

HK 23: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 14:00–16:00

Raum: RW 2

Gruppenbericht

HK 23.1 Mi 14:00 RW 2

Messungen zu den Meson-Polarisierbarkeiten und zu chiraler Dynamik in Pion-Photon-Reaktionen an COMPASS — ●JAN FRIEDRICH für die COMPASS-Kollaboration — TU München

Das COMPASS-Experiment am CERN bietet weltweit einzigartige Bedingungen zur Untersuchung von Meson-Photon-Reaktionen in einem weiten kinematischen Bereich. Die hochgenaue Messung der Endzustände von Pion- und Kaonstrahlen mit 190 GeV Einschussenergie auf ruhende Kerne erlaubt die Identifikation von Wechselwirkungen mit dem Coulombfeld bei kleinsten Impulsüberträgen $Q^2 < 0.001 \text{ GeV}^2/c^2$ und Schwerpunktsenergie des Meson-Photon-Systems im Bereich $\lesssim 1 \text{ GeV}$.

Die Bestimmung der Polarisierbarkeiten durch die Comptonreaktion $\pi\gamma \rightarrow \pi\gamma$ ist das wichtigste Ziel der Messungen. Nach einer kurzen Strahlzeit im Jahr 2009, deren aktuellste Ergebnisse vorgestellt werden, ist für 2012 Datennahme mit sehr hoher Statistik geplant, die neben Termen höherer Ordnung für Pionen auch eine erste Messung der Kaonpolarisierbarkeit zum Ziel hat.

Weitere Aspekte der untersuchten Reaktionen sind die Bestimmung der chiralen Anomalie in $\pi\gamma \rightarrow \pi\pi^0$, sowie die chirale Dynamik von $\pi\gamma \rightarrow 3\pi$. Der Vergleich der Ladungszustände $\pi^-\pi^-\pi^+$ und $\pi^-\pi^0\pi^0$ erlaubt detaillierte Aussagen über Schleifen-Beiträge, die von der chiralen Störungsrechnung vorhergesagt werden.

HK 23.2 Mi 14:30 RW 2

Cross section for quasi-real photo-production of charged hadrons with high transverse momenta in muon-deuteron scattering — ●CHRISTIAN HÖPPNER for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

The measurement of unpolarized high- p_T hadron-production cross sections provides an important benchmark for the applicability of perturbative QCD (pQCD) calculations, especially at lower center-of-mass energies, where corrections beyond the next-to-leading order could become important. These calculations rely on the factorization of unpolarized and polarized cross sections into non-perturbative parton distribution functions, which parametrize the structure of the nucleon, hard scattering cross sections, calculable in pQCD, and non-perturbative fragmentation functions. In this contribution we shall present the first measurement of the unpolarized cross section for the quasi-real photo-production of charged hadrons with high transverse momenta from muon-deuteron scattering data at $\sqrt{s} = 17.4 \text{ GeV}$ at COMPASS. The dependence of the cross section on p_T for forward and central rapidities is discussed. The presented cross section results are compared to recent NLO pQCD calculations.

HK 23.3 Mi 14:45 RW 2

Diffraction Dissociation into 3 Pion Final States at COMPASS — ●FLORIAN HAAS for the COMPASS-Collaboration — Technische Universität München

Diffraction dissociation reactions studied at the COMPASS experiment, CERN, provide access to the light meson spectrum. During a pilot run in 2004, using a pion beam and a lead target, 500k events of $\pi^-\pi^-\pi^+$ final state events with masses below $2.5 \text{ GeV}/c^2$ were recorded, yielding a significant signal for the $\pi_1(1600)$ spin-exotic resonance. After a significant upgrade of the spectrometer in 2007, the following two years were dedicated to meson spectroscopy. Using again a pion beam, but now with a liquid hydrogen target, an unique statistics of $\sim 60\text{M}$ events of the same final state was gathered in 2008. During a short campaign in 2009, the liquid target was exchanged by several solid state targets in order to compare final states produced on targets with different atomic numbers. After a short summary of a partial wave analysis (PWA) of 2004 data, the focus will be on a PWA of 2008 data in the same kinematic range of momentum transfer ($0.1 \text{ GeV}^2/c^2 < t' < 1.0 \text{ GeV}^2/c^2$). In addition the progress of the analysis of data recorded with solid state targets in 2009 and a comparison with 2008 and 2004 data will be presented.

HK 23.4 Mi 15:00 RW 2

Single-Hadron transverse target spin asymmetries at COMPASS — ●CHRISTOPH ADOLPH — Physikalisches Institut IV der Universität Erlangen-Nürnberg

The quark content of the nucleon at twist-two level in the collinear case can be fully characterized by three independent distribution functions for each quark flavour: the unpolarized distribution function $f_1(x)$, the helicity distribution function $g_1(x)$ and the transverse spin distribution function $h_1(x)$, also called transversity. COMPASS is a fixed target experiment at CERN where the nucleon spin structure is investigated using a 160 GeV/c polarized μ^+ beam and polarized solid state targets. The measurements of single spin asymmetries in semi-inclusive deep inelastic scattering (SIDIS) on a transversely polarized target are an important part of the COMPASS physics program. After taking data in the years 2002-2004 using a transversely polarized ^6LiD (deuteron) target, in 2007 and 2010 data were collected on a transversely polarized NH_3 (proton) target. The data allows to investigate the transversity distribution function, e.g. coupled to the Collins fragmentation function, as well as transverse momentum dependent distribution functions, like the Sivers distribution function, by measuring azimuthal asymmetries in hadron production. In this contribution we present the results on one hadron spin asymmetries from the 2010 data for the Collins and Sivers asymmetries.

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HK 23.5 Mi 15:15 RW 2

OZI rule violation and spin alignments in vector meson production at COMPASS — ●JOHANNES BERNHARD — for the COMPASS collaboration — Institut für Kernphysik, Johannes-Gutenberg-Universität, Johann-Joachim-Becher-Weg 45, 55099 Mainz

The COMPASS collaboration at CERN dedicated the 2008 and 2009 run time to meson spectroscopy measurements. At 190 GeV/c beam momentum, both diffractive and double-diffractive production mechanisms overlap which can be explored with vector meson production studies. We present results for spin alignments of $\omega(782)$ and $\phi(1020)$ depending on x_F and t alongside with systematics of the event selection. In addition, we find an OZI rule violation of a factor of 3 in the comparison of yields for $pp \rightarrow pp\omega$ and $pp \rightarrow pp\phi$.

HK 23.6 Mi 15:30 RW 2

COMPASS results on transverse spin asymmetries in two-hadron production in SIDIS — ●CHRISTOPHER BRAUN for the COMPASS-Collaboration — Physikalisches Institut IV der Universität Erlangen-Nürnberg

At twist-two level the nucleon and its quark content can exist in three states regarding their polarizations in the collinear case: both can be unpolarized, longitudinally or transversely polarized. This refers to three independent parton distribution functions (PDF) for each quark flavour q : the quark distribution $f_1^q(x)$, the helicity distribution $g_1^q(x)$ and the transversity distribution $h_1^q(x) = q_{\uparrow\uparrow}^q(x) - q_{\uparrow\downarrow}^q(x)$. Where $\uparrow\uparrow$ means quark spin parallel and $\uparrow\downarrow$ antiparallel to the spin of the nucleon. The transversity function is chiral-odd and therefore is not accessible in deep inelastic scattering (DIS). However, $h_1^q(x)$ can be observed in semi-inclusive DIS in combination with another chirally odd function like the two-hadron interference fragmentation function (IFF) $H_{1,q}^{\leftarrow}$ in two-hadron production, which is the subject of this contribution. The 160 GeV/c polarized μ^+ beam of CERN's M2 beamline allows COMPASS to investigate the spin structure of the nucleon using polarized solid state targets. After taking the first data on a transversely polarized proton target (NH_3) in 2007, a full year of data taking followed in 2010 to increase precision. In this contribution the latest results from the 2010 data for the azimuthal asymmetries in two-hadron production are presented. An extraction of $h_1^q(x)$ via a coupling to the two-hadron IFF $H_{1,q}^{\leftarrow}$ has been carried out for the 2007 data.

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HK 23.7 Mi 15:45 RW 2

Hard exclusive ρ^0 production to constrain generalized parton distributions — ●KATHARINA SCHMIDT, STEFFEN BAUER, HORST FISCHER, TILLMANN GUTHÖRL, KAY KÖNIGSMANN, FRANK NERLING, CHRISTIAN SCHILL, STEFAN SIRTIL, and JOHANNES TER WOLBEEK — for the COMPASS collaboration - Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The theoretical framework of Generalized Parton Distributions (GPDs) provides a dynamical and geometrical picture of the nucleon. Additional to the longitudinal momentum information of partons they

contain information on the transverse localization of the constituents. The exclusive production of ρ^0 mesons off a transversely polarized target allow to constrain the GPD E which is connected, according to Ji's sum rule, with the total angular momentum of quarks and gluons.

In 2007 & 2010 measurements were performed scattering a 160 GeV/c longitudinal polarized muon beam off a transversely polarized

NH₃ target at the COMPASS experiment at CERN.

This talk gives an introduction to the analysis of exclusively produced ρ^0 mesons. Results for the transverse target single spin asymmetry $A_{UT}^{sin(\phi-\phi_s)}$ are presented. Supported by BMBF, DFG and EU FP7 (Grant Agreement 227431).