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Probing the Nucleus with Linearly Polarized Photons

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Ultra-relativistic heavy ion collisions are expected to produce some of the strongest magnetic fields $(10^{13} - 10^{16} \text{ Tesla})$ in the Universe[1].

These intense electromagnetic fields have been proposed as a source of linearly-polarized, quasi-real photons[2] that can interact via the Breit-Wheeler process to produce e^+e^- pairs[3]. Demonstration that these photons are linearly polarized provides a precision tool for the study of open questions in Quantum Chromodynamics.

In this talk we present STAR measurements of e^+e^- pair production and diffractive photo-production of the ρ^0 -meson (and direct $\pi^+\pi^-$ pairs) in ultra-peripheral Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. The pairs produced in the $\gamma\gamma \rightarrow e^+e^-$ process display a striking 4th-order azimuthal modulation which is a direct result of vacuum birefringence[4,5].

Using the same technique we present measurements of azimuthal modulations in $\pi^+\pi^-$ pairs from diffractive photo-production of the ρ^0 and of direct $\pi^+\pi^-$ pairs.

The measured $\pi^+\pi^-$ pairs reveal a similar 4th-order azimuthal modulation. We will discuss the implications of these measurements for the study of gluon transverse momentum dependent (TMD) distributions within nuclei[6,7] at existing experiments and at a future Electron Ion Collider.

[1] V. Skokov, A. Illarionov, and V. Toneev. International Journal of Modern Physics A 24 (2009): 5925-32.

[2] C. Weizsäcker, Zeitschrift für Physik 88 (1934): 612-25.

[3] G. Breit and J. A. Wheeler. Physical Review 46 (1934): 1087

[4] L. Cong, J. Zhou, and Y. Zhou. (2019). arxiv:1903.10084v1

[5] Heisenberg, W., and H. Euler. Zeitschrift für Physik, (1936) arXiv: physics/0605038

[6] J. Collins, and D. Soper. Nuclear Physics B 194 3 (1982): 445-92.

[7] A. Metz, and J. Zhou. Physical Review D 84 5 (2011).

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