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Enhanced production of direct photons in Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV and implications for the initial temperature

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The production of e^+e^- pairs for $m_{e^+e^-} < 300$ MeV/c^2 and $1 < p_T < 5$ GeV/c is measured in $p+p$ and Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. Enhanced yield above hadronic sources is observed. Treating the excess as photon internal conversions, the invariant yield of direct photons is deduced. In central Au+Au collisions, the excess of direct photon yield over $p+p$ is exponential in transverse momentum, with inverse slope $T = 221 \pm 19(\text{stat}) \pm 19(\text{syst})$ MeV. Hydrodynamical models with initial temperatures ranging from $T_{init} \approx 300 - 600$ MeV at times of 0.6 - 0.15 fm/c after the collision are in qualitative agreement with the data. Lattice QCD predicts a phase transition to quark gluon plasma at ≈ 170 MeV.

[1]for PHENIX Collaboration