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Measurements of proton-antiproton pairs from QED vacuum excitation in Au+Au ultra-peripheral collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV from STAR

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Relativistic heavy-ion collisions generate extremely strong electromagnetic (EM) fields, providing an ideal environment to study the EM excitation of the vacuum. The Breit-Wheeler process, which involves the electron-position pair production via photon-photon interactions, represents the lowest-order decay mode of the QED vacuum excitation. This process was first observed by the STAR experiment in 2021, and has stimulated further exploration into higher-order decay modes, including hadron-antihadron pair production.

In this presentation, we will report the first measurement of proton-antiproton pairs resulting from QED vacuum excitation in Au+Au ultra-peripheral collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV by the STAR experiment. The pairs' invariant mass distributions (from $M_{p\bar{p}}$ = 2.1 to 2.4 $\mathrm{GeV/c^2}$), transverse momentum p_{T} spectra, and the azimuthal angular modulation caused by the polarized EM field will be presented. The measured results will be compared with theoretical calculations. These measurements will shed new light on the understanding of the QED vacuum.

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