

Opening statement

Panel discussion of RHIC future
strategy

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6 key Questions from Steve Vigdor

- 1) What is the optimal trajectory for RHIC? What are critical decisions and branch points?*
- 2) Since LHC HI results seem very similar to RHIC's, are both facilities needed?*
- 3) Will 2-3 year cessation of RHIC operations be essential to fund eRHIC? If so, what is optimal timing?*
- 4) Is it crucial to maintain AA & pp capability into eRHIC era? If so, can we reconfigure IR's annually, or do we separate HI from eA in different IR's?*
- 5) What eRHIC science is realizable within a reasonable total project cost limit?*
- 6) How do STAR and PHENIX Collaborations evolve smoothly from RHIC to eRHIC?*

In the opening statement, we (panelists) are asked to give input to the question 1, and other questions.

My Key question

- QGP is discovered at RHIC and LHC confirmed it. Why do we want to continue heavy ion physics at RHIC and LHC?

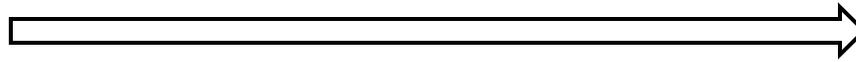
My answer:

- QGP is a fundamental object. We should determine the properties of QGP
 - This is the only known different “phase” of QCD vacuum
 - QGP properties are fundamental properties of QCD field
 - We have only started to measure the values of η/s , q_{hat} with relatively large errors. Others, e.g. screening length, are not quantified yet.
 - Many puzzles remain (e.g. rapid thermalization, energy loss mechanism, etc)

Measuring the Properties of the QGP

4

Conditions



Properties

$\mu \sim 0$

$T_i = 300-600 \text{ MeV}$

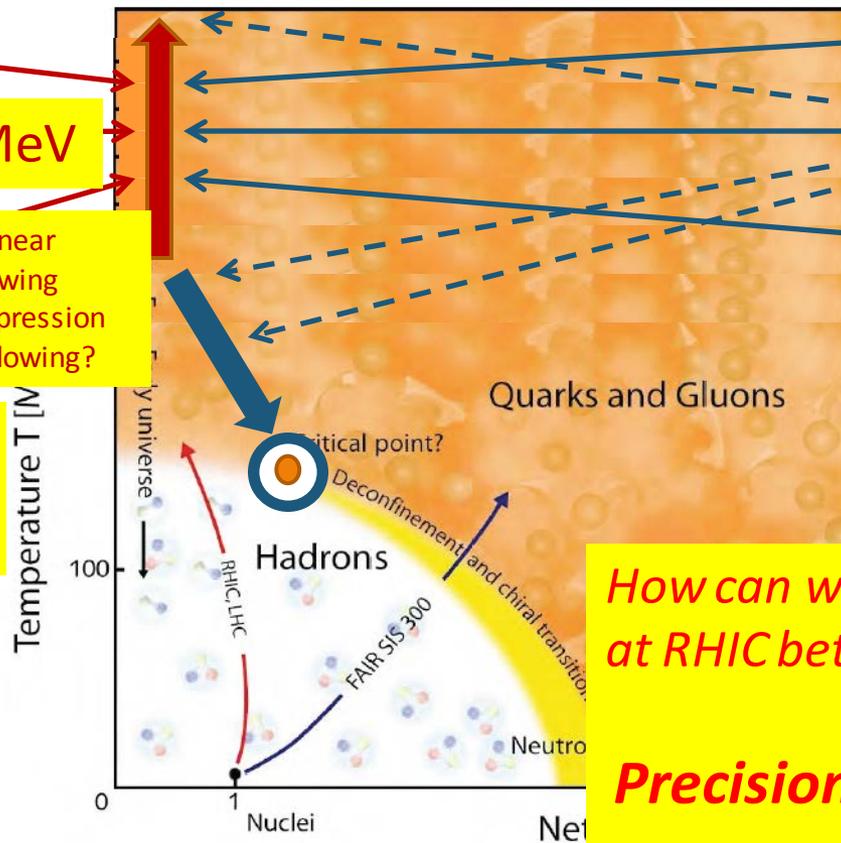
CNM effects
non-linear shadowing
low-x suppression
anti-shadowing?

Initial State
 \rightarrow Glauber

Screening length

$\eta/s \rightarrow 1/4\pi$

$\Delta E \rightarrow \beta$

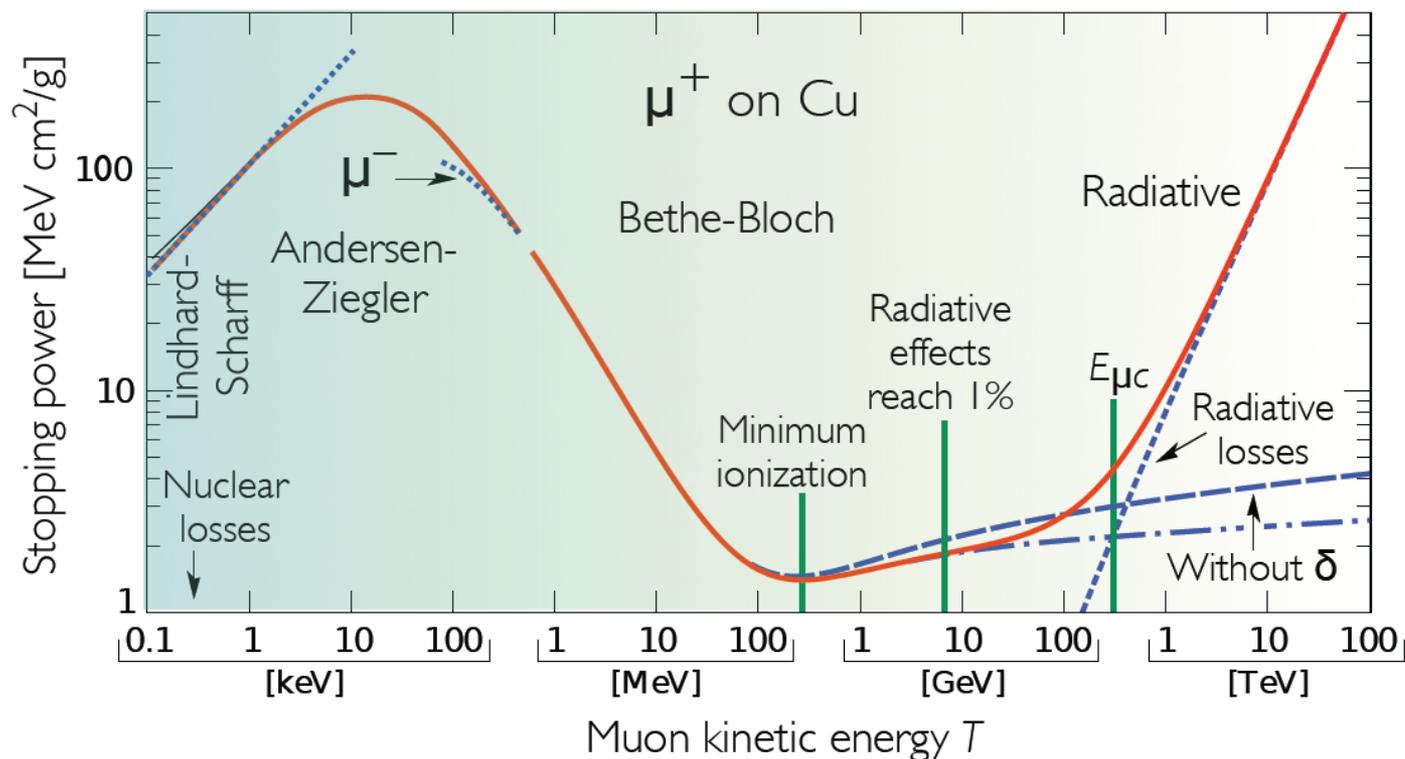


How can we measure QGP properties at RHIC better in the next decade?

Precision Measurement of QGP properties

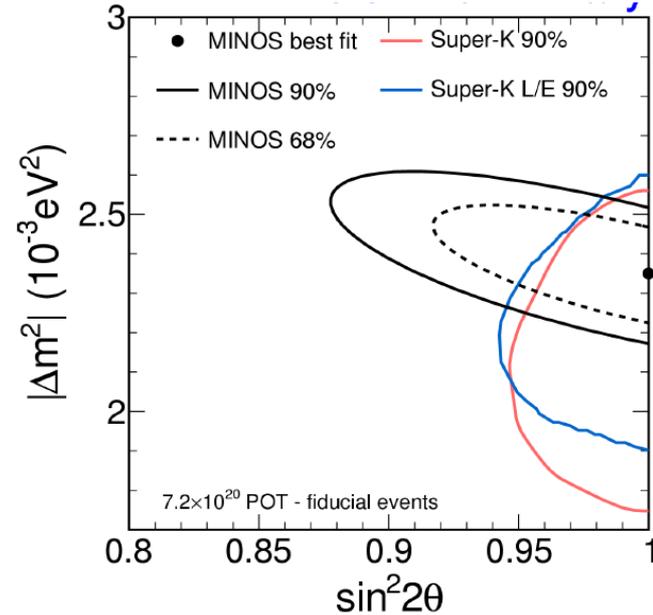
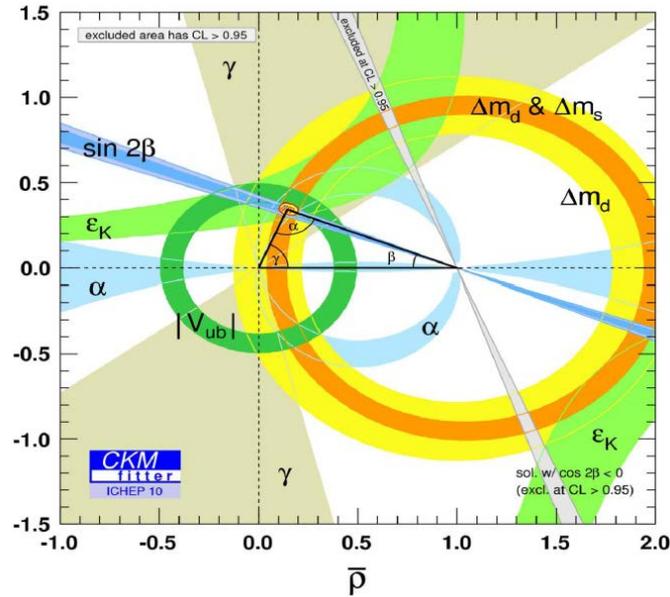
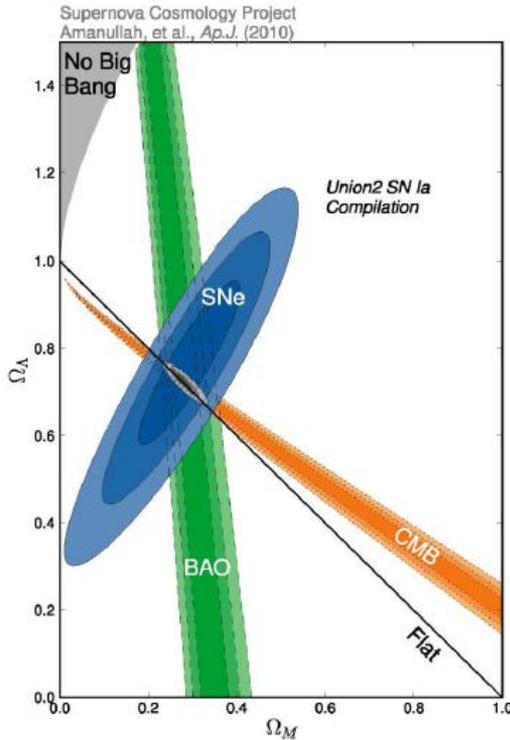
Stefan Bathe for

Study of parton-medium interaction



- In QED, a rich structure of energy loss is well understood and quantitatively calculated.
- *Energy loss in QCD matter can have richer structure. We are just starting to understand the energy loss in QCD medium.*
 $\Delta E \sim L, L^2, \text{ or } L^3?$
How does ΔE scale with the energy density of the matter?

How other fields show the progress



- The progress is measured by the precision of a few fundamental parameters
- New experiments and facilities are evaluated based on how they can contribute to those key measurements
- In my opinion, QGP properties are no less fundamental than those above. RHIC's future should be evaluated based on how well it can determine the properties of QGP

Since LHC HI results seem very similar to RHIC's, are both facilities needed?

- Yes, absolutely.
- RHIC and LHC can study QGP at different condition ($\epsilon(\text{LHC}) \sim 3\epsilon(\text{RHIC})$). We can understand QGP properties better by comparing the data from RHIC and LHC
- Competition of two facility is good
- In the competition, we at RHIC should think how we can measure QGP properties better than LHC
 - RHIC have more flexibility, more beam time, and higher luminosity
 - Phase transition happens within the beam energy range of RHIC
 - Some measurement, like soft EM radiation, can be easier to measure at RHIC

Is it crucial to maintain AA & pp capability into eRHIC era?

- I think it is very important to maintain AA & pp capabilities
- This will make RHIC/eRHIC as a complete facility to study QCD, unique QCD lab in the world
 - AA, pp, eA, ep are complementary. We are studying different aspects of the same QCD
 - The new knowledge from eA and ep from can feedback to AA, pA, and pp
 - It is quite possible that study of QGP will not over by the time of eRHIC

What is the optimal trajectory for RHIC?

- Now to ~2016

Physics with current detector and RHIC upgrades

In case of PHENIX: Heavy quark physics with VTX/FVTX, W physics with PHENIX muon trigger

- From ~2016

Realization of next upgrade, e.g. sPHENIX

If this becomes too late, it is very hard to keep interest in the field

The upgrade should bring in substantial new capabilities for better determination of QGP properties

- ~2020 transition to eRHIC/RHIC era

What are critical decisions and branch points?

- Decide on if BNL and RHIC community want to make *large* investment in the future of RHIC based on physics.
 - How large the next detector upgrades are?
 - How many people are willing to work?
- Decide on what are the most important physics questions to be addressed in 2015+ at RHIC
 - We cannot do every thing within realistic boundary condition
 - For some questions, we don't know how to solve the question.
- Decide on what are the most important physics questions at the first stage of eRHIC