Nuclear Deep-Inelastic Scattering ◇

G. Piller and W. Weise

We summarize recent developments in the understanding of nuclear effects in deep-inelastic lepton scattering. Our focus is on coherence phenomena, such as shadowing, with special emphasis on the role of the nucleus as a diffractive filter for hadronic and quark-gluon fluctuations of the high-energy virtual photon. New results for the electroproduction of ρ mesons from a nucleus are discussed in the same context.

to be published in Nucl. Phys. A

◇ *Invited talk presented by W. Weise at the International Conference on Quark Nuclear Physics, Adelaide, 21–25 February 2000; Supported in part by BMBF project 06 TM 980*

Nucleon Polarisabilities from Compton Scattering on the Deuteron ◇

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An analytic calculation of the differential cross section of elastic Compton scattering on the deuteron at photon energies ω in the range of $25-50\,MeV$ is presented to next-to-next-to-leading order, i. e. to an accuracy of $\sim 3\%$. The calculation is model-independent and performed in the low energy nuclear Effective Field Theory without dynamical pions. The iso-scalar, scalar electric and magnetic nucleon polarisabilities α_0 and β_0 enter as free parameters with a theoretical uncertainty of about 20 %. Using data at $\omega_{Lab} = 49\,MeV$ we find $\alpha_0 = 8.4$ $pm 3.0(exp) \pm 1.7(theor)$, $\beta_0 = 8.9 \pm 3.9(exp) \pm 1.8(theor)$, each in units of $10^{-4}\,fm^3$. With the experimental constraint for the iso-scalar Baldin sum rule, $\alpha_0 = 7.2 \pm 2.1(exp) \pm 1.6(theor)$, $\beta_0 = 6.9 \mp 2.1(exp) \mp 1.6(theor)$. A more accurate result can be achieved by: (i) better experimental data, and (ii) a higher order theoretical calculation including contributions from a couple of so far undetermined four-nucleon-two-photon operators.

◇ *Supported in part by BMBF project 06 TM 980, DFG and USDOE*

Nucleon Spin Structure: Resonances and Higher Twist ◇

J. Edelmann, G. Piller, N. Kaiser, and W. Weise

We present a detailed analysis of resonance contributions in the context of higher twist effects in the moments of the proton spin structure function g_1. For each of these moments, it is found that there exists a characteristic Q^2 region in which (perturbative) higher twist corrections coexist with (non-perturbative) resonance contribution of comparable magnitude.

to be published in: Proceedings "GDH 2000", Mainz

◇ *Supported in part by BMBF project 06 TM 980 and DFG project We 655/14-2*

Photoproduction of η and η' Mesons off Nucleons Close to Threshold ◇

B. Borasoy

We investigate η and η' photoproduction off both the proton and neutron within $U(3)$ baryon chiral perturbation theory. Low-lying resonances such as the vector mesons and $J^P = 1/2^+$, $1/2^-$ baryon resonances are included explicitly and their contributions together with the Born terms are calculated. The coupling constants of the resonances are determined from strong and radiative decays. We obtain reasonable agreement with experimental data.

published in Eur. Phys. J. A 9 (2000) 95

◇ *Supported in part by BMBF project 06 TM 980*