approx 26$ keV. We present a method to measure the width of the $D_{s0}^*(2317)$, and for the first time a complete full simulation performed with PandaRoot is shown. Feasibility studies for assumption of different signal cross sections are shown, to accommodate the incomplete experimental and theoretical knowledge of the corresponding process of interest. A proposal for a threshold scan for the production reaction $\bar{p}p \to D_s^- D_{s0}^*(2317)^+$ in 100-keV-steps is presented, together with an estimate of the competitiveness of $\overline{\text{P}}$ANDA in this field, assuming an average luminosity of $L{=}10^{31}$ cm^{-1}s^{-1}.