

J/ψ in Hot Nuclear Matter at PHENIX

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Introduction

- Matsui & Satz showed that in a medium of high enough temperature we can expect the J/ψ to be Debye-screened away. This led to J/ψ suppression being considered a “smoking gun” signature of the QGP.
- Today there are many competing effects that must be accounted for, including CNM effects as in the previous talk, and hot nuclear matter effects such as recombination and lack of feed-down from other suppressed charmonia.

Suppression and R_{AA}

- Take the yields from nuclear collisions and divide by p+p yields, scaled by the appropriate number of binary collisions (N_{coll}).

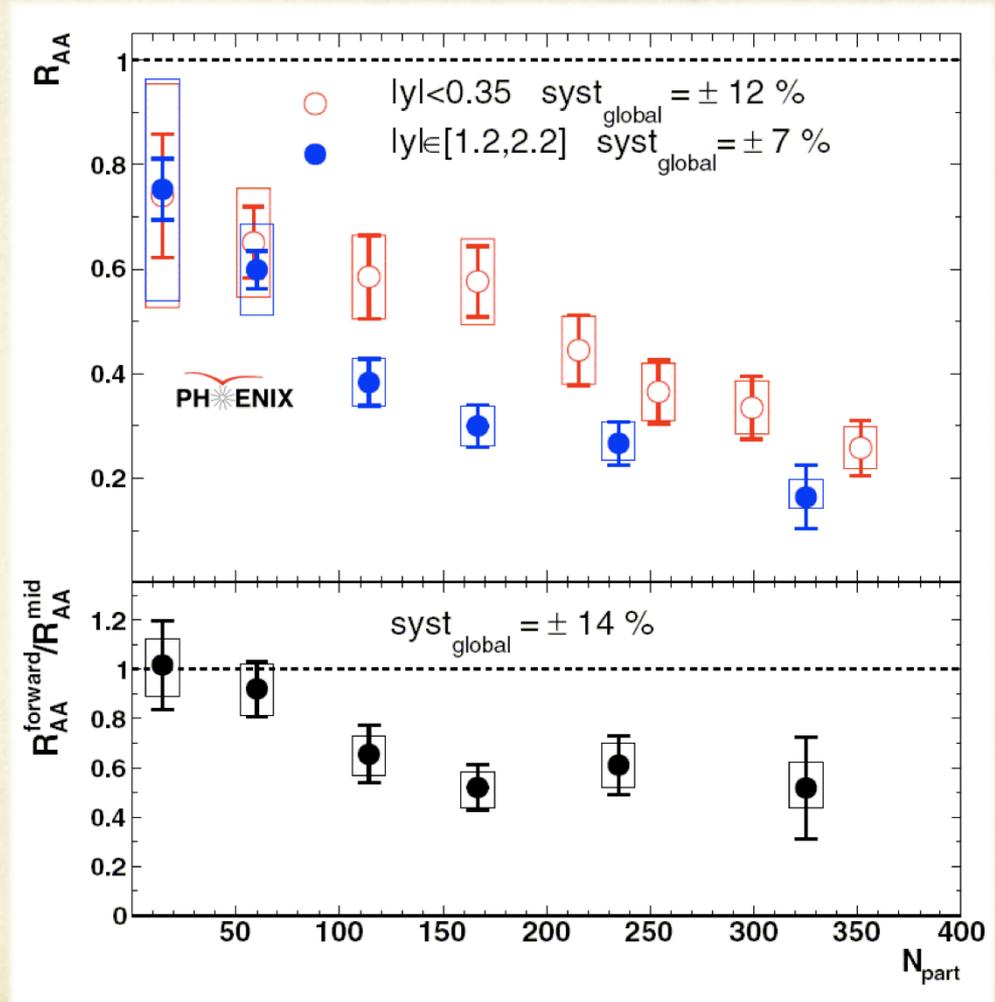
$$R_{AA} = \frac{1}{\langle N_{coll} \rangle} \frac{dN^{AuAu} / dy}{dN^{pp} / dy}$$

- Deviations from unity should first be compared to CNM effects. Any remaining suppression can be attributed to the deconfined medium (QGP).

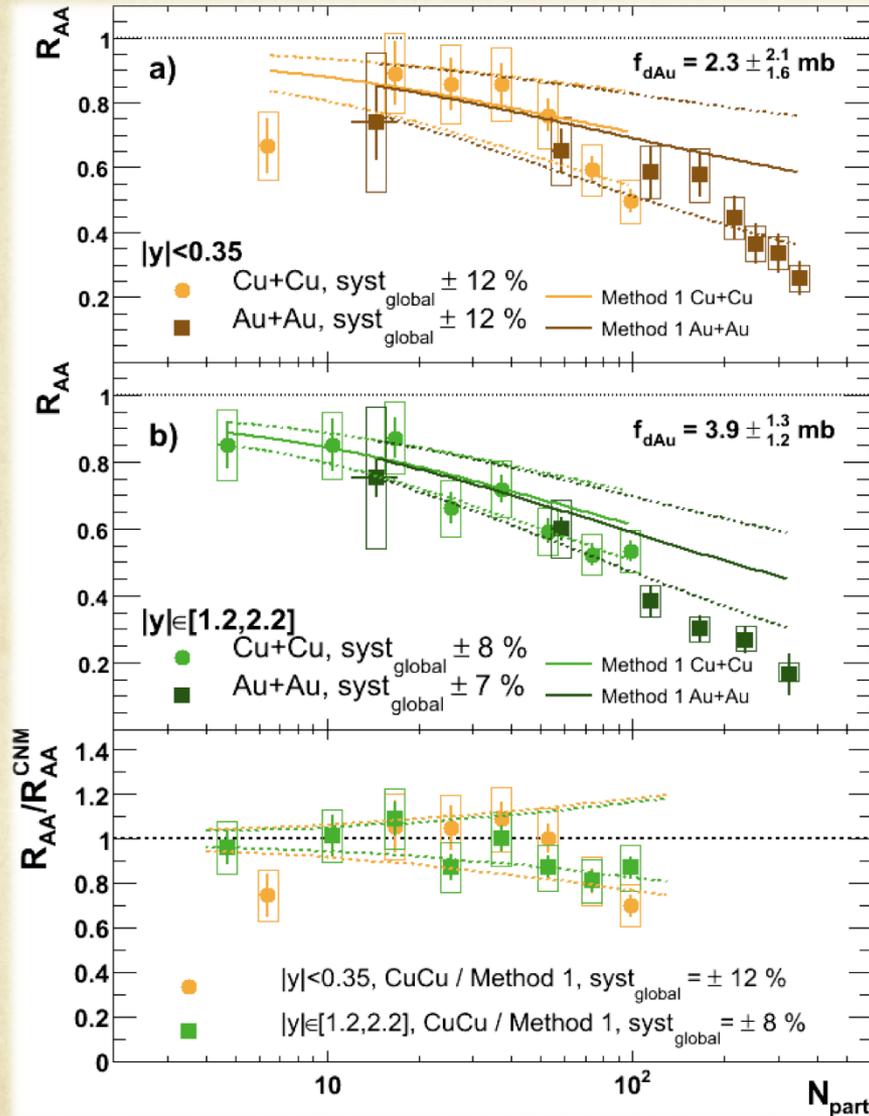
J/ψ Suppression vs. Centrality

Suppression in 200GeV Au+Au

- J/ψ production is suppressed in more central collisions.
- The suppression is larger at forward rapidities than mid-rapidity.
- Contrary to what we might expect due to local energy-density arguments.



Suppression in 200GeV Cu+Cu



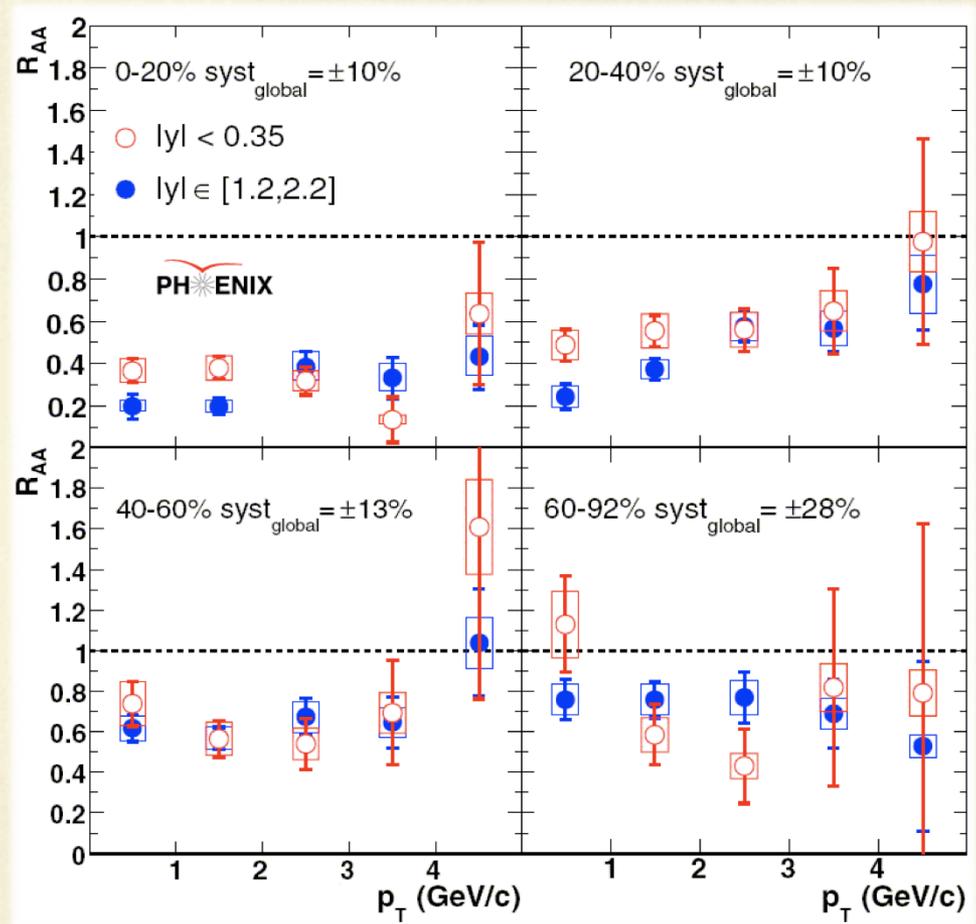
○ Run 5 Cu+Cu J/ψ results available at arXiv:0801.0220 and is Phys. Rev. Lett. 101, 122301 (2008).

○ Cu+Cu R_{AA} is in line with CNM projections from d+Au (central lines in panels a & b).

J/ ψ Suppression vs. p_T

R_{AA} vs. p_T in Au+Au

- No sign of extra suppression at high- p_T here.
- Error bars at higher p_T s make it hard to determine whether trend is flat or increasing.



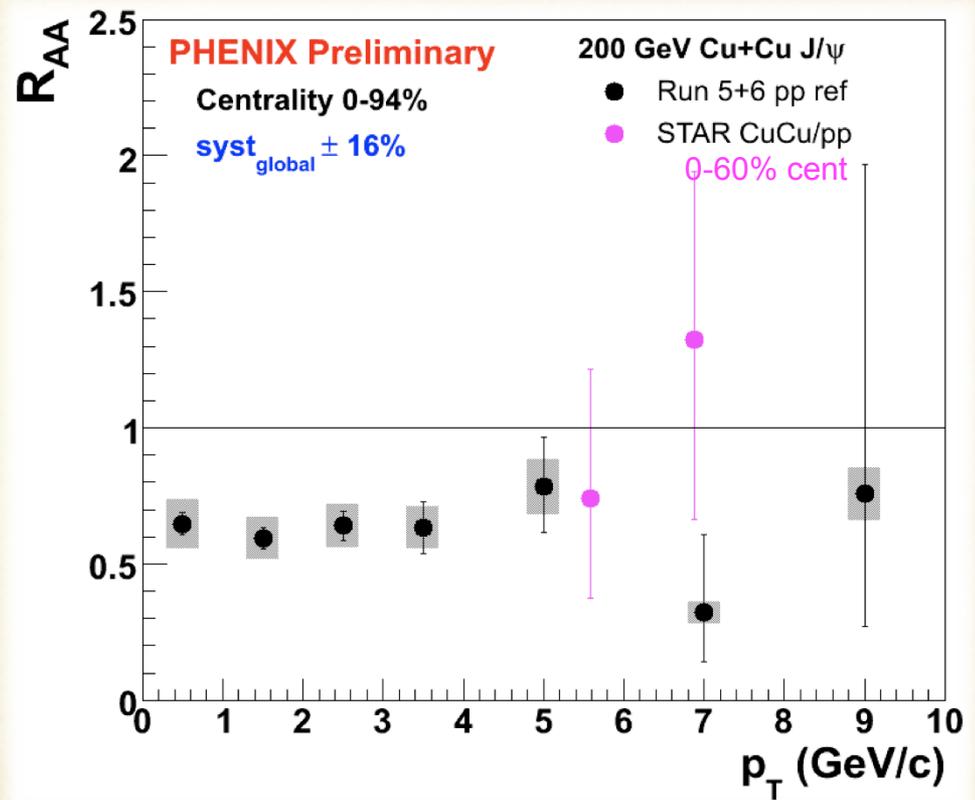
nucl-ex/0611020
Phys. Rev. Lett. 98 (2007) 232301

R_{AA} vs. p_T in Cu+Cu

- Brand-spanking-new PHENIX points at $p_T > 4$ GeV/c for $J/\psi \rightarrow e^+e^-$.

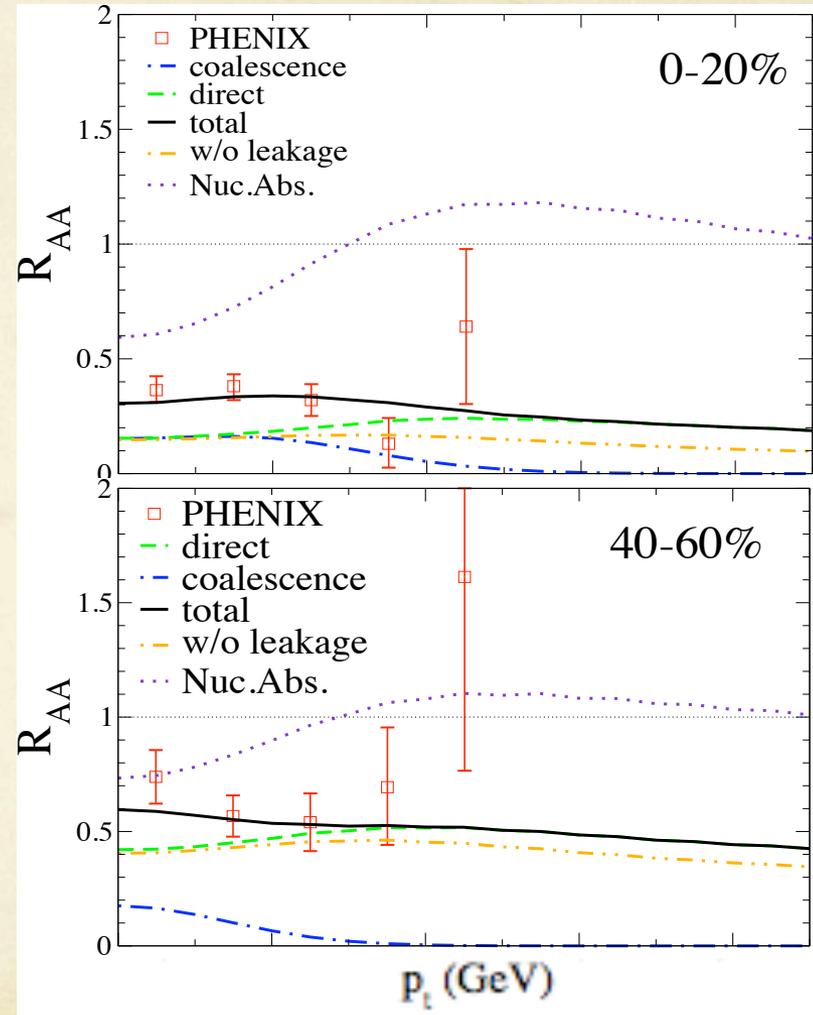
- Would expect PHENIX points to be higher due to different centralities, but are in fact lower.

- Consistent with an R_{AA} that is flat in p_T .



Two-Component Model

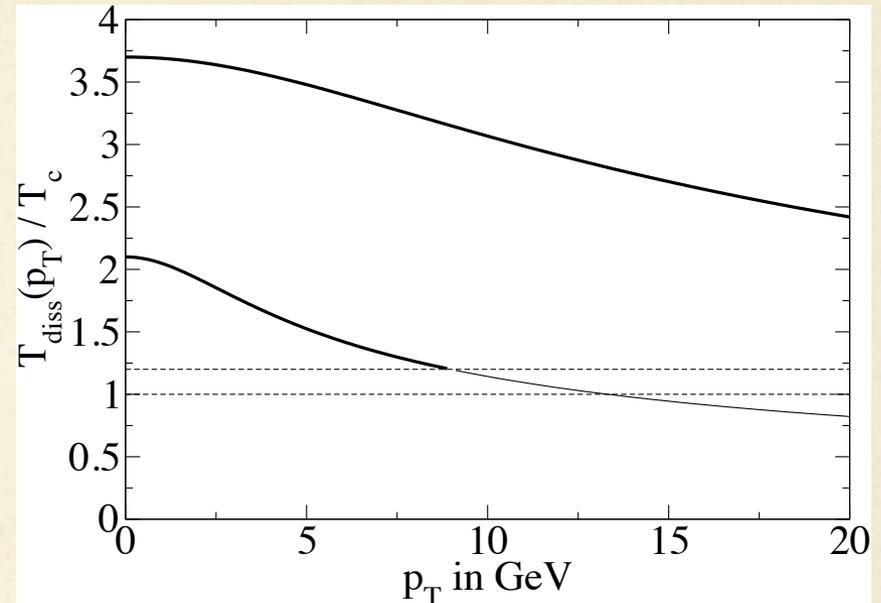
- Includes direct ($NN \rightarrow J/\psi$) and coalescence contributions.
- Coalescence mainly at low- p_T and central collisions.
- Leads to R_{AA} that is flat or gradually decreases at high- p_T .
- Not ruled out by PHENIX data.



X. Zhao & R. Rapp, 0712.2407v3

Hot Wind Model

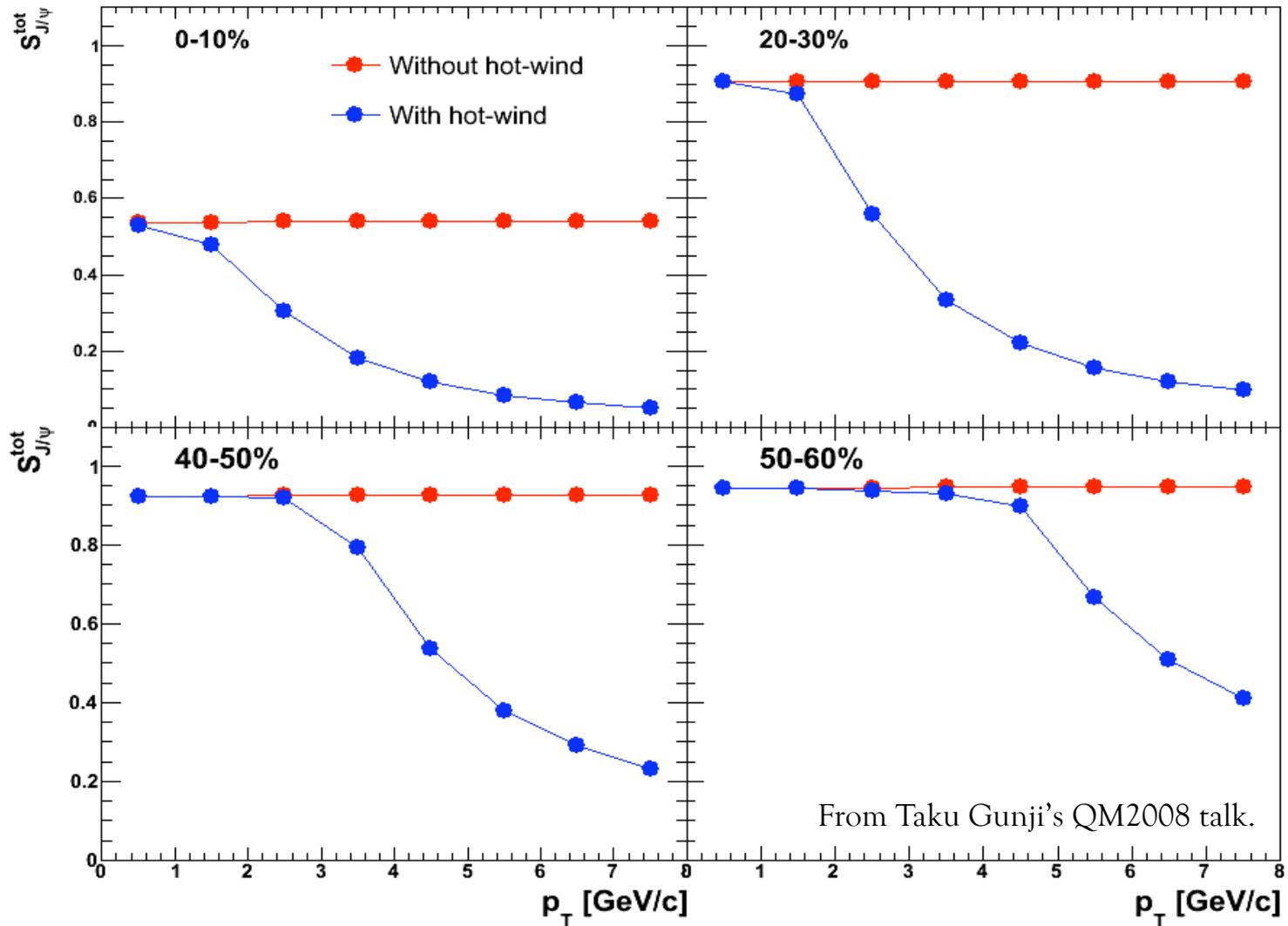
- Uses AdS/CFT correspondence to model velocity-dependence of the screening length for heavy quarkonia.
- Predicts a decrease of the J/ψ dissociation temperature at increasing p_T .



Liu, Rajagopal, Wiedemann, hep-ph/0607062v3

- Experimentally, this would lead to an increasing cutoff in p_T where the J/ψ suppression quickly turns on as we go from central to peripheral collisions.

Hot Wind Model



From Taku Gunji's QM2008 talk.

Summary

- PHENIX has measured J/ψ R_{AA} as functions of N_{part} and p_T in 200 GeV Au+Au and Cu+Cu collisions.
 - Suppression in central collisions.
- R_{AA} vs. p_T now extends to 10 GeV/c in Cu+Cu.
 - Large suppression seen at low- p_T extends through 7 GeV/c.
- R_{AA} is consistent with a flat function of p_T in Cu+Cu collisions, and a flat or rising function in Au+Au.
 - Is not consistent with sharp increase in suppression at some p_T , as in the “hot wind” model.
 - Two-component model not ruled out, but really must be compared at higher p_T .