Charmonium Production in Proton-Nucleon and Proton-Nucleus Collisions ◇

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Systematic nuclear effects discovered in the production of J/ψ particles in high-energy proton-nucleus collisions cannot be explained within the conventional picture in which a heavy color singlet $Q\bar{Q}$ pair, after its production, experiences multiple scattering from nucleons of the residual nucleus. We propose to take into account color octet intermediate states formed in the primary production of the heavy-quark pairs. Using a perturbative QCD analysis we study the microscopic production mechanism for $Q\bar{Q}$ pairs through gluon-gluon fusion with subsequent color neutralization ina strongly interacting medium. The influence of the surrounding matter on this process is investigated.

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Inclusive Heavy-Flavor Production from Nuclei ◇

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We describe a light-cone wave-function formulation for hadroproduction of heavy-flavors at high energies. At moderate values of x_F heavy-flavor production can be viewed as a diffractive excitation of heavy quark-antiquark Fock states, present in the interacting gluon from the projectile. The approach developed here is well suited to address coherence effects in heavy-quark production from nuclei at small values of $x_t \lesssim 0.1 \cdot A^{1/3}$.

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Chiral Corrections to the Kroll-Ruderman Theorem

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We calculate the one-loop corrections to the Kroll-Ruderman low-energy theorems for charged pion photoproduction in the framework of heavy baryon chiral perturbation theory. We predict the threshold S-wave multipole E_{0+} to be $E_{0+}^{thr}(\gamma p \to \pi^+ n) = (28.2 \pm 0.6) \cdot 10^{-3}/M_\pi$ and $E_{0+}^{thr}(\gamma n \to \pi^- p) = (-32.7 \pm 0.6) \cdot 10^{-3}/M_\pi$, respectively, for a fixed pion-nucleon coupling constant, $g_{\pi N} = 13.4$. A comparison to the existing data is also given.

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