HK 70: Hadron Structure and Spectroscopy II

Time: Thursday 16:30–19:00 Location: H-ZO 30

Invited Group Report HK 70.1 Th 16:30 H-ZO 30

Superscaling analyses, lepton scattering and nucleon momentum distributions in nuclei — •Anton Antonov — Institute of Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia BG-1784, Bulgaria

A scaling function $f(\psi')$ for inclusive electron scattering from nuclei was constructed within the Coherent Density Fluctuation Model (CDFM) that is a natural extension to finite nuclei of the Relativistic Fermi Gas (RFG) model. The approach was used to calculate the total, longitudinal and transverse scaling functions built up from the hadronic tensor and the corresponding response functions in the RFG model. The results are in good agreement with the experimental data for the scaling functions, showing superscaling (independence on the transverse momentum q and the mass number A) for negative values of ψ' including those in the region $\psi' < -1$, whereas the RFG model result for this region is $f_{\rm RFG}(\psi') = 0$. The CDFM scaling functions are used to calculate the cross sections of electron scattering in the quasielastic (QE) region for nuclei from $12 < A < 208$ in comparison with the available experimental data, as well as to calculate charge-changing and neutral current neutrino (antineutrino) scattering on ^{12}C in the QE and the Δ-resonance regions at energies from 1 to 2 GeV. It was shown that superscaling is due to the high-momentum tail of the momentum distributions and the form of its general power-law asymptotics similar for all nuclei which is known to be caused by the short-range and tensor nucleon-nucleon correlations.

Invited Group Report HK 70.2 Th 17:00 H-ZO 30

Overview of recent HERMES results — •Charlotte Van Hulse for the HERMES-Collaboration — Gent University - Department of Subatomic and Radiation Physics-Proeftuinstraat 86, 9000 Gent - Belgium

In the last decade, the HERMES experiment has expanded its program of measuring the quark spin contribution to the nucleon spin, towards forming three dimensional pictures of the partonic structure of the nucleon. These are described in terms of transverse momentum distributions and generalized parton distributions. The former distributions can be accessed by analyzing azimuthal asymmetries in the semi-inclusive deep-inelastic cross section, while the latter can be constrained by the analysis of azimuthal asymmetries in exclusive reactions.

An overview will be given on recent HERMES results on such asymmetries in exclusive real photon and meson production as well as in inclusive and semi-inclusive deep-inelastic scattering. This overview will be supplemented by results on the strange quark distribution and polarization.

HK 70.3 Th 17:30 H-ZO 30

The HERMES measurement of transverse single-spin asymmetries — •Markus Diefenthaler for the HERMES-Collaboration — DESY

In 2005 the HERMES collaboration published first evidence for azimuthal single-spin asymmetries in the semi-inclusive production of charged pions on a transversely polarised hydrogen target. Significant signals for both the Collins and Sivers mechanisms were observed in data recorded during the 2002–2003 running period of the HERMES experiment. In the conference contribution a preliminary analysis of the full data set with transverse target polarisation is presented for π-mesons and charged K-mesons. These results contribute substantially to the global analysis of the transversity distribution and provide clear evidence for the naive time reversal odd Sivers distribution function.

The published results on single-spin asymmetries in semi-inclusive dihadron production provide an independent experimental constraint on the transversity distribution. Thereby first evidence is found for a non-zero naive time reversal odd chiral-odd dihadron fragmentation function $H_{1,q}^{\sphericalangle}$.

HK 70.4 Th 17:45 H-ZO 30

Selected HERMES Results on Deeply Virtual Compton Scattering — •Caroline Riedl for the HERMES-Collaboration — DESY/Zeuthen

The HERMES experiment has collected a rich data set for the analysis of Deeply Virtual Compton Scattering (DVCS), employing different settings of the beam helicity, the beam charge, the target polarization (both longitudinal and transverse) and the target type (H, D and heavier nuclei).

The azimuthal asymmetries measured for the exclusive DVCS reaction allow to access the imaginary and/or real part of certain Generalized Parton Distributions (GPDs). Those GPDs are of great theoretical interest as they embody both spatial and momentum density information of quarks and gluons. Moreover, in a certain kinematic limit, certain moments of the quark (gluon) GPDs E and H deliver the total angular momentum carried by quarks (gluons) in the nucleon.

Until the year 2005, the recoiling target nucleon from the DVCS reaction was not detected by HERMES. Exclusivity was ensured indirectly by a missing-mass-technique. Data with a new Recoil Detector were taken in the last two years of HERA running. The Recoil Detector can identify the recoiling target nucleon and the particles from underlying background processes and can thus be used to directly tag exclusive events and to reject competing background channels. Selected DVCS results will be shown and an outlook to results from the HERMES Recoil Detector will be presented.

HK 70.5 Th 18:00 H-ZO 30

Structure functions of nucleons and nuclei — •Wolfgang Bentz[1], Ian Cloet[2], Takuya Ito[1], Anthony Thomas[3], and Koichi Yazaki[4] — [1]Department of Physics, Tokai University, Kanagawa, Japan — [2]Department of Physics, University of Washington, Seattle, USA — [3]Jefferson Lab, Newport News, VA, USA — [4]RIKEN, Wako-shi, Saitama, Japan

We use an effective chiral quark theory to calculate the quark distributions and structure functions of nucleons and nuclei. The description of the single nucleon is based on the Faddeev framework, and nuclear systems are described in the mean field approximation. Particular amphasis is put on the prediction of the polarized EMC effect in nuclei, and on applications to deep inelastic neutrino-nucleus scattering. Concerning the polarized EMC effect, we discuss the quenching of the quark spin sum in nuclei and its implications for the spin dependent nuclear structure functions, and present results for several nuclei where an experimental observation is feasible. Concerning the case of deep inelastic neutrino-nucleus scattering, we estimate the effect of medium modifications of the quark distribution functions on the measured cross sections, and discuss an interesting resolution of the so called NuTeV anomaly. Finally, we discuss extensions of our model to describe fragmentation functions for semi-inclusive processes. The connection between our effective quark model description and the jet model of Field and Feynman is discussed.

HK 70.6 Th 18:15 H-ZO 30

Transverse quark charge densities — •Cédric Lorcé — Johannes Gutenberg-Universität Mainz

Transverse quark charge densities have recently been studied since they provide a well founded interpretation of the particle structure and shape. We will review shortly the results obtained for spin-1/2 (e.g. nucleon), spin-1 (e.g. deuteron) and spin-3/2 (e.g. Delta) systems. An educated guess allows one to generalize to any spin and leads to definite values for the "natural" electromagnetic moments, i.e. the ones associated to a structureless particle in leading order of the electromagnetic coupling and for real photons.

HK 70.7 Th 18:30 H-ZO 30

First Results of exclusive ρ^0 Production from the Recoil Detector at HERMES — •Roberto Perez-Benito for the HERMES-Collaboration — II. Phys. Institut, Univ. Giessen, Giessen, Germany

The HERMES experiment (HERa MEasurement of Spin) at DESY was designed to study the spin structure of the nucleon by semi-inclusive deep inelastic scattering. Here, we report on hard exclusive processes that can be understood in terms of Generalised Patron Distributions (GPDs). The accumulated HERMES data offer access to GPDs in different combinations of beam charge and beam helicity asymmetries. The ratio of the cross-sections of ρ^0 meson production between hydrogen and deuterium will provide an insight into the relative contribution to the nucleon cross-section from quarks and gluons.

In January 2006 a Recoil Detector was installed that surrounded the internal gas target of the HERMES experiment. The HERMES Recoil

Detector consisted of three components: a silicon strip detector inside the vacuum, a scintillating fiber tracker and the photon detector with three layers of tungsten and scintillator bars in three different orientations. All three detectors were located inside a solenoidal magnet which provided a 1T longitudinal magnetic field. The detector improves the selection of exclusive events by a direct measurement of the recoiling target nucleon in an intermediate momentum range from 0.1 to 1.4 GeV/c as well as by rejecting non-exclusive background.

HK 70.8 Th 18:45 H-ZO 30

Experiment E06007 at Jefferson Lab — •Guido Maria Urciuoli — Instituto Nazionale di Fisica Nucleare, Sezione Roma 1

Experiment E06007 at Jefferson Lab measured cross sections for the $(e, e'p)$ reaction at constant $(\mathbf{q}, \omega)$ for $Q^2 = 0.81$ GeV^2 over a wide range of missing momenta. At missing momentum $p_m = 0$ MeV/c cross sections were also measured at $Q^2 = 1.4$ GeV^2 and 1.97 GeV^2. E06007 experiment addresses several issues concerning our understanding of the nuclear structure. The role of relativity in the description of nuclei is clarified thanks to the measurement of the asymmetry A_{TL} in the cross section, measured forward or backward of the three momentum transfer q. This asymmetry is a distinctive signature of dynamical relativistic effects in the nucleon wave function. The role of the correlations on the strength of high momentum components of single nucleon states is also investigated by the measurement of the cross sections for missing momenta from 300 MeV/c to 500 MeV/c for the ^{208}Pb(e,e'p) reaction going to the low lying states of ^{207}Tl. Furthermore a possible dependence of the spectroscopic factors on Q^2 suggested by previous experimented is studied. To achieve all these goals a very good energy resolution was needed. The experiment made use of the two High Resolution Spectrometer (HRS) located in experimental Hall A at Jefferson Lab and of the high monochromatic, small emittance, JLab electron beam. A special effort was involved to optimize the optical performances of HRS. The preliminary results of E06007 and their comparison to theoretical predictions will be shown.