Measurement of J/ψ energy correlator in p+p collisions at $\sqrt{s} = 500$ GeV at STAR

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Abstract

The J/ψ meson, consisting of a charm quark and its antiquark, serves as an exceptional testing ground of Quantum Chromodynamics (QCD). However, our understanding of its underlying production mechanism remains incomplete. One of the principal challenges lies in experimentally disentangling perturbative from non-perturbative process contributions. The recently proposed J/ψ-energy correlator[1] observable shows a remarkable ability to distinguish between soft and hard processes, thereby establishing the observable as a potent tool for investigating J/ψ production mechanism. Theoretical calculations [1] further indicate that the J/ψ-energy correlator, observed within the J/ψ helicity frame, possesses a strong discriminatory power against existing models.

In this talk, we will present the first measurement of the J/ψ-energy correlator in hadron collisions. The study is conducted by reconstructing the J/ψ via its di-electron decay channel at mid-rapidity ($|y| < 1$), within the transverse momentum range of $5 < p_T < 10$ GeV/c, in proton-proton collisions at $\sqrt{s_{\mathrm{NN}}} = 500$ GeV at RHIC-STAR experiment. By comparing J/ψ energy correlator with different model calculations, we aim to provide a robust basis for distinguishing among the existing J/ψ production models.

[1] An-Ping Chen, Xiaohui Liu, and Yan-Qing Ma. Shedding light on hadronization by quarkonium energy correlator. *Physical Review Letters*, 133(19):191901, 2024.