Modeling Systematic Trends in Exclusive Meson-Production in a Relativistic Quark-Diquark Model

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Exclusive near-threshold hadronic meson production in the reaction $pp - pB\lambda$ is characterized by a very large momentum transfer of $q \sim 1GeV/c$. Such processes - which test the short range dynamics of the baryon-baryon system - are an essential part of the experimental program of modern proton (and electron) accelerators (like COSY and CELSIUS or Jlab) [1]. Crucial for a microscopic description of the production mechanism is the choice of the effective degrees and the sharing of the large momentum transfer between them, which we investigate in two microscopic models:
- Meson exchange models for pseudo-scalar 0^- meson :
Assuming resonance dominance (i.e. the $N^*(1535)$ and the $N^*(1650)$) the model is formulated perturbatively from standard effective Lagrangians for the various meson-baryon couplings for the dominante meson exchanges below 1 GeV with a monopole type off-shell continuation and the coupling stengths extracted from the partial decay width of the corresponding resonances; Different aspects of the approach are investigated with particular emphasis, among them a covariant versus a nonrelativistic formulation, in the extraction of the relative phases between the various meson exchanges from their coupling to the mesonic continuum or loop corrections to the standard factorization [2];
- Relativistic quark-gluon models:
In a more systematic attempt, we investigate the exclusive production of the pseudoscalar mesons π^0, η, η', K^+ and of the vector mesons ω, ϕ in a microscopic gluon-exchange or instanton model. We describe the baryons as covariant quark - scalar diquark systems with harmonic confinement, thus taking into account center-of-mass corrections and Lorentz contraction in different frames; the excitation of intermediate baryon resonances - to make contact with characteristic findings from meson exchange models for η and K^+ production, is accounted by colorless 2-gluon (soft Pomeron) exchange. The main phenomenological parameters are restricted from baryon spectroscopy or studies of nucleon form factors [3]. In additional steps, the perturbative expansion of the multi-gluon exchange qq interaction in the heavy mass (spectator limit) or the the impact of the OZI rule for ϕ production are investigated.

References

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