

Measurements of thermal dielectron production in isobar collisions at $\sqrt{s_{NN}} = 200$ GeV with STAR



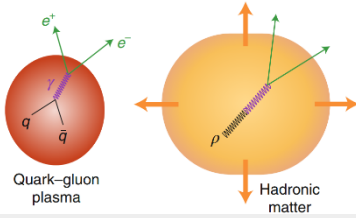
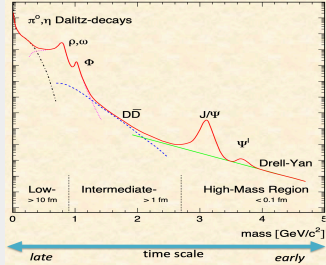
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Abstract

We present the measurements of the thermal dielectron production in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV with the STAR experiment. The average temperatures extracted from thermal dielectrons in the low-mass and intermediate-mass regions are presented as a function of baryon chemical potential and compared with those from other collision energies and systems. These measurements will shed new light on the understanding of the QGP evolution and the in-medium properties of the ρ meson.

Introduction

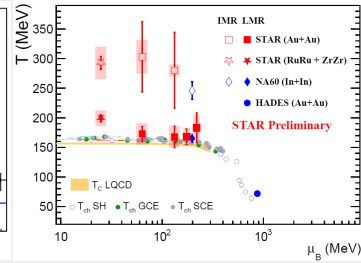
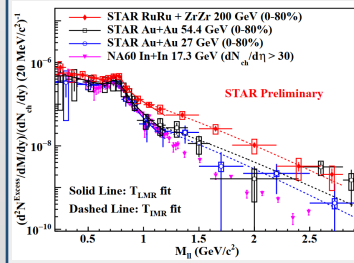


$$\text{QGP: } M^{3/2} * e^{-M/T}$$

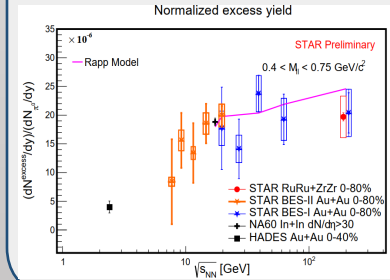
$$\text{In-med. } \rho: \text{Relativistic Breit-Wigner} * e^{-M/T}$$

- Temperature, as one of key properties of medium, is still poorly known
- T measurement **without distortion by blue-shift effects**
- **Thermometer:** extract temperature from mass spectra

Excess yield and Temperature measurement



- T_{LMR} in isobar collisions at 200 GeV **$\sim 3.0 \sigma$ higher** than T_{pc}
- $T_{\text{IMR}} \sim 4.7 \sigma$ higher than T_{pc} , indicating that the emission is predominantly from deconfined QGP phase
- Normalized excess yield at 200 GeV higher than at lower energies



- Normalized by π^0 yield to cancel the volume effect
- The Rapp model describe the data well
- Hint of an increasing trend from low to high $\sqrt{s_{NN}}$ (lower μ_B)

Inclusive dielectron signal

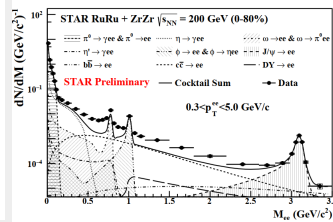
Inclusive signal

Interested signals:

- QGP radiation
- In-medium ρ decays

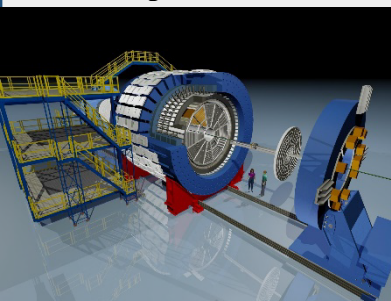
Physical background (Cocktails):

- $\omega, \phi, J/\psi \rightarrow e^+e^-$
- $\pi^0, \eta, \eta' \rightarrow \gamma e^+e^-$
- $\omega \rightarrow \pi^0 e^+e^-$
- $\phi \rightarrow \eta e^+e^-$
- $c\bar{c}, b\bar{b} \rightarrow e^+e^-X$
- Drell-Yan



- Physical background can be determined using the well-established cocktail simulation techniques
- Clear enhancement compared to cocktail contributions in both low mass region (LMR) and intermediate mass region (IMR)
- The **highest-precision** dielectron measurement at RHIC

STAR Experiment



- TOF: Time Of Flight, particle identification
- TPC: tracking, momentum and energy loss

Collision species

- $^{96}\text{Ru} + ^{96}\text{Ru}$ ($\sim 2\text{B}$ events)
- $^{96}\text{Zr} + ^{96}\text{Zr}$ ($\sim 2\text{B}$ events)

Summary

- ✓ Excess mass spectra in isobar collisions at $\sqrt{s_{NN}} = 200$ GeV
- ✓ Temperature measurement at 200 GeV without distortion by blue-shift effects
- ✓ T_{IMR} provides strong evidence of thermal radiation from early QGP

Outlook

- Temperature measurement in O+O collisions
- Polarization measurement of thermal dielectron

References

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- [3] H. van Hees, R. Rapp, *Phys. Rev. Lett.* **97**, 102301 (2006).
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The STAR
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