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# Collision species and beam energy dependences of photon-induced lepton pair production at STAR

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Ultra-strong electromagnetic field can generate a large flux of quasi-real photons arising from the Lorentz-contraction and the large electric charge (Z) of heavy nuclei colliding at ultra-relativistic speeds. These ultra-strong fields can be studied through dileptons ($e^+e^-$ and $\mu^+\mu^-$) and vector mesons ($J/\psi$) produced via photon-photon and photonuclear processes, respectively, in which the photon flux is proportional to $Z^2$. In particular, the photo-produced dileptons carry information about the strength and spatial distribution of the colliding fields. Therefore, they provide a novel tool to test the spatial and polarization dependent effects predicted by QED for vacuum birefringence and the Breit-Wheeler process.

In this talk, we present the first investigation of impact parameter and collision species dependences of dilepton and $J/\psi$ photo-production in isobaric collisions ($^{96}_{44}Ru$ + $^{96}_{44}Ru$, $^{96}_{40}Zr$ + $^{96}_{40}Zr$) at $\sqrt{s_{\rm NN}}$ = 200 GeV. The collision energy dependence of these photo-production processes is further studied in peripheral Au+Au collisions with measurements at $\sqrt{s_{\rm NN}}$ = 54.4 GeV and 200 GeV. We discuss the physics implications of these results and compare them to models.

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