How the nuclear Fermi motion plus a simple statistical model explains the EMC effect

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We propose a simple explanation of the EMC effect by means of accounting for nuclear Fermi motion in a simple statistical model description of parton distributions advocated recently [1,2]. In it nucleon is an ensemble of quark-gluon Fock states, which include also energetically favored baryon-meson fluctuation. The equipartition of energy is assumed and energy-momentum constraints are strictly imposed. When going to the nucleus the room must be made for the nuclear interactions and they are included at first by accounting in a proper way for the Fermi motion of nucleons inside the nucleus (keeping all time, and this is of particular importance in our case, the strict energy-momentum conservation). In our approach the Fermi motion of nucleons contribute to the transverse momentum distribution of quarks which remain massless and on energy shell. The Monte Carlo sampling method is used to change the input free nucleon structure functions to the nuclear one (this mechanism works similarly to the decreasing the size of valence parton momentum distribution, i.e., to increasing of the deconfinement region in the configuration space advocated in [3]). However, it turns out that to account also for the nuclear Drell-Yan production data, one has, in addition to Fermi motion, also enlarge nuclear Fock space by a small admixture of pions originating from the nuclear forces[fig.1]. By doing so we are able to obtain good agreement with both deep inelastic scattering data[fig.2] (in the whole range of the Bjorken x variable) and with recent lepton-pair production data.

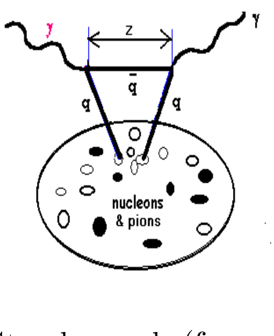

Figure 1: Struck quark (from nucleon or pion) propagates through the nucleus.

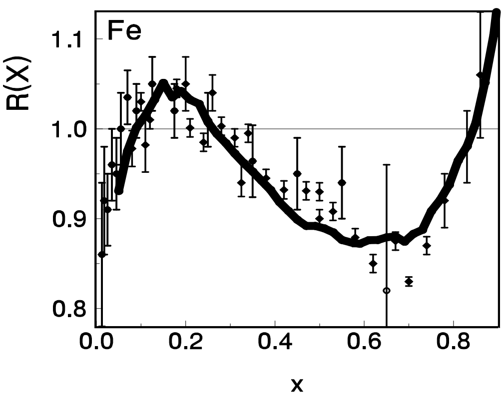

Figure 2: R(x) - the ratio of nuclear structure functions (iron to deuterium).

References

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