

Production of prompt polarized J/ψ in the NRQCD and Generalized Parton Model

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The heavy quarkonium spin-physics is an important task of high energy physics which we study using charmonium production within the Nonrelativistic Quantum Chromodynamics (NRQCD) approach and Generalized Parton Model (GPM). We extracted a set of the NRQCD and GPM parameters by fitting data of charmonium production in proton–proton collisions measured by the PHENIX and NA3 collaborations, both at small and large rapidities. This set includes the NRQCD octet nonperturbative matrix elements and values of averaged squared transverse momentum in Gaussian q_T -distributions for initial quarks and gluons. The data of NA3 collaboration ($\sqrt{s} = 19.4$ GeV) was used due to the energy closeness to the SPD NICA future experiment. Therefore, we could make predictions for unpolarised prompt J/ψ production for $\sqrt{s} = 27$ GeV. Also, we calculated polarization of the J/ψ as one of the angular coefficients λ in angular distribution of leptonic decay of J/ψ . Our results are compared with the PHENIX polarization data in a helicity frame. We found quite bad agreement for our polarization prediction unlike our prediction of unpolarized prompt J/ψ production. However, we provide calculations of the polarized prompt J/ψ for the SPD NICA experiment as well. Besides, we demonstrate validity of calculations in the GPM, as a version of Transverse-Momentum-Depended Parton Model, by comparison with the conventional Collinear Parton Model calculations.

Primary authors: KARPISHKOV, Anton (Samara National Research University, JINR); SALEEV, Vladimir (Samara National Research University, JINR); SHILYAEV, Kirill (Samara National Research University)

Presenter: SHILYAEV, Kirill (Samara National Research University)

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