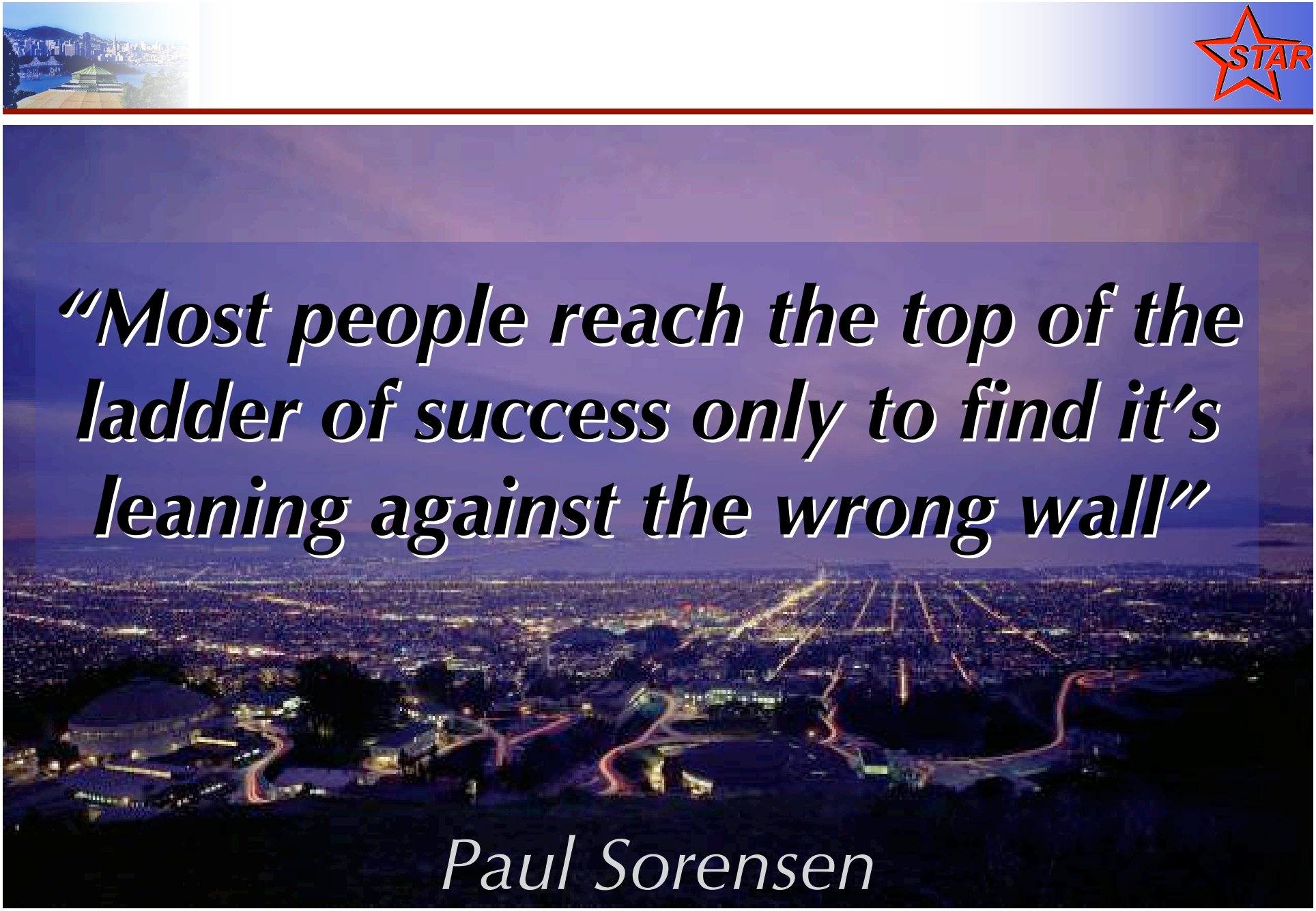
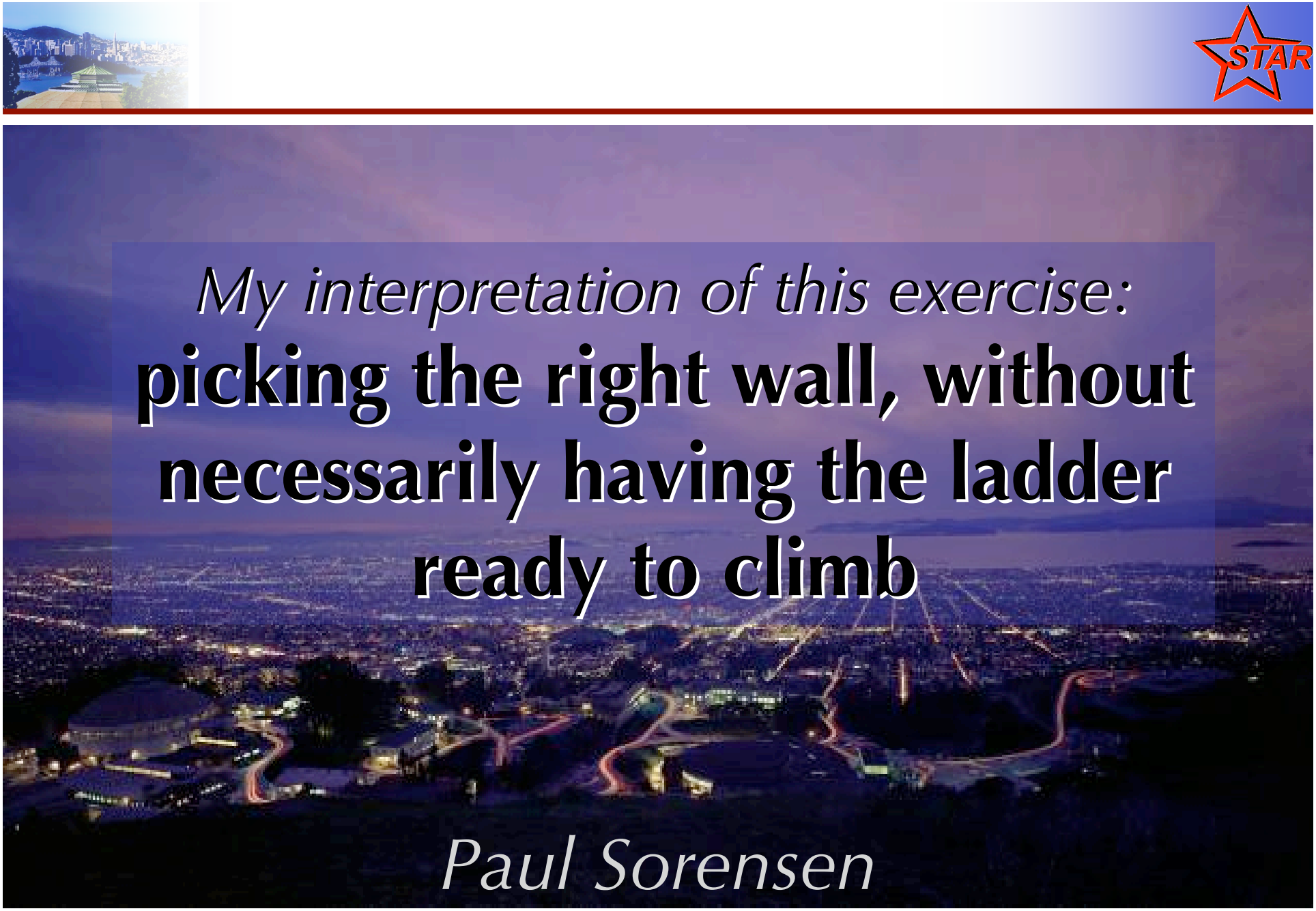
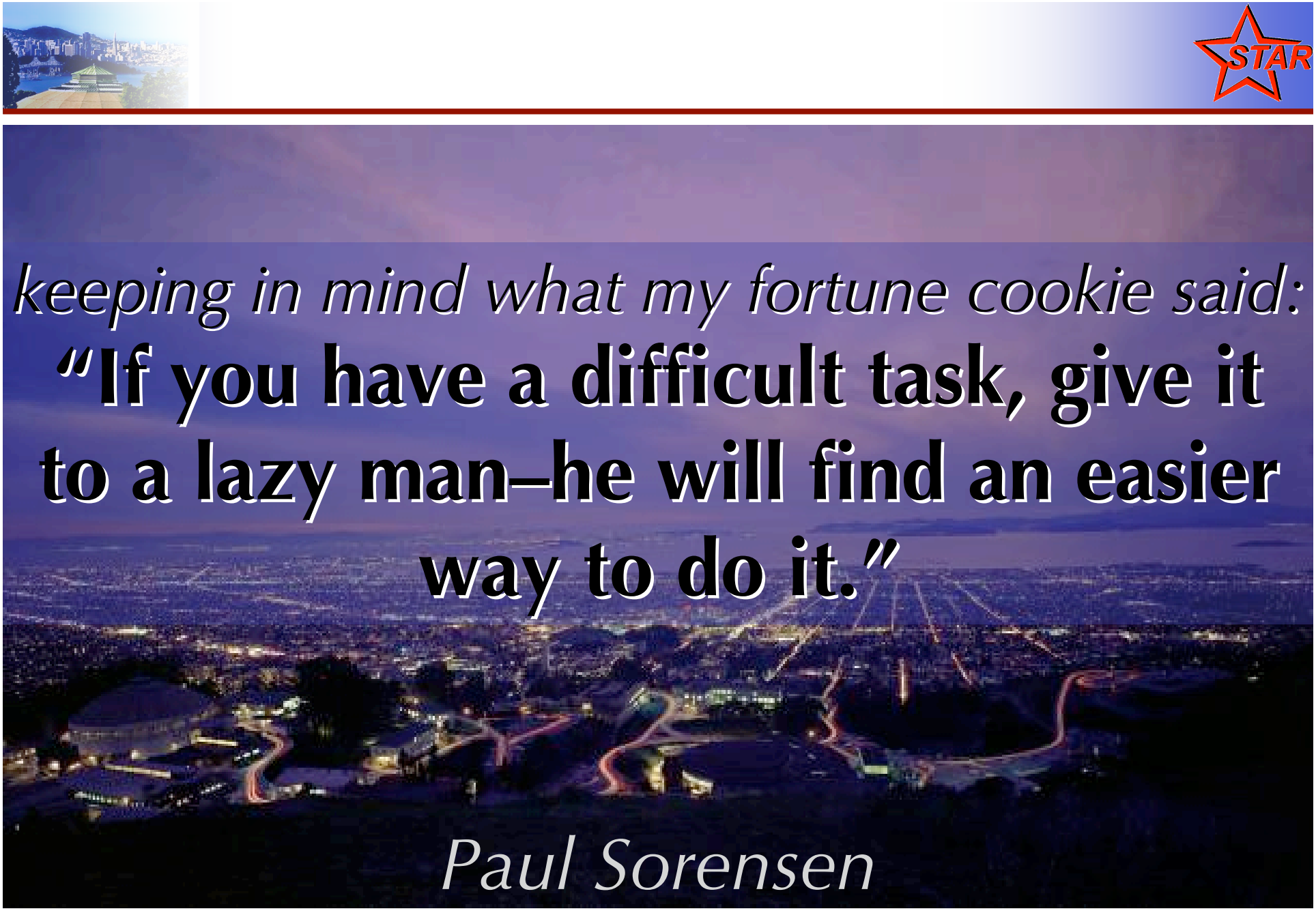
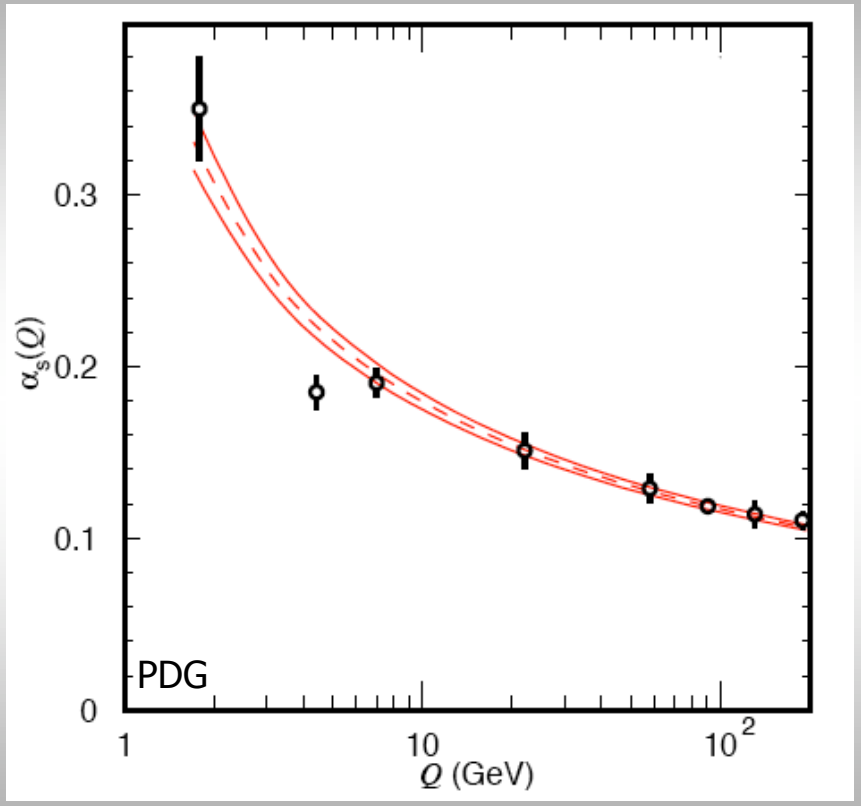

"Most people reach the top of the ladder of success only to find it's leaning against the wrong wall"
Paul Sorensen


My interpretation of this exercise:
picking the right wall, without necessarily having the ladder ready to climb
Paul Sorensen


keeping in mind what my fortune cookie said:
"If you have a difficult task, give it to a lazy man–he will find an easier way to do it."
Paul Sorensen

Heavy Ion Goals

1) Create a system of quasi-free quarks and gluons.
2) Study the deconfined-to-confined transition:
   - hadronization of the matter.
   - development of mass.
3) Determine properties of the matter:
   - modification of α_s.



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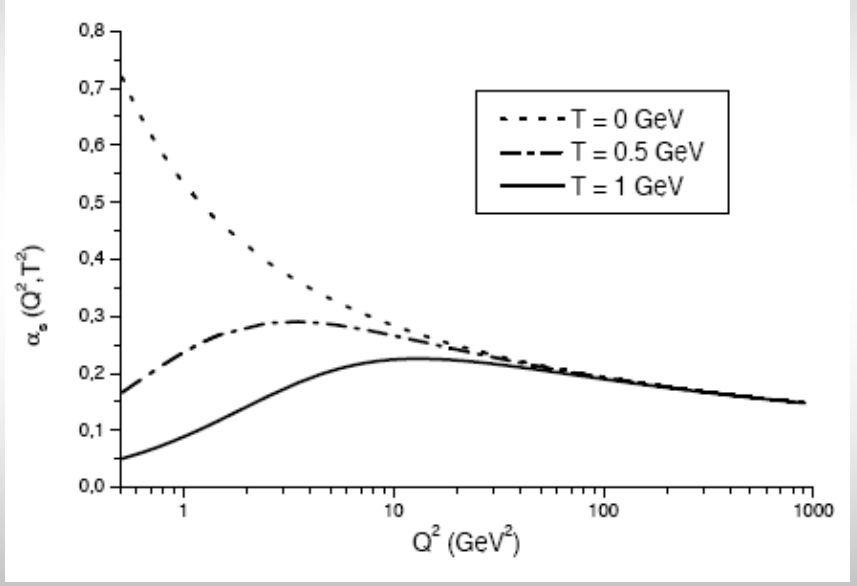

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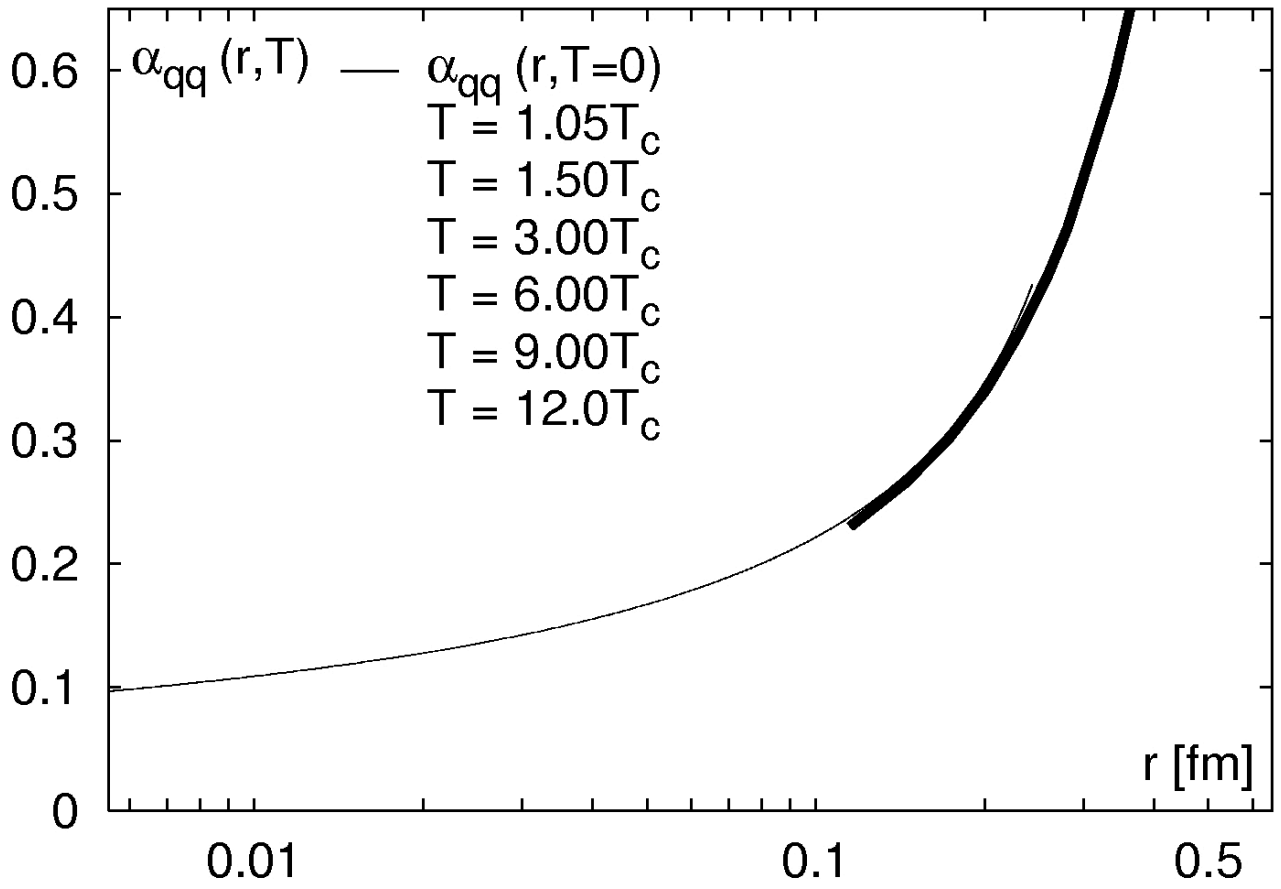
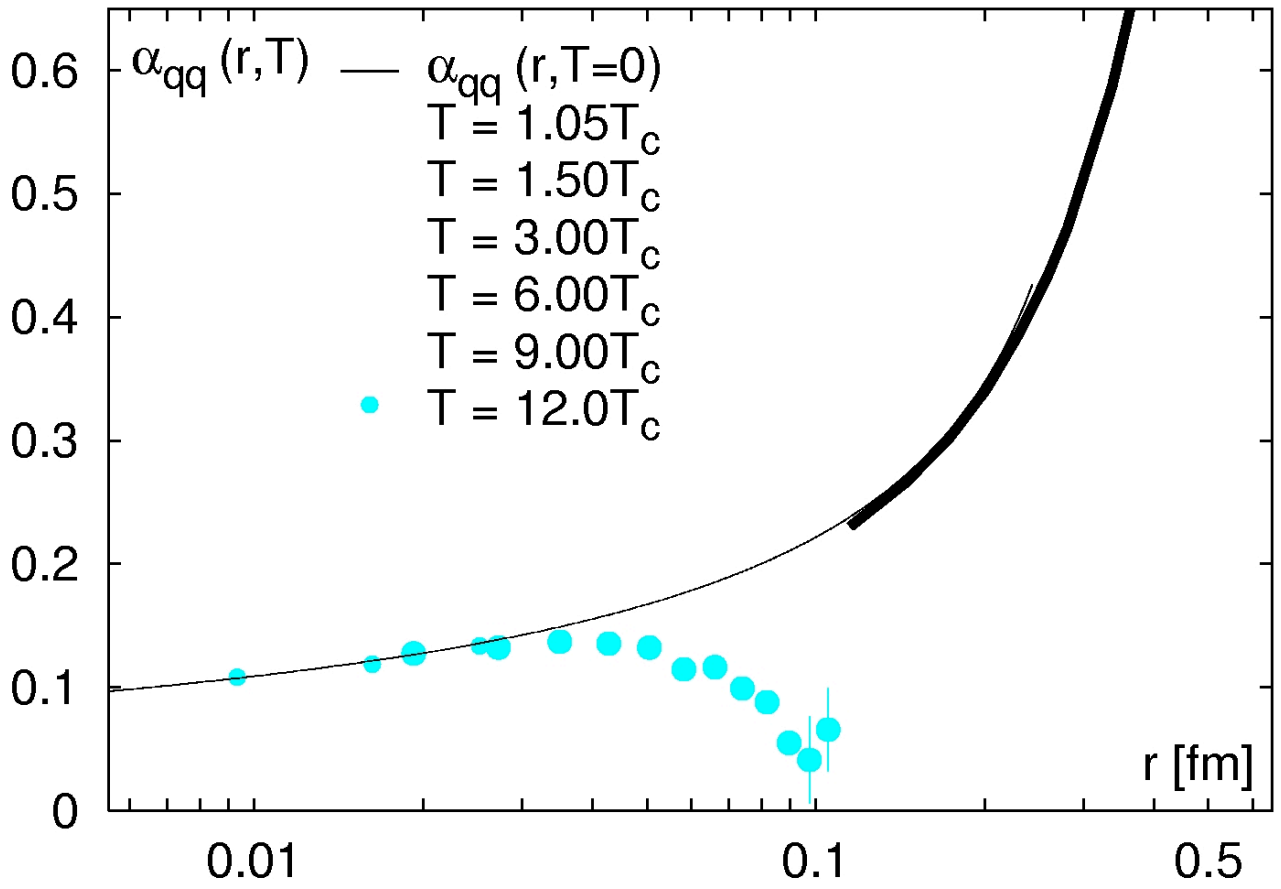


For illustration:
heavy quark-antiquark coupling
at finite T from lattice QCD
O.Kaczmarek, hep-lat/0312015



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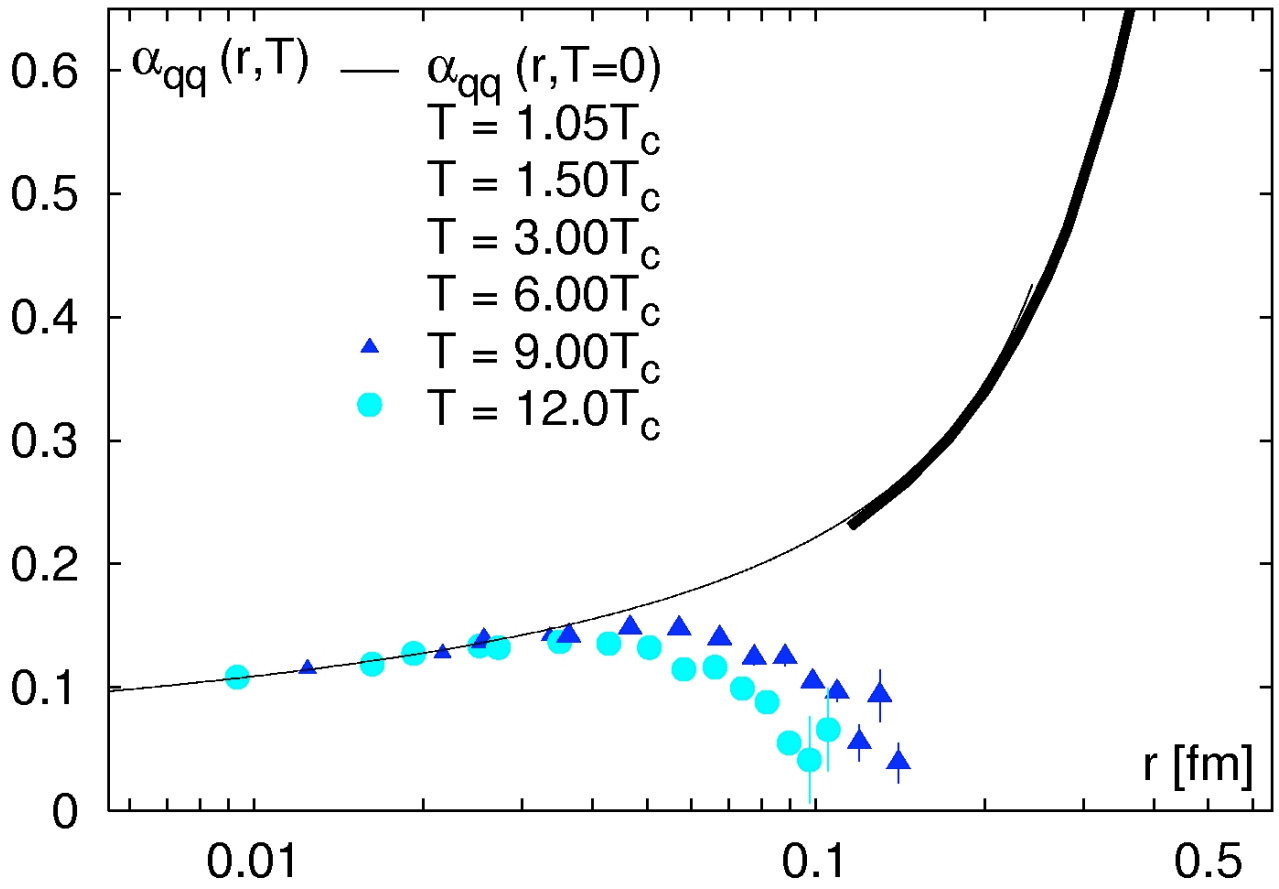

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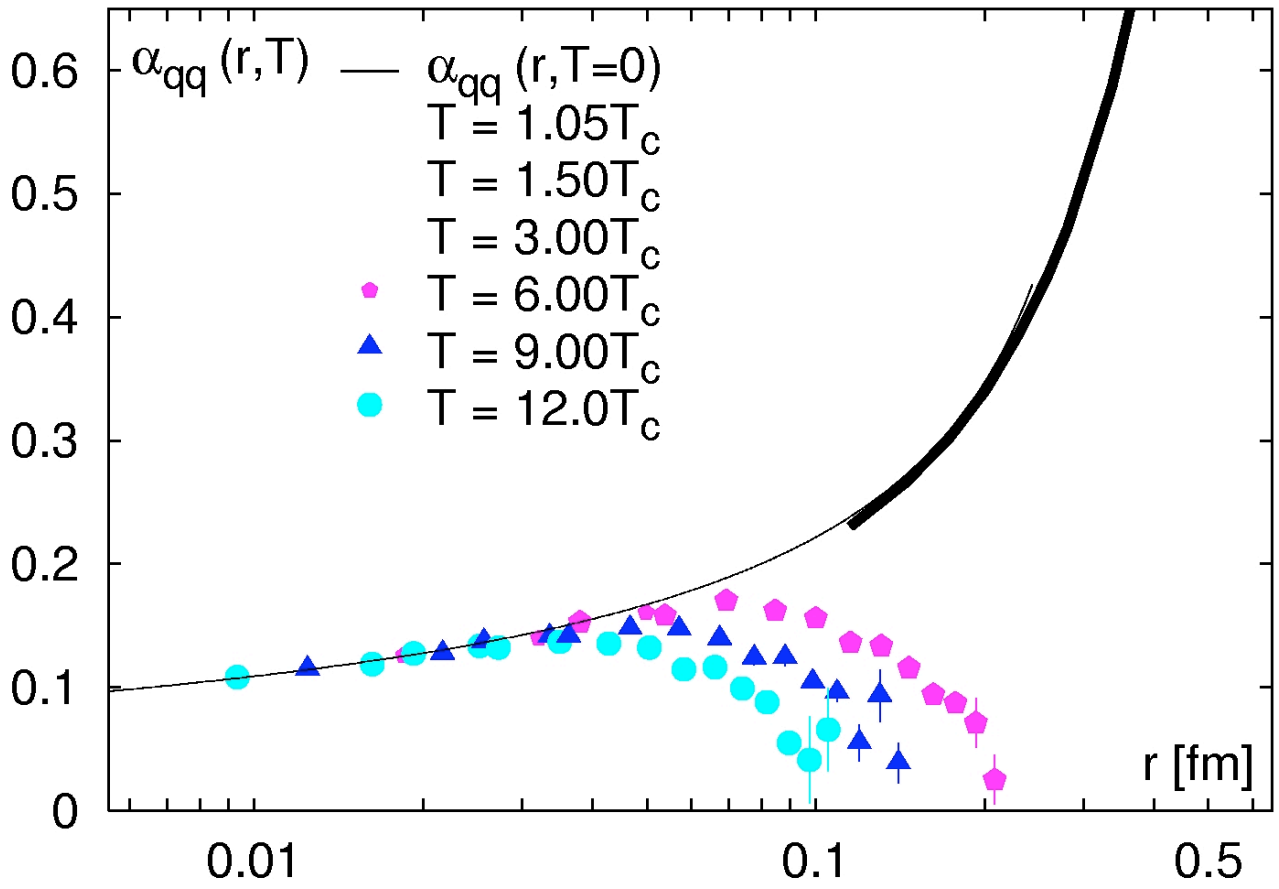

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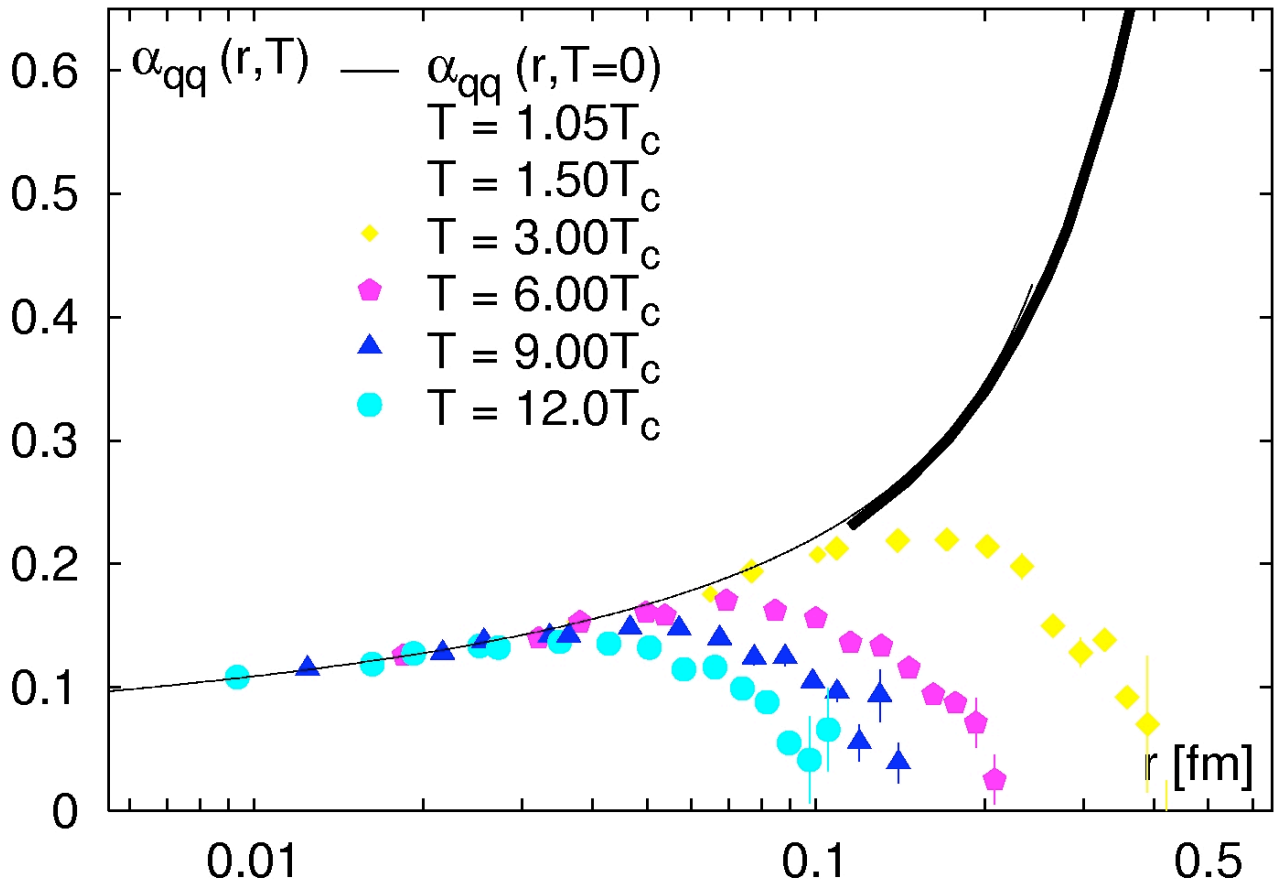

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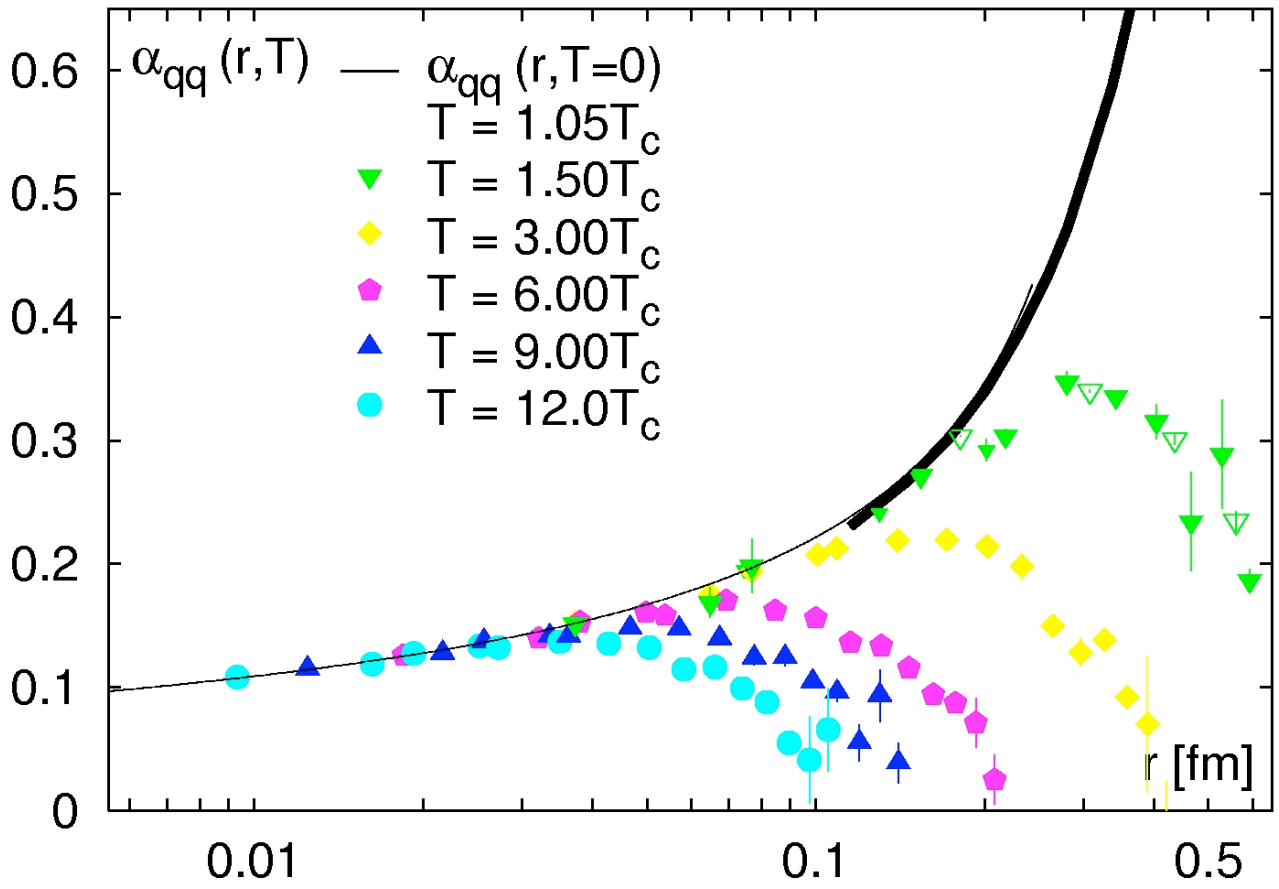

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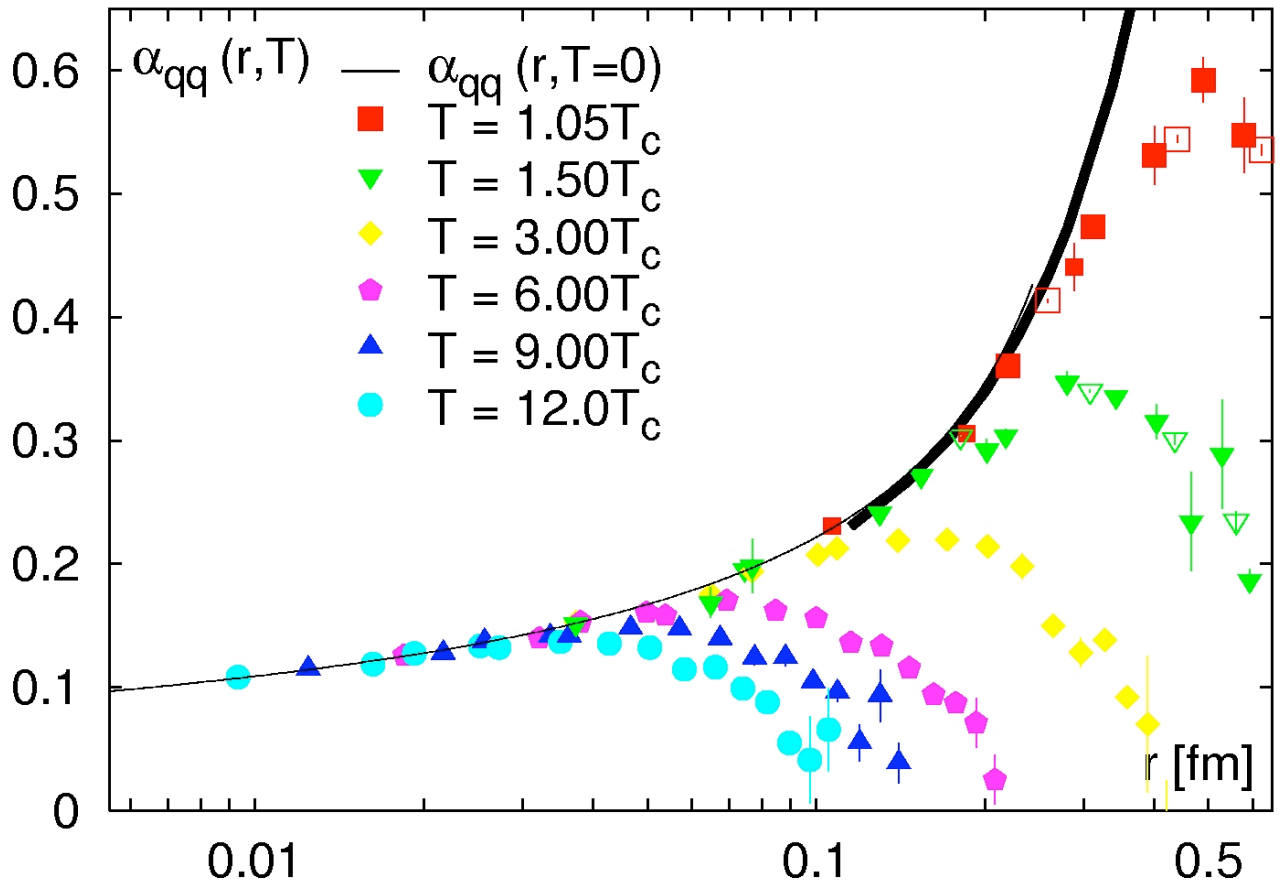

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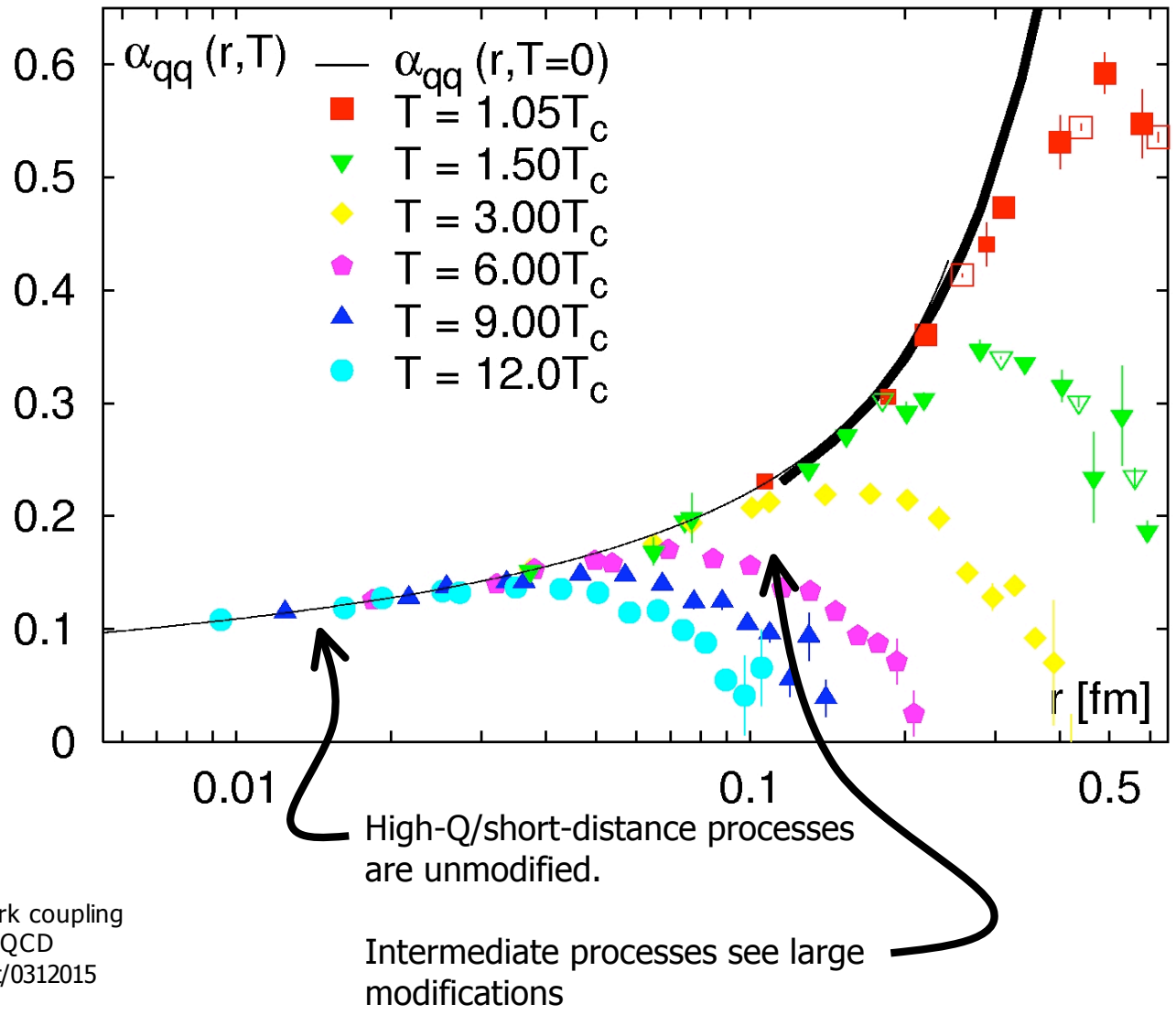

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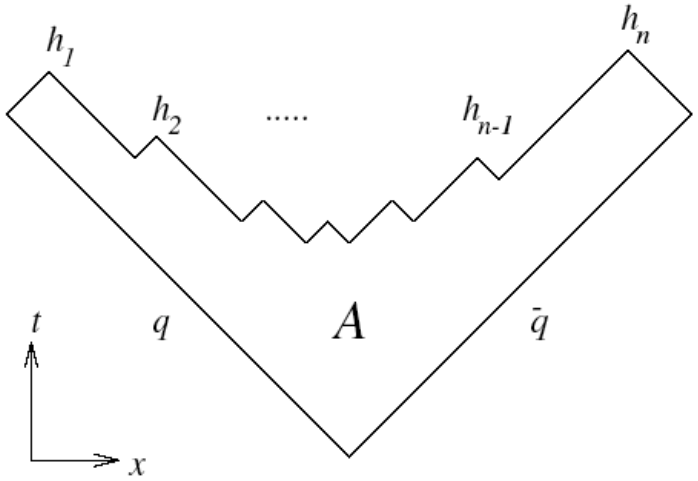
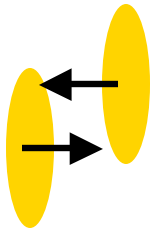
Modifications to the strong coupling should alter the hadronization process.
Perhaps we have already seen these effects.





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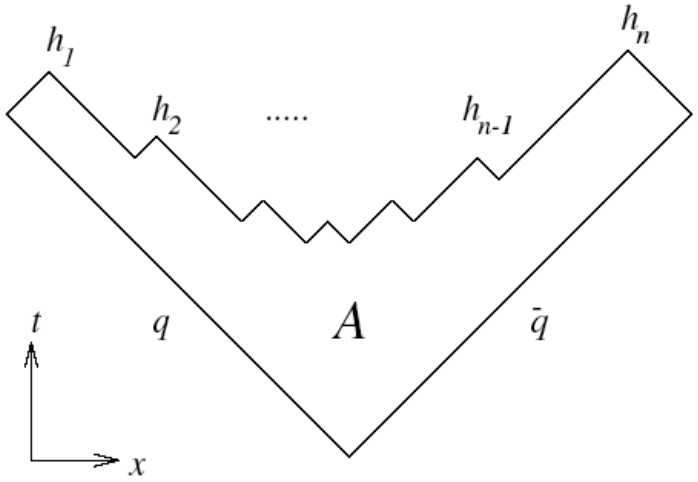

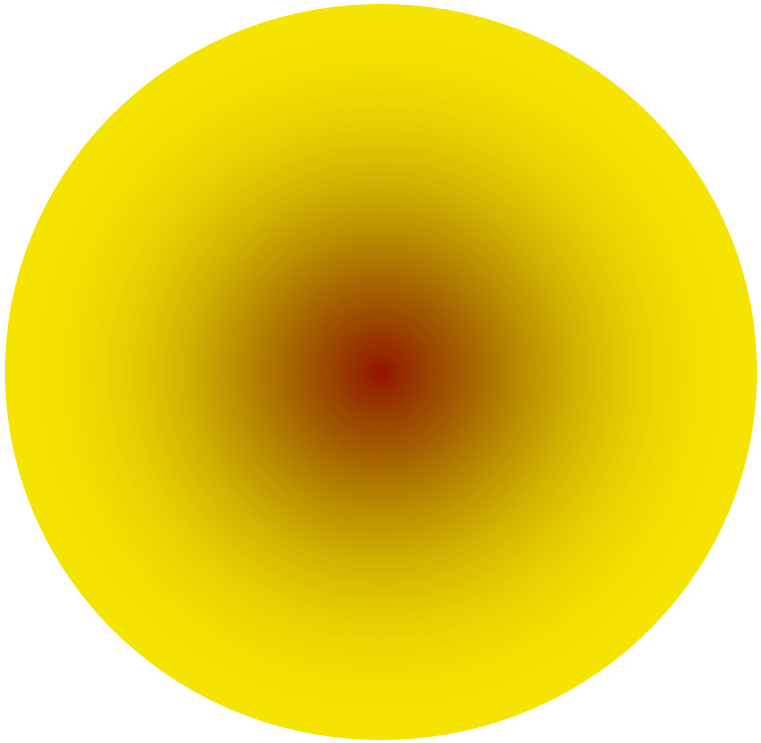

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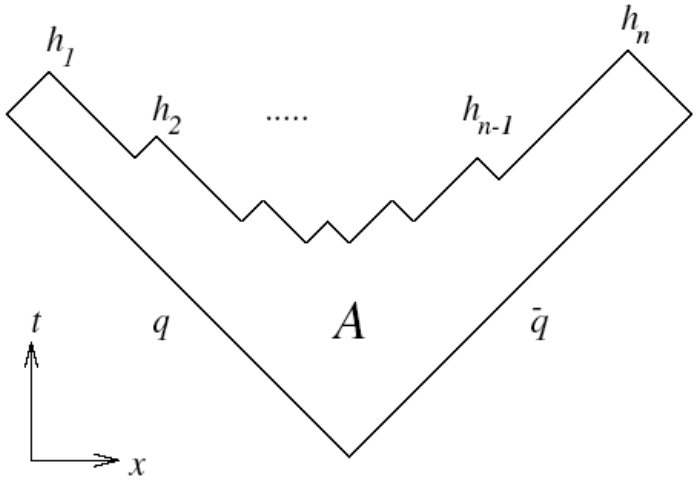
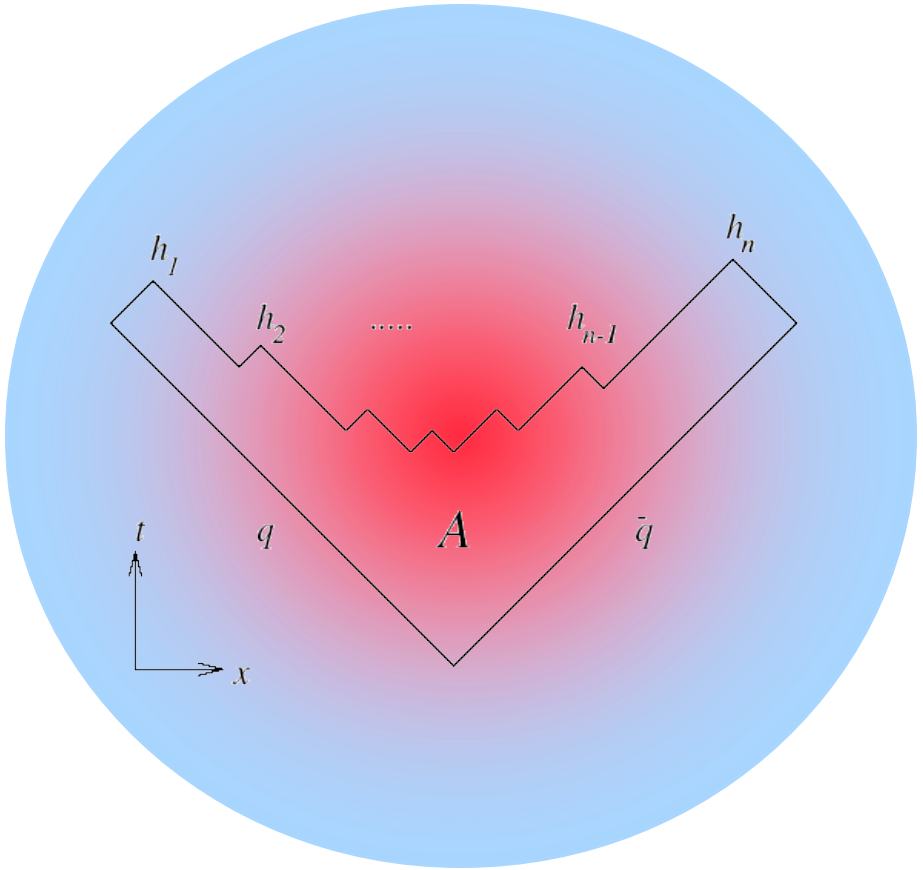
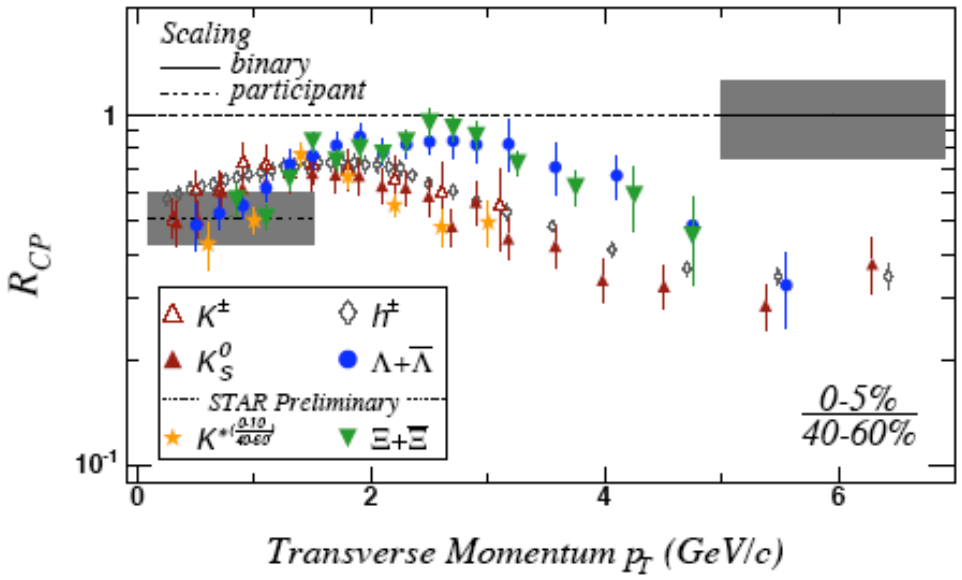
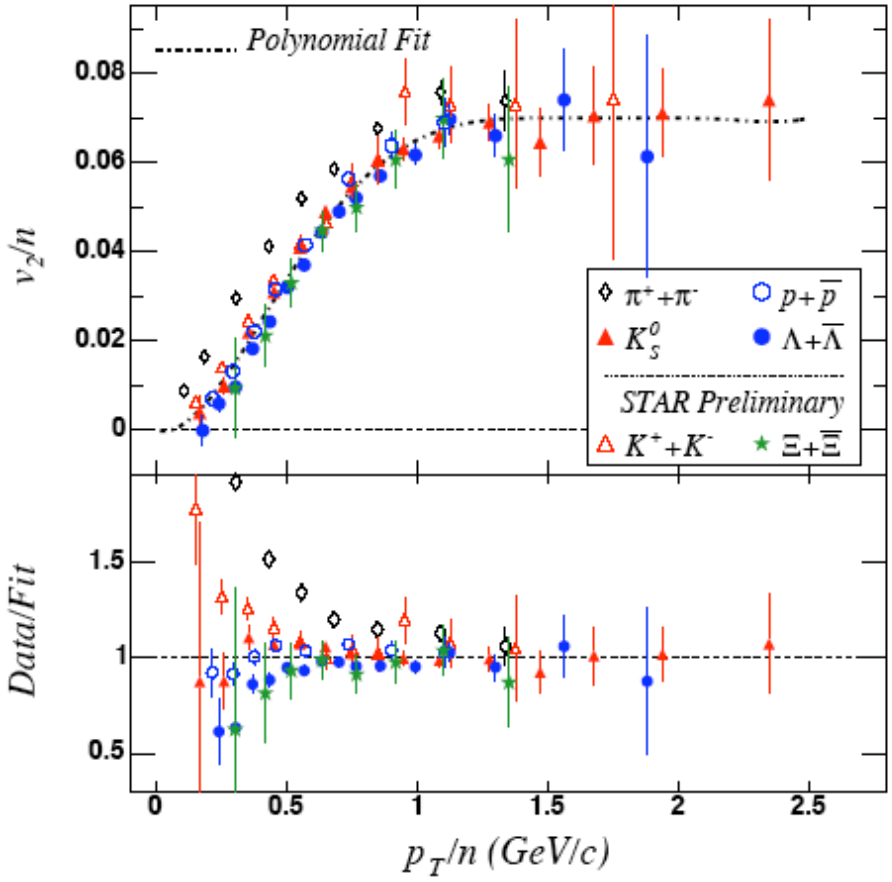




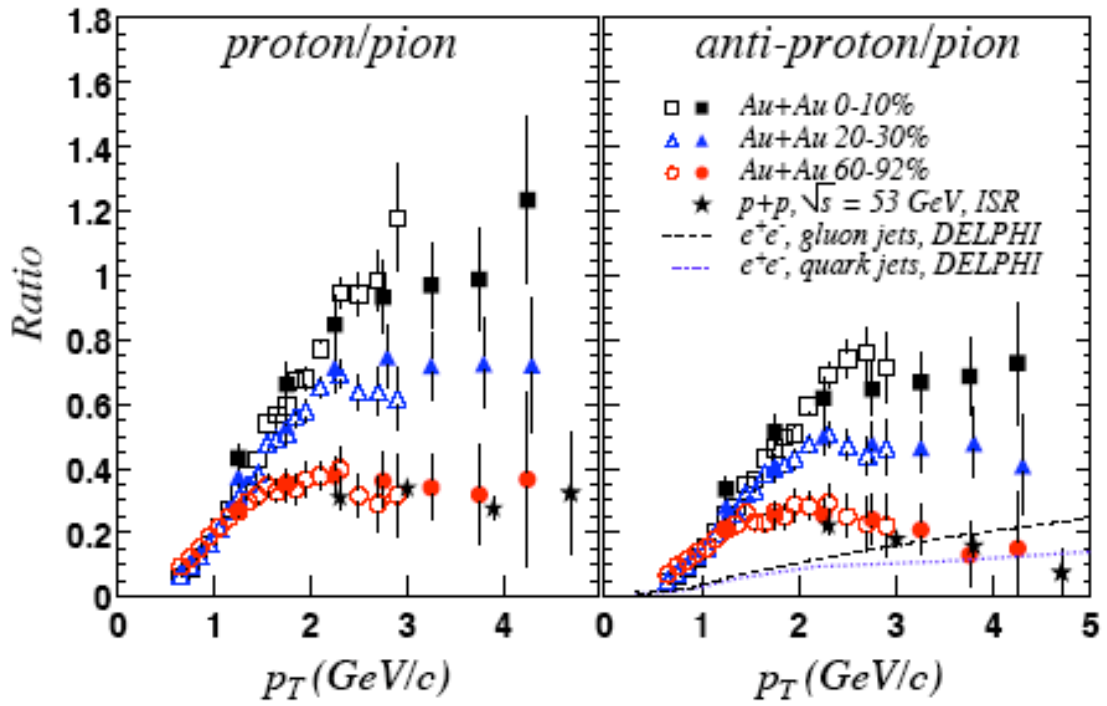
R_{CP} and v_2

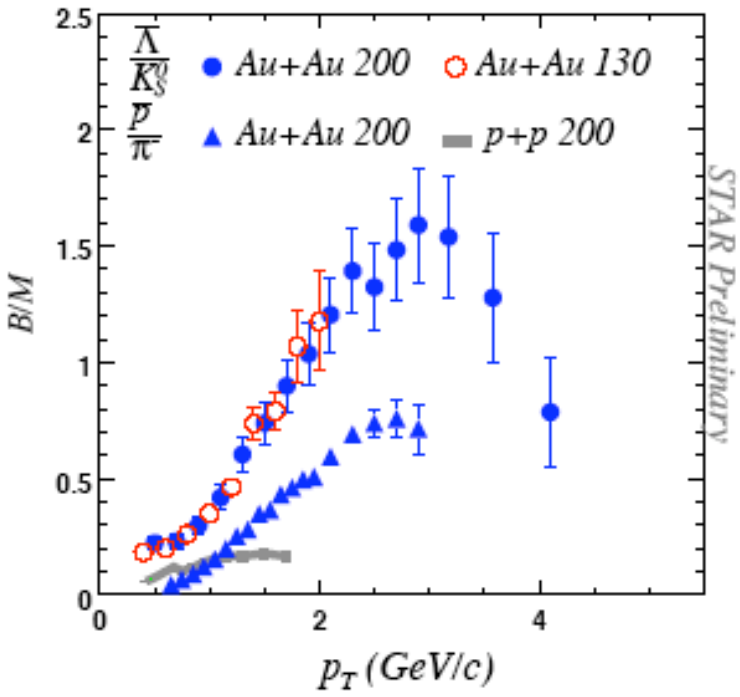
Quark number scaling may be related to novel hadronization mechanisms in heavy ion collisions





Baryon to Meson Ratios





Modifications to hadronization seem to be present in heavy ion collisions.
Observations are consistent with a modified η_s, but not proof. Other interpretations are still possible.

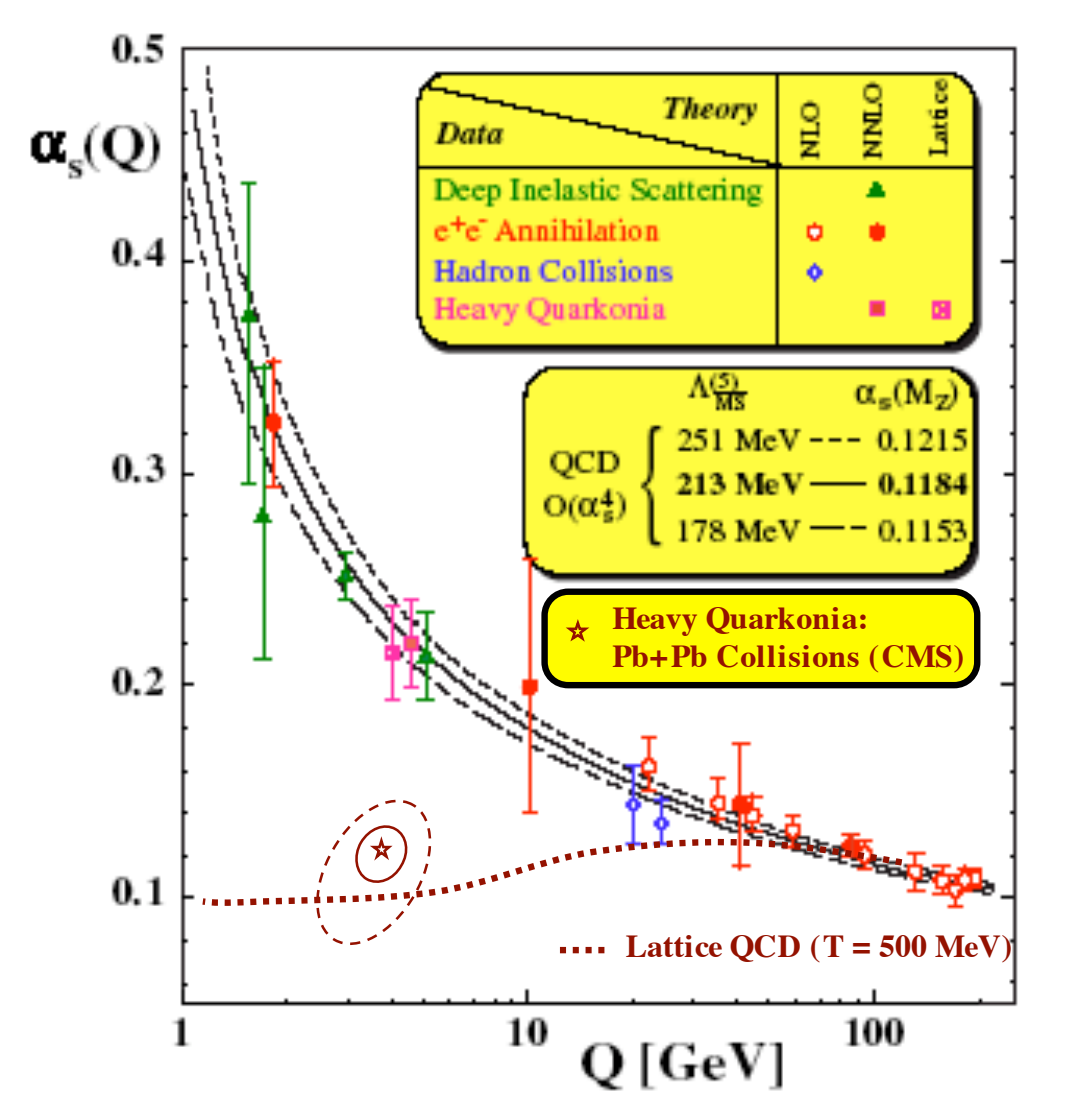
Challenge:

- How do we really find out if chiral symmetry was restored and a QGP existed?
- One way: measure α_s in heavy ion collisions.
  - At high-Q only very small modifications to α_s are expected.
  - At lower-Q large modifications are possible.
  - Would a smaller α_s imply an increased range of applicability for pQCD calculations?
  - Can we measure any of this?
- We need an observable that is:
  - sensitive to α_s.
  - sensitive to the early stages (not final state).
  - made at low enough Q^2.
  - observable!

α_s in Au+Au collisions

- γ-γ HBT
  - o we can extract α_s from Bose-Einstein correlations (hep-ph/0412243) but is this only sensitive to hadronization? Not well established.
  - ✓ photons are produced during the whole evolution.
  - ✓ samples small Q values.
  - ✓ in principle we can measure this.
- R$_{\mu\mu}$ ratio of hadronic and leptonic branching ratios.
  - ✓ can be directly related to α_s (using pQCD).
  - o is it sensitive to the medium: not really (cτ $\sim$ 90 μm).
  - o samples small Q values
  - o Observable in heavy ion collisions?
- **J/ψ and Υ decays (branching ratios and energy levels)**
  - ✓ **Can be related to α_s (through LQCD for mass splitting).**
  - ✓ **Sensitive to early stage when heavy flavor is produced.**
  - o **Sensitive to intermediate Q values (5-10 GeV/c).**
  - ✓ **Measurable with triggering and instrumentation (CMS).**
- Scaling violations in fragmentations functions.
- Something new?

Outlook



What the future could look like.

Other searches have proven to be ladders leaning on the wrong walls (*e.g.*. sudden transitions with s_{NN}).

Such a measurement would be easily interpretable and of broad interest to the physics community.

Thanks!

-Paul Sorensen