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Small- p_T production of J/ψ mesons within Soft Gluon Resummation Approach

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Prompt heavy quarkonium production is well described within the collinear parton model in the next-to-leading order of perturbative QCD at kinematical region of $p_T \gg M$ where M is a mass of a quarkonium state. But the region of small p_T is still being researched and the factorisation approach which is valid here is TMD-factorisation (transverse-momentum dependent). We studied J/ψ production in collision of protons at $\sqrt{s} = 200, 27$ and 19.4 GeV. Certainly, we used Nonrelativistic QCD (NRQCD) as a standard hadronisation model for charmonium production, and we extracted nonperturbative matrix elements for octet color states of the NRQCD from a set of experimental data on prompt J/ψ production because color singlet model can't be considered as sufficient for experimental data description.

The TMD approach is a general factorisation model for $p_T \ll M$ region [1]. One of the realisations of the TMD-factorisation is a so called Soft Gluon Resummation approach [2] where soft gluon emission by partons is considered, evolution of the TMD parton distribution functions is controlled by the Collins – Soper equations [3] though the TMD distribution is partly reduced to the collinear one. We perform our study at the LO+LL approximation for now. We describe data from PHENIX Collaboration at $\sqrt{s} = 200$ GeV and from NA3 Collaboration at $\sqrt{s} = 19.4$ GeV and do predictions for future SPD NICA experiments at $\sqrt{s} = 27$ GeV. We considered both gluons and quarks as initial partons, we also estimated a contribution of P -wave charmonium production and calculated polarised J/ψ production as an angular coefficient λ . The Inverse-Error Weighting Scheme [4] is used as an approach for matching of collinear and TMD factorisations.

References:

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