Measurements of the $\gamma\gamma \to e^+e^-$ process and its angular correlations in UPC and peripheral Au+Au collisions with the STAR Detector

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Ultra-relativistic heavy ion collisions are expected to produce some of the strongest magnetic fields ($10^{13} - 10^{16}$ Tesla) in the Universe[1]. Recently, there has been intense interest in the magnetic fields produced by heavy ion collisions and their possible observational impacts through phenomena like the Chiral Magnetic Effect. The initial strong electromagnetic fields produced in heavy ion collisions have been proposed as a source of linearly-polarized, quasi-real photons[2] that can interact to produce e^+e^- pairs.

In this talk we present STAR measurements of e^+e^- pair production in ultra-peripheral and peripheral Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. Multi-differential measurements of the pair kinematics are presented to distinguish the $\gamma\gamma \to e^+e^-$ process from other possible production mechanisms. These measurements provide an important experimental tool and baseline for the possible measurement of medium effects driven by strong final state magnetic fields or from Coulomb multiple scattering through the QGP.

Furthermore, we present the first observation of a 4th-order azimuthal modulation of e^+e^- pairs produced in heavy ion collisions. The observed 4th-order angular modulation, a result predicted for the collision of linearly-polarized photons[3], has general implications for fermion, anti-fermion pair production in the collision of polarized fields. Specifically, similar angular measurements of heavy quark pairs have been proposed for the study of gluon transverse momentum dependent (TMD) distributions within nuclei[4,5].

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