Results on Breit-Wheeler process and vacuum birefringence

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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. The initial strong electromagnetic fields have been proposed as a source of linearly-polarized, quasi-real photons that can interact via the Breit-Wheeler process to produce e^+e^- pairs.

In this talk, we will present latest STAR measurements of e^+e^- pair production in ultra-peripheral and peripheral Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. A comprehensive study of the pair kinematics is presented to distinguish the $\gamma\gamma \to e^+e^-$ process from other possible production mechanisms. Furthermore, we will present and discuss the observation of a 4th-order azimuthal modulation of e^+e^- pairs produced in the Breit-Wheeler process. The striking 4th-order angular modulation is a direct result of vacuum birefringence, a phenomenon predicted in 1936 that empty space can split light according to its polarization components when subjected to a strong magnetic field. Their implications for the properties of the magnetic filed produced in heavy-ion collisions will be discussed.