Title: Concluding Remarks

Date: May 25, 2007 05:40 PM

URL: http://pirsa.org/07050082

Abstract:

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# Exotic States of Hot & Dense Matter and their Dual Description Wrap-up

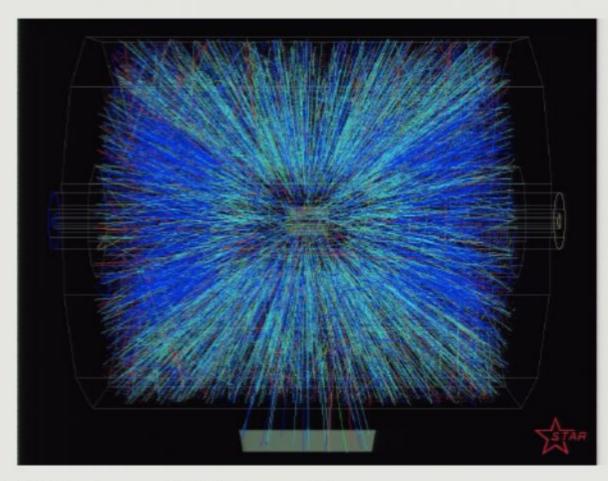
Laurence Yaffe

University of Washington



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# Heavy ion collisions



QGP @ RHIC ≠ weakls interacting gas

Important discovery.

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Video games are good for science.

Z. Fodor

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Extracting spectral functions tough, not hopeless. G. Aarts

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Extracting spectral functions tough, not hopeless.

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Large  $N_{\rm c}$  works!  $3 \approx \infty$ .

M. Teper

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# AdS/CFT for QCD

Bad name. Much Better: gauge/string duality.

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# AdS/CFT for QCD

Wonderful progress.

P. Argyres, J. Erdmenger, N. Evans, S. Gubser,
C. Herzog, R. Janik, K. Kajantie, Y. Kovchegov,
H. Liu, D. Mateos, R. Myers, L. Pando Zayas,
K. Rajagopal, D. Son, M. Stepahov, D. Teaney

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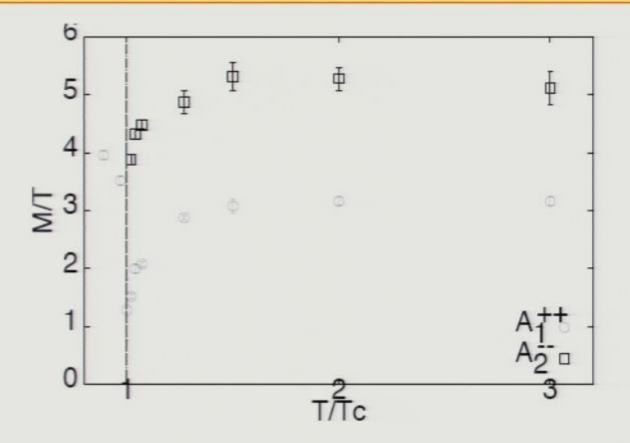
## AdS/CFT for QCD

#### Much more to do:

```
light quark dynamics, \hat{q} controversy \langle T^{\mu\nu}(x) \rangle_{\rm interesting\ non-eq.\ states} important! 1/\lambda corrections, 1/N_{\rm c} corrections, results for more QCD-like theories (with known gravity duals), ... L. Pando Zayas A. Buchel, ...
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# AdS/CFT: Relavance to real QGP?



S. Datta & S. Gupta

#### Screening masses:

m/T temperature independent for  $1.5 \le T/T_{\rm e} \le 4$ .

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## AdS/CFT: Relavance to real QGP?

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6 Comparing N = 4 to the QGP

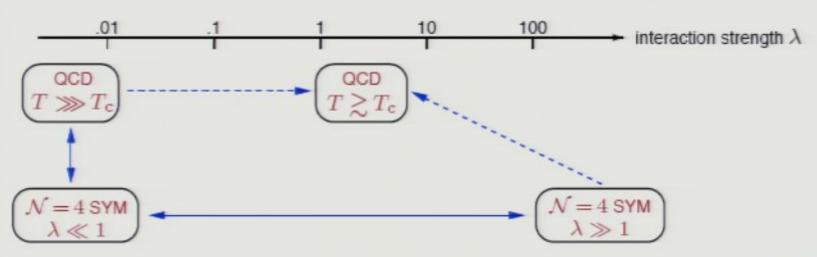
quantity	formula	obvious	alternative	QGP	comments
s/s <sub>free</sub> [21, 22]	$\frac{3}{4} + \frac{45\zeta(3)}{32\lambda^{3/2}}$	0.77	0.88	0.6 - 0.9	lattice e. g. [23] HTL [24, 25]
$\frac{\eta/s}{[26, 27]}$	$\frac{1}{4\pi} + \frac{135\zeta(3)}{32\pi\lambda^{3/2}}$	0.10	0.2	0 - 0.3	
τ <sub>therm</sub> [13]	$\frac{1}{2.2T_{\mathrm{peak}}}$	0.3 fm	0.4 fm	0.6 - 1.0  fm	Also [28, 29] T <sub>peak</sub> =300 MeV
t <sub>charm</sub> [1, 3, 2]	$\frac{2m_c}{\pi T^2 \sqrt{\lambda}}$	0.65 fm	2.1 fm	3 - 6 fm	[30, 31, 32] hadronization b-tagging
$\hat{q}$ [33] $\hat{q}_T$ [4, 5]	$\frac{\pi^{3/2}\Gamma(3/4)\sqrt{\lambda}T^3}{\Gamma(5/4)}$ $2\pi\sqrt{\lambda\gamma}T^3$	$\begin{array}{c} 2.6 \frac{\mathrm{GeV^2}}{\mathrm{fm}} \\ 5.8 \frac{\mathrm{GeV^2}}{\mathrm{fm}} \end{array}$	$0.61 \frac{\rm GeV^2}{\rm fm} = 1.4 \frac{\rm GeV^2}{\rm fm}$	$1-15\frac{\rm GeV^2}{\rm fm}$	$\hat{q}_T$ for charm @ $E=10~{ m GeV}$
m <sub>D</sub> [18]	$(10.6 - \frac{6.7}{\lambda^{3/2}}) T$	3.6 GeV	2.6 GeV	$\sim 1.9\mathrm{GeV}$	lattice [34] T=340 MeV 6.7 conjectural

Table 1: A few comparisons between N=4 SYM and the QGP. QGP numbers are representative ranges.  $T=250\,\mathrm{MeV}$  unless otherwise noted.  $T_c=170\,\mathrm{MeV}$ ,  $m_c=1.4\,\mathrm{GeV}$  assumed.

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# Goal: "Extrapolate to Reality"

D. Teaney



G. Moore

E. Shuryak

A. Rebhan

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## Other directions

#### Cold and dense matter

No end of subtleties, need data!

V. Miranskyy

I. Shovkovy

T. Schaefer

T. Kunihiro

E. Ferrer

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Cosmological applications

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A. Zhitnitsky

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A. Zhitnitsky

Quantum critical transport

P. Kovtun

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# Thanks...

to the organizers and the PI!

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