HK 30 Elektromagnetische und Hadronische Proben

Zeit: Dienstag 16:30–19:00 Raum: TU MA001

Gruppenbericht

HK 30.1 Di 16:30 TU MA001

Transversale Spin Physik bei Hermes — •Ulrike Elschenbroich für die Hermes-Kollaboration — Universiteit Gent, Vakgroep Subatomaire en Stralingsfysica, Proeftuinstraat 86, B-9000 Gent

Das Hermes–Experiment am Hera-Elektronenring untersucht die Spinstruktur des Nukleons mit polarisierter tiefinelastischer Elektron–Nukleon–Streuung an einem internen Gastarget. Für eine komplette Beschreibung der Quark–Gluon–Struktur des Nukleons benötigt man drei Quarkverteilungen: die spin–gemittelte (unpolarisierte) $q(x)$, die longitudinal spinabhängige $\Delta q(x)$ und die transversale spinabhängige Quarkverteilung $h_1^q(x)$, auch *transversity* genannt. Da letztere ein chiral ungerades Objekt ist, kann sie nicht in inklusiver aber beispielsweise in semi–inklusiver tief inelastischer Streuung (SIDIS) in Verbindung mit einer chiral ungeraden Fragmentationsfunktion, der sogenannten *Collins* Funktion $H_1^{\perp q}(z)$, gemessen werden. Diese Verbindung verursacht eine sinusoidale Abhängingkeit vom azimutalen Winkel des produzierten Hadrons.

Der gleiche Wirkungsquerschnitt beinhaltet zusätzlich die Kombination der bekannten unpolarisierten Fragmentationsfunktion $D^q(z)$ und einer weiteren Quarkverteilung $f_{1T}^{\perp q}(x)$ (*Sivers* Funktion), die eine andere Sinus–Modulation zur Folge hat. Eine Sivers Funktion, die von Null verschieden ist, deutet auf einen vorhandenen Drehimpuls der Quarks im Nukleon hin.

Aktuelle Ergebnisse des Hermes–Experiments und von Monte–Carlo Studien werden präsentiert.

HK 30.2 Di 17:00 TU MA001

First measurements of Collins and Sivers asymmetries at COMPASS — •Richard Webb for the COMPASS collaboration — Physikalisches Institut, Friedrich-Alexander-Universität Erlangen-Nürnberg

The cross-section for deep inelastic lepton scattering off spin 1/2 hadrons is parametrised in leading order in terms of three quark distribution functions: the unpolarised distribution q(x), the longitudinally polarised distribution $\Delta q(x)$ and the so-called transversity distribution $\Delta_T q(x)$. This last function is chiral-odd and so can only be measured incombination with a chiral-odd fragmentation function such as the Collins function $H_1^{\perp}(z)$, requiring the detection of part of the hadronic endproduct (semi-inclusive measurement). An asymmetry is expected in the azimuthal production angle of the hadron in the scattering process which should depend on the Collins angle $\Phi_C = \Phi_h - \Phi'_s$, where Φ'_s is the spin angle of the fragmenting quark. The deep-inelastic cross-section also contains the product of the unpolarised fragmentation function $D_q(z)$ and the Sivers distibution function $f_{1T}(x)$. Here the dependency of the expected asymmetry is on the Sivers angle $\Phi_S = \Phi_h - \Phi_s$, Φ_s being the angle of the quark spin in the initial state. COMPASS is a fixed target experiment on the SPS M2 beamline at CERN. Its ^{6}LiD target can be polarised both longitudinally and transversally with respect to the polarised 160GeV/c μ^+ beam. Approximately 20% of the beam-time is spent in the transverse configuration. Results of the analysis of the Collins and Sivers asymmetries on the basis of the first COMPASS data will be reported here. This work is supported by the BMBF.

HK 30.3 Di 17:15 TU MA001

Sivers effect in semi-inclusive DIS and the Drell-Yan process — •Simone Menzel[1], A.V. Efremov[2], K. Goeke[1], A. Metz[1], and P. Schweitzer[1] — [1]Institut für Theor. Physik II, Uni Bochum — [2]Dubna, JINR, Russland

The Sivers parton distribution describes an azimuthal asymmetry of unpolarized quarks in a transversely polarized target. For quite some time this time-reversal odd function was considered to be zero, and only recently it was proved that it may well exist [1, 2]. In ref.[2] it was predicted that the Sivers function in semi-inclusive DIS and Drell-Yan should have opposite signs. An experimental check of this prediction is still missing. The Sivers asymmetry was measured recently in semi-inclusive DIS by the HERMES collaboration[3]. We use these data to fit the Sivers function and present our results. On this basis we make predictions for the Sivers asymmetry in the Drell-Yan process, which can be measured in the future at the GSI and at COMPASS/CERN via the transverse single spin asymmetries $p^\uparrow + \bar{p} \to l + \bar{l} + X$ and $p^\uparrow + \pi^- \to l + \bar{l} + X$, respectively.

[1] S.J.Brodsky, D.S.Hwang, I.Schmidt, Phys. Lett. **B 530**, 99 (2002)
[2] J.Collins, Phys. Lett. **B 536**, 43 (2002)
[3] HERMES, hep-ex/0408013

HK 30.4 Di 17:30 TU MA001

Tranversity signals in two pion correlation at COMPASS — •Rainer Joosten for the COMPASS collaboration — Helmholtz Institut für Strahlen- und Kernphysik,Rheinische Friedrich-Wilhelms-Universität Bonn

The cross-section for deep inelastic scattering off spin 1/2 hadrons can be parametrised in leading order in terms of three quark distribution functions: the helicity averaged distribution q(x), the longitudinal helicity distribution Δq(x) and the transverse spin distribution Δ_Tq(x). This last distribution function, referred to as transversity, is chiral-odd and can only be measured in combination with a chiral-odd function. So far, attempts were made to measure Δ_Tq(x) in combination with the Collins fragmentation-function $H_1^{\perp}(z)$, requiring the partial detection of the hadronic products (semi-inclusive measurement). Another probe is the measurement of two hadron production introducing the chiral odd interference fragmentation function $H_1^{\sphericalangle}(z)$. An asymmetry is expected in the azimuthal angle of the hadron plane which should depend on $\varphi_R + \varphi_S$, where φ_S is the angle of the initial quark spin and φ_R the angle of the hadron plane in the lepton scattering plane. Some models even expect an interference term in the region of the ρ-mass. COMPASS is a fixed target experiment on the SPS M2 beamline at CERN. Its ^{6}LiD target can be polarised both longitudinally and transversally with respect to the polarised 160 GeV/c μ^+ beam. 20% of the beam-time is spent in the transverse configuration, allowing the measurement of transversity effects. First results of the analysis of two hadron production will be reported. This work is supported by the BMBF.

HK 30.5 Di 17:45 TU MA001

The Cahn-Effect at COMPASS — •Eric Weise, H. Fischer, J. Franz, S. Hedicke, F.H. Heinsius, M. von Hodenberg, D. Kang, K. Königsmann, D. Matthiä, C. Schill, D. Setter, and S. Trippel for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg, Germany

COMPASS is a fixed target experiment at CERN studying nucleon spin structure in polarised deep inelastic muon nucleon scattering and investigating hadron spectroscopy using hadron beams. One of the goals of COMPASS is to analyse the transverse momenta of the quarks in the nucleon. In semi inclusive deep inelastic scattering these intrinsic transverse momenta of the quarks generate an asymmetry in the azimuthal angle ϕ of the hadron, to which the struck quark fragments. This angle is measured with respect to the direction of the virtual photon and the lepton-scattering plane. The asymmetry causes $\cos n\phi$-modulations in the count rates, which has been predicted by Cahn in 1987. The status of the analysis on this subject will be presented. This work is supported by the BMBF.

HK 30.6 Di 18:00 TU MA001

Longitudinal Λ polarization in the COMPASS experiment — •Donghee Kang, H. Fischer, J. Franz, S. Hedicke, F.H. Heinsius, M. von Hodenberg, K. Königsmann, D. Matthiä, C. Schill, D. Setter, and S. Trippel for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg

At the COMPASS experiment at CERN Λ and $\bar{\Lambda}$ particles are produced in the deep inelastic scattering process with high statistics. The main focus of the research is the understanding of the longitudinal Λ and $\bar{\Lambda}$ polarization and the spin transfer mechanism through fragmentation processes. The Λ and $\bar{\Lambda}$ polarization can be studied by measuring the acceptance corrected angular distribution of its decay products. The results of the longitudinal polarization and spin transfer will be compared and discussed with further measurements. The project is supported by BMBF.

HK 30.7 Di 18:15 TU MA001

Measurement of Transverse Lambda Polarization at COMPASS — •B. Grube, M. Becker, R. de Masi, J.M. Friedrich, A.-M. Dinkelbach, S. Gerassimov, B. Ketzer, I. Konorov, R. Kuhn, T. Nagel, S. Paul, L. Schmitt, Q. Weitzel, and M. Wiesmann for the COMPASS collaboration — TU München, Physik Department E18

COMPASS has made a first analysis of the transverse Lambda polarization in quasi-real photo-production ($Q^2 < 0.5$ (GeV/c)^2) using a 160 GeV/c muon beam from the CERN SPS.

The transverse polarization with respect to the production plane was measured using the self-analyzing weak decay of the Λ and $\bar{\Lambda}$. We have evaluated the polarization in different kinematic regions using the variables x_F and p_T. Systematic effects were reduced by utilizing the bias-canceling method.

This work is supported by the BMBF and the Maier-Leibnitz-Labor, Garching.

HK 30.8 Di 18:30 TU MA001

Bestimmung der Pion-Polarisierbarkeiten im COMPASS-Experiment * — •Anna-Maria Dinkelbach, Matthias Becker, Rita De Masi, Jan Friedrich, Sergei Gerassimov, Boris Grube, Bernhard Ketzer, Igor Konorov, Roland Kuhn, Stephan Paul, Lars Schmitt und Quirin Weitzel — TU-München, Physik Department E18

Das COMPASS Experiment (CERN NA58) hat in einer dreiwöchigen Pilotstrahlzeit Ende 2004 mit einem 190 GeV Hadronstrahl weiche Reaktionen untersucht. Bei der Streuung von Pionen und Kaonen im Coulombfeld von Bleikernen werden die Primakoff-Reaktionen beobachtet. Im Falle der Produktion eines reellen Photons, welches Comptonstreuung in inverser Kinematik entspricht, hat man hier Zugang zu den elektromagnetischen Polarisierbarkeiten der Strahlteilchen. Wir präsentieren den Messaufbau sowie den Status der laufenden Analyse.

*Diese Arbeit wird unterstützt vom BMBF and dem Maier-Leibnitz-Labor, Garching.

HK 30.9 Di 18:45 TU MA001

Improved radiative corrections for $(e, e'p)$ experiments — •Florian Weissbach, Kai Hencken, Daniela Rohe, Ingo Sick, and Dirk Trautmann — Departement für Physik und Astronomie, Universität Basel, CH – 4056 Basel, Switzerland

$(e, e'p)$ experiments are well-suited to study nuclear structure. However, these experiments are subject to radiative corrections which have to be carefully considered in oder to reach the desired accuracy. Up to now radiative corrections for $(e, e'p)$ experiments have always been approached using the so called 'peaking approximation' which assumes that all the bremsstrahlung is aligned with the particle momenta. We show that this assumption is not applicable to radiation coming from the scattered proton, and that this approach generally underestimates unpeaked bremsstrahlung contributions. We remove the peaking approximation with the effect that we can describe the reconstructed bremsstrahlung photon angular distribution much better than the peaking approximation. This check is done against data from the Thomas Jefferson National Accelerator Facility (TJNAF). Also we gain some insight in the limits of the 'soft photon approximation' which underlies most calculations of radiative corrections.