HK 22 Elektromagnetische und Hadronische Sonden

Zeit: Dienstag 17:00–18:30 Raum: F

Gruppenbericht

HK 22.1 Di 17:00 F

Transverse spin effects 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 function, referred to as transversity, is chiral-odd and can only be measured in combination with another chiral-odd function. At COMPASS, Δ_Tq(x) can be measured in semi-inclusive measurements, requiring the partial detection of the hadronic products. It can be measured in combination with the chiral-odd Collins fragmentation-function $H_1^\perp(z)$ producing an asymmetry in the azimuthal production angle of the hadron which depends on the Collins angle $\varphi_C = \varphi_h - \varphi_{S'}$, where $\varphi_{S'}$ is the spin angle of the fragmenting quark. A second probe is the measurement of two hadron production introducing the chiral odd interference fragmentation function $H_1^\sphericalangle(z)$. Here, an asymmetry is expected in the azimuthal angle of the hadron plane which depends on $\varphi_R - \varphi_{S'}$, where φ_R is the angle of the hadron plane in the lepton scattering plane. 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. In 2002 – 2004, 20% of the beam-time was spent in the transverse configuration, allowing the measurement of transversity effects. Present results of the analysis of one and two hadron production will be reported. (This work is supported by the BMBF)

Gruppenbericht

HK 22.2 Di 17:30 F

The transverse spin structure of the nucleon from lattice QCD — •Philipp Hägler for the QCDSF collaboration — Institut für Theoretische Physik T39, Physik-Department der TU München, James-Franck-Strasse, D-85747 Garching

Tensor generalized parton distributions (GPDs) yield essential information on the transverse spin structure of the nucleon. In this talk, we present recent results from lattice QCD on tensor GPDs. We find that densities of quarks in the nucleon are strongly distorted for transverse quark and nucleon polarizations and discuss possible implications for the Sivers and Boer-Mulders function.

HK 22.3 Di 18:00 F

Drell-Yan process: quark k_T and quark off–shellness vs. next–to–leading order of perturbative QCD — •Olena Linnyk, Stefan Leupold und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

It has been shown[1] that accounting for the off-shellness of quarks and gluons in proton greatly improved the agreement of theoretically calculated high energy cross sections with data. We study the relation between the aforesaid phenomenological corrections and the next-to-leading order (NLO) of the conventional perturbative QCD (pQCD). Drell-Yan lepton pair production $\bar{p}p \to l^+l^-X$ proves sensitive to the effects beyond leading order (LO) of pQCD. LO reaction mechanism with the assumption of on-shell collinear quarks fails to reproduce: (1) the magnitude of the double differential Drell-Yan cross section $d^2\sigma/dQ^2dx_F$, the discrepancy being usually parametrized by a K-factor; (2) the average transverse momentum p_T of the dileptons; (3) the triple differential cross section $d^3\sigma/dQ^2dx_Fdp_T$,*i.e.* the p_T-spectrum. Possible extensions of the LO pQCD are (a) addition of the NLO processes and (b) taking into account the quark transverse motion and off-shellness. We calculate the Drell-Yan process cross section in these two approaches. The results suggest that corrections due to quark off-shellness and intrinsic-k_T contain NLO as well as higher twist contributions.

Work supported by BMBF.

[1] J. Collins and H. Jung, hep-ph/0508280; O. Linnyk, S. Leupold and U. Mosel, hep-ph/0412138

HK 22.4 Di 18:15 F

Chiral-ungerade generalisierte Partonverteilungen im chiralen Quark-Soliton Modell — •Anna-Maria Mischler, K. Goeke und Peter Schweitzer — Institut für Theoretische Physik II, Ruhr-Universität Bochum, 44780 Bochum

Es gibt vier generalisierte Partonverteilungen für Quarks [1], die die Helizität der Quarks umdrehen: die transversalen generalisierten Partonverteilungen. Gegenwärtig ist experimentell nichts über sie bekannt. Jedoch ermöglicht harte Elektroproduktion zweier Vektormesonen mit großem Rapiditätsunterschied auf einem Nukleontarget einen Zugang [2]. Nur für den Vorwärtsfall h_1^q wurden kürzlich erste Daten erhoben [3].

Verschiedene Modellrechnungen wurden für die transversalen generalisierten Partonverteilungen durchgeführt. Es gibt Gitterrechnungen und Berechnungen in Konstituentenquarkmodellen. Ein realistischeres Modell des Nukleons, welches unter gewissen Annahmen aus dem Instantonmodell des QCD-Vakuums hergeleitet wurde, ist das chirale Quark-Soliton Modell. Dieses Modell liefert eine phänomenologisch erfolgreiche und theoretisch konsistente Beschreibung der Eigenschaften des Nukleons, z.B. gelten im Modell Polynomialität und Positivität. Wir berichten die ersten Resultate einer Berechnung der chiral-ungeraden generalisierten Partonverteilungen im chiralen Quark-Soliton Modell.

[1] M. Diehl, Eur. Phys. J. C **19**, 485 (2001).
[2] D. Y. Ivanov, B. Pire, L. Szymanowski and O. V. Teryaev, Phys. Lett. B **550** (2002) 65.
[3] A. Airapetian *et al.* [HERMES], Phys. Rev. Lett. **94** (2005) 012002.