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The Gluon Exchange Model for Baryon Stopping

Wednesday, 6 April 2022 10:00 (20 minutes)

We propose a new model for a homogeneous description of hadron-hadron, hadron-nucleus and nucleus-nucleus collisions, the Gluon Exchange Model (GEM). While technically our model can be regarded as a generalization of the Dual Parton Model by Capella and Tran Thanh Van, it is fundamentally based on the number of exchanged color octets (gluons) and significantly extends the Fock space of states available for the participating protons and nucleons.

In proton-proton collisions we provide an *exact* description of the final state proton and neutron spectrum. What is remarkable is that unlike the original DPM, GEM successfully describes the proton "diffractive peak" at high rapidity.

In proton-nucleus reactions we propose a statistical scheme for the process of soft color octet (gluon) exchange, based on the assumption that probabilities to form an effective diquark are equal for all allowed pairs of quarks. The latter effective diquark can form either from two valence, one valence and one sea, or from two sea quarks. Consequently we calculate the probabilities for different color configurations involving diquarks of valence-valence, valence-sea and sea-sea type. These probabilities appear to depend on the number of exchanged gluons, which results in increasing baryon stopping as a function of the number N of proton-nucleon collisions in the nucleus. As such, the baryon nuclear stopping power appears to be governed by the emergence of new color configurations as a function of N rather than by the energy loss of the original valence diquark.

The advantage of our approach lies in its high predictive power which makes it verifiable by the new, precise data on proton and neutron production from the CERN SPS. The latter verification, a set of predictions for the N-dependence of the baryon stopping process, and a discussion of implications for proton-oxygen collisions planned at the LHC, will be included in the talk.

References:

[1] M. Jeżabek and A. Rybicki, Phys. Lett. **B816**, 136200 (2021).

[2] M. Jeżabek and A. Rybicki, 2111.03401 [nucl-th].

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