

# XXV International Baldin Seminar on High Energy Physics Problems "Relativistic Nuclear Physics and Quantum Chromodynamics"



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## Production of $\eta_c$ –mesons at high energy in proton-proton collisions

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Study of charmonium production at high energy in proton-proton collisions is important test of perturbative QCD, factorization approach and hadronization model in a heavy quark sector. There are many sets of experimental data for  $J/\psi$ ,  $\psi(2S)$  and  $\chi_{cJ}$  production cross sections [1]. Oppositely, the only results of direct measurements was published by LHCb Collaboration for  $\eta_c$  production cross section and transverse momentum spectrum [2]. In the article, we predict  $\eta_c$  production cross sections on energies in range from  $\sqrt{s} = 27$  GeV up to 13 TeV for present and future proton-proton colliders to estimate opportunity of their experimental measurements. We perform our study using different factorization approaches such as Collinear Parton Model (CPM), Transverse Momentum Depended Parton Model (TMD PM) [3], Generalized Parton Model (GMP) and Parton Reggeization Approach (PRA) [4].  $\eta_c$  production cross section is also sensitive to hadronization model of  $c\bar{c}$ –pair in the final  $\eta_c$ –meson. We compare predictions for  $\eta_c$  production cross sections using different hadronization models: Color Singlet Model, NRQCD approach and Color Evaporation Model (CEM).

[1] E. Chapon, D. d’Enterria, B. Ducloue, M. G. Echevarria, et al. Prospects for quarkonium studies at the high-luminosity LHC, Prog. Part. Nucl. Phys. 122 (2022), 103906

[2] R. Aaij, C. Abellan Beteta, B. Adeva et al. Measurement of the  $\eta_c(1S)$  production cross-section in proton-proton collisions via the decay  $\eta_c(1S) \rightarrow p\bar{p}$ . The Eur. Phys. J. C vol. 75, 311 (2015), 579 (2017).

[3] J. Collins Foundations of perturbative QCD. Camb. Monogr. Part. Phys. Nucl. Phys. Cosmol. 32, 1-624 (2011).

[4] V. A. Saleev, M. A. Nefedov and A. V. Shipilova, Prompt  $J/\psi$  production in the Regge limit of QCD: From Tevatron to LHC, Phys. Rev. D 85 (2012), 074013

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