Phenomenology of Nuclear Shadowing in Deep-Inelastic Scattering ◊

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We investigate shadowing effects in deep inelastic scattering from nuclei at small values $x < 0.1$ of the Bjorken variable. Unifying aspects of generalized vector meson dominance and color transparency we first develop a model for deep-inelastic scattering from free nucleons at small x. In application to nuclear targets we find that the coherent interaction of quark-antiquark fluctuations with nucleons in a nucleus leads to the observed shadowing at $x < 0.1$. We compare our results with most of the recent data for a large variety of nuclei and examine in particular the Q^2 dependence of the shadowing effect. While the coherent interaction of low mass vector mesons causes a major part of the shadowing observed in the Q^2 range of current experiments, the coherent scattering of continuum quark-antiquark pairs is also important guarantees a very weak overall Q^2 dependence of the effect. We also discuss shadowing in deuterium and its implications for the quark flavour structure of nucleons. Finally we comment on shadowing effects in high energy photon-nucleus reactions with real photons.

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Non-Perturbative Scales in Soft Hadronic Collisions at High Energy ◊

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We investigate the role of the non-perturbative quark-gluon dynamics in soft high energy proceses. In order to reproduce differential and total cross sections for elastic proton-proton and proton-antiproton-scattering at high energy and small momentum transfer it turns out that we need two scales, the gluonic correlation length and a confinement scale. We find a small gluonic correlation length, $a \simeq 0.2\ fm$, in accordance with recent lattice QCD results.

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Spin-Dependent Nuclear Structure Functions: A General Approach with Application to the Deuteron ◊

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We study deep-inelastic scattering from polarized nuclei within a covariant framework. A clear connection is established between relativistic and non-relativistic limits, which enables a rigorous derivation of convolution formulae for the spin-dependent nuclear structure functions g_1^A and g_2^A in terms of offmass-shell extrapolations of polarized nucleon structure functions, g_1^N and g_2^N. Approximate expressions for $g_{1,2}^A$ are obtained by expanding the off-shell $g_{1,2}^N$ about their on-shell limits. As an application of the formalism we consider nuclear effects in the deuteron, knowledge of which is necessary to obtain accurate information on the spin-dependent structure functions of the neutron.

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