Low-p_T $\mu^+\mu^-$ pair production in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV at STAR

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Abstract

~~Dileptons are produced in the whole evolution of the system and escape with minimum interaction with the strongly interacting medium. Thus, dilepton measurements play an essential role in the study of hot and dense nuclear matter.~~ Recently, significant enhancements of e^+e^- pair at very low transverse momentum (p_T) were observed by the STAR collaboration in peripheral Au+Au collisions. The excess can be explained by photon-photon interactions induced by the extremely strong electromagnetic field produced by the fast moving heavy ions. The photon interaction was usually studied in ultra-peripheral collisions without any nuclear overlaps. However, the photon interaction in peripheral collisions may provide a novel probe of QGP because the very-low-p_T dileptons are produced in the early stage of the collisions and there could be QGP produced in the nuclear overlapping region in peripheral collisions. In such collisions, the photon-photon interactions could be further used to probe the possible existence of strong magnetic fields trapped in a conducting QGP medium. Measurements with $\mu^+\mu^-$ pairs provide a complementary channel to investigate these phenomena.

In 2014 and 2016, the STAR experiment at RHIC recorded large samples of Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. In this talk, we will present invariant mass and yield distributions for $\mu^+\mu^-$ pair production at $p_T < 0.15$ GeV/c. The p_T^2 distribution of the excess yields ~~for these very-low-p_T $\mu^+\mu^-$ pairs~~ will also be shown. ~~Physics implications will be discussed together with model comparisons.~~