

RIKEN BNL Research Center:
Some recollections and new directions

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Stony Brook University



My Timeline:

Professional Experience:

Full-Time Teaching or Research Institution	Academic Rank and Field	From:	To:
Stony Brook University	Professor and Graduate Program Director	Jan. 2025	Present
Stony Brook University	Professor in Physics	Jan. 2021	Jan. 2025
Stony Brook University	Associate Professor in Physics	Sept. 2013	Jan. 2021
Stony Brook University	Assistant Professor in Physics	Sept. 2007	Sept. 2013
<u>RIKEN BNL Research Center</u>	<u>RIKEN Fellow</u>	<u>Sept. 2007</u>	<u>Sept. 2013</u>
Arkansas State University	Assistant Professor in Physics	Sept. 2006	Aug. 2007
Stony Brook University	Postdoctoral Associate in Physics	Sept. 2004	Aug. 2006
Brookhaven National Lab	Postdoctoral Associate in Physics	Sept. 2001	Aug. 2004

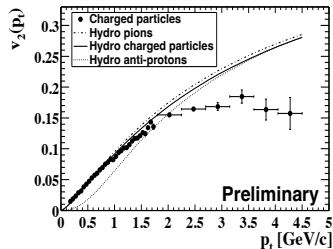
Working at and about RIKEN-BNL Research Center was incredible!

Let's find out why!

Interactions between Theory and Experiment

Amazing Results From RHIC!

“talk2.ps”



- $v_2(p_T)$ **increases** until $p_T \approx 2.0$ GeV and then **flattens** at $v_2 \approx 0.15$
 - v_2 is **Large** even at $p_T \approx 4.0$ GeV.
- There is a 1.8 to 1 asymmetry between x and y.

Where does Hydrodynamics Breakdown?

Ideal hydro was “working”, but experimentalists were pushing into new domains

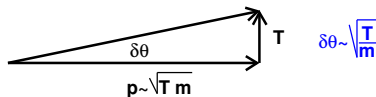
- What is flow?
- What about large momenta?
- Heavy quarks?
- Small systems and viscosity?

Interactions between Theory and Experiment

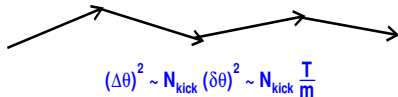
Will the charm quark thermalize?

“talk7.ps”

- In collaboration with Guy Moore



- The collision only scarcely changes the direction of the charm quark
- The charm quark undergoes a random walk suffering many collisions provided $\ell_{m.f.p} \ll L$



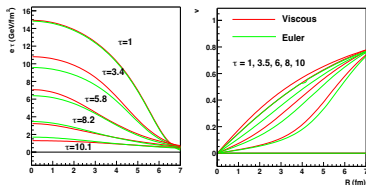
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Interactions between Theory and Experiment

Bjorken Solution with transverse Expansion: “talk6.ps”

Initial conditions from Kolb's Hydro: $p = \frac{1}{3}e$ and $\eta/s = 0.2$



- First the viscous case does less longitudinal work.
- But, the viscous transverse velocity grows more rapidly because the transverse pressure is larger
- The larger transverse velocity then reduces the viscous energy density more quickly than Euler hydro.

Viscous corrections do NOT integrate to give an $O(1)$ change to the flow.

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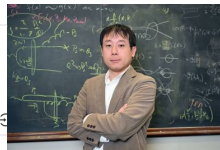
Broad and “unfocused” theory community

1. The theory community was very broad and had open minded hiring:

Universality, the QCD critical / tricritical point and the quark number susceptibility

Yoshitaka Hatta (Kyoto U. and Wako, RIKEN), Takashi Ikeda (RIKEN BNL) (Oct, 2002)

Published in: *Phys.Rev.D* 67 (2003) 014028 • e-Print: [hep-ph/0210284](https://arxiv.org/abs/hep-ph/0210284) [hep-ph]



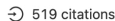
2. Trying new things, which later proved inter-related

Induced gluon radiation in a QCD medium

#11

R. Baier (Bielefeld U.), Yuri L. Dokshitzer (Lund U. and Orsay, LPT), S. Peigne (Orsay, LPT), D. Schiff (Orsay, LPT) (Nov, 1994)

Published in: *Phys.Lett.B* 345 (1995) 277-286 • e-Print: [hep-ph/9411409](https://arxiv.org/abs/hep-ph/9411409) [hep-ph]

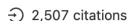


Computing quark and gluon distribution functions for very large nuclei

#13

Larry D. McLerran (Minnesota U.), Raju Venugopalan (Minnesota U.) (Aug, 1993)

Published in: *Phys.Rev.D* 49 (1994) 2233-2241 • e-Print: [hep-ph/9309289](https://arxiv.org/abs/hep-ph/9309289) [hep-ph]



3. Broad theorists drawn into the field, e.g. S. Gubser from Princeton

Sincere thanks to RBRC!