Upsilon Measurements with sPHENIX

Anthony Frawley
Florida State University

QCD Town Hall Meeting
Temple University

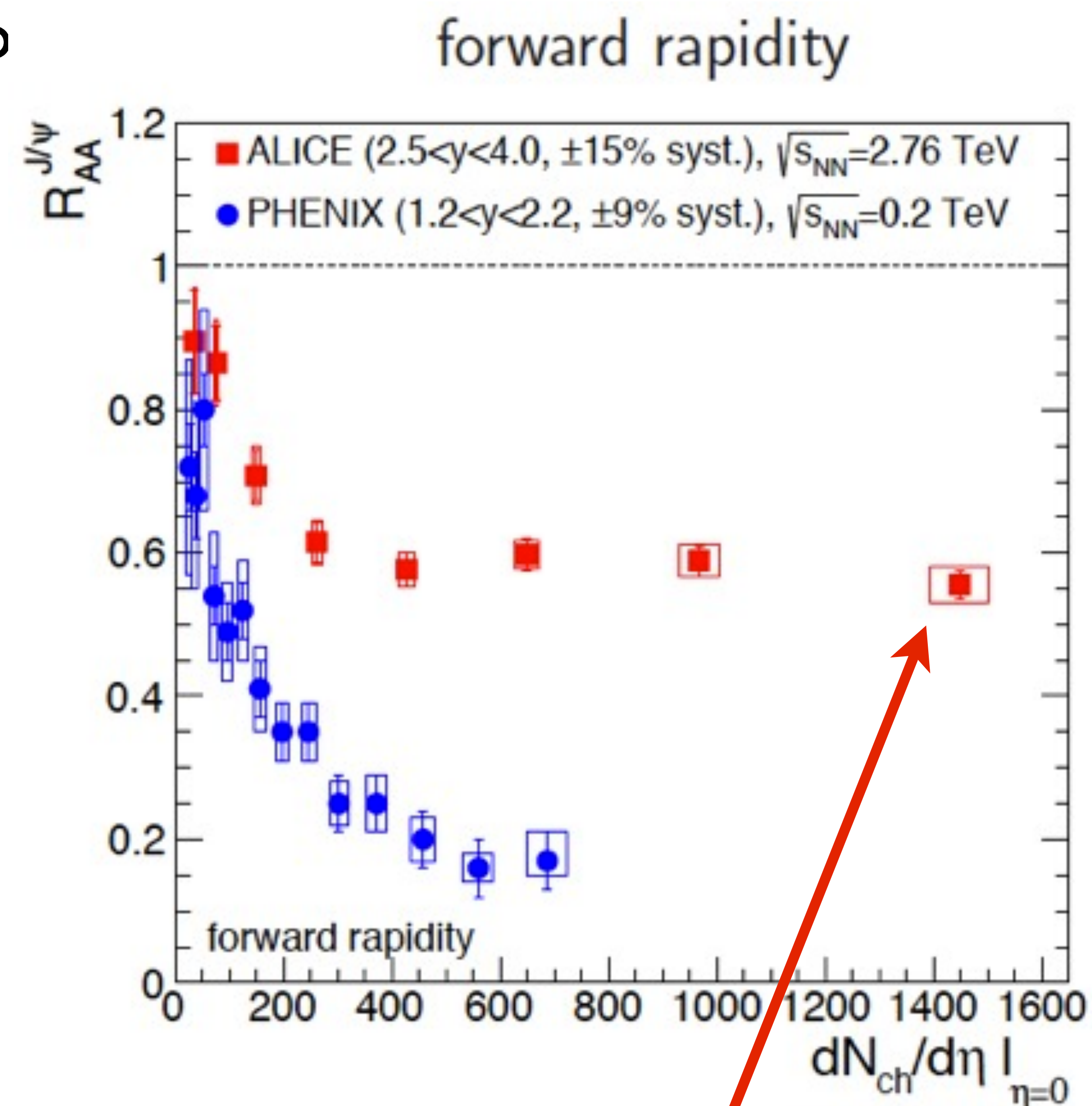
September 15, 2014

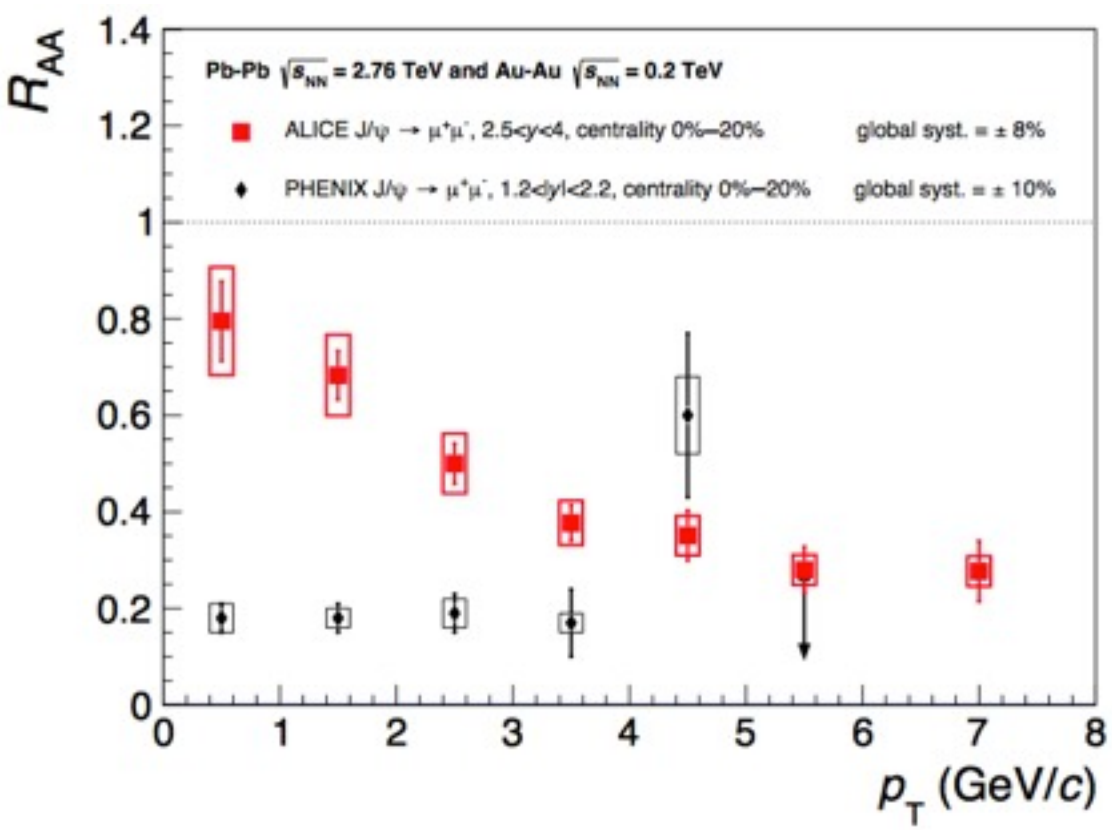
Quarkonia as a probe of the QGP

Charmonia and bottomonia mesons allow us to probe the QGP on length scales comparable with their radii.

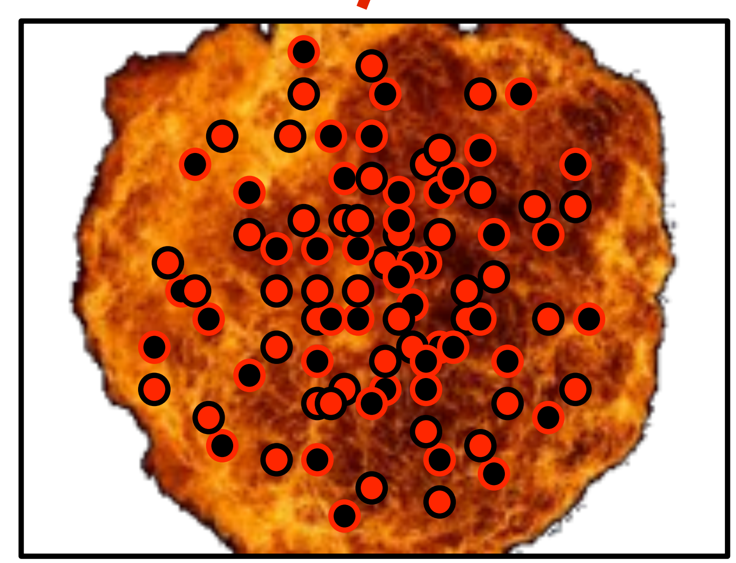
The comparison between RHIC and LHC J/ψ modifications is very striking. At LHC, so many charm pairs that coalescence dominates!

Nice physics! But we cannot directly compare melting at RHIC and LHC temperatures because different mechanisms dominate.





Charm pairs in central Pb+Pb collision



Upsilons

Upsilons have the advantages that:

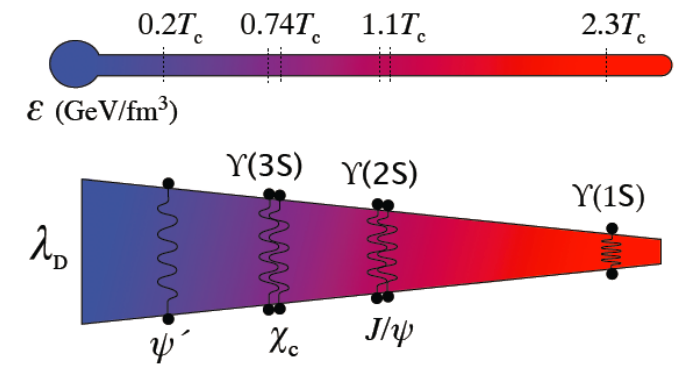
- All 3 states seen simultaneously via dilepton decays.
- Coalescence not large at RHIC **or** LHC.
- Range of radii from 0.28-0.78 fm.

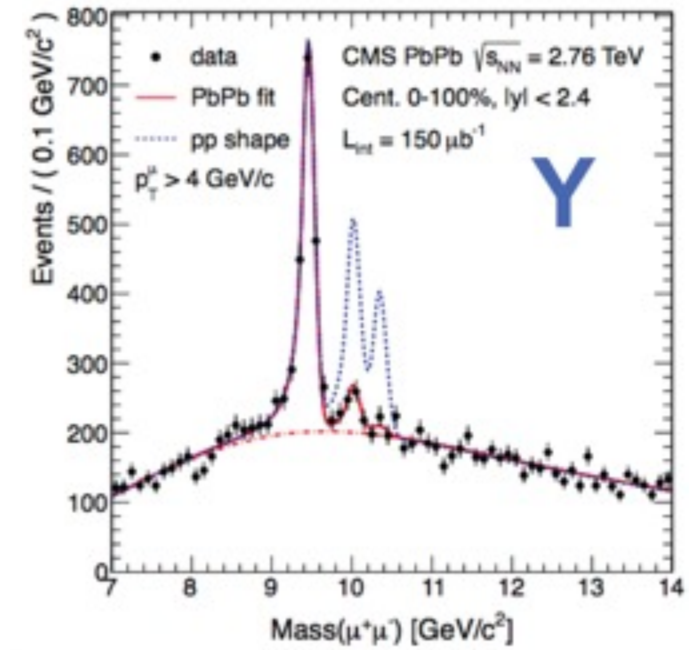
Directly compare melting at 200 GeV and 2.76 TeV on 3 states of very different size.

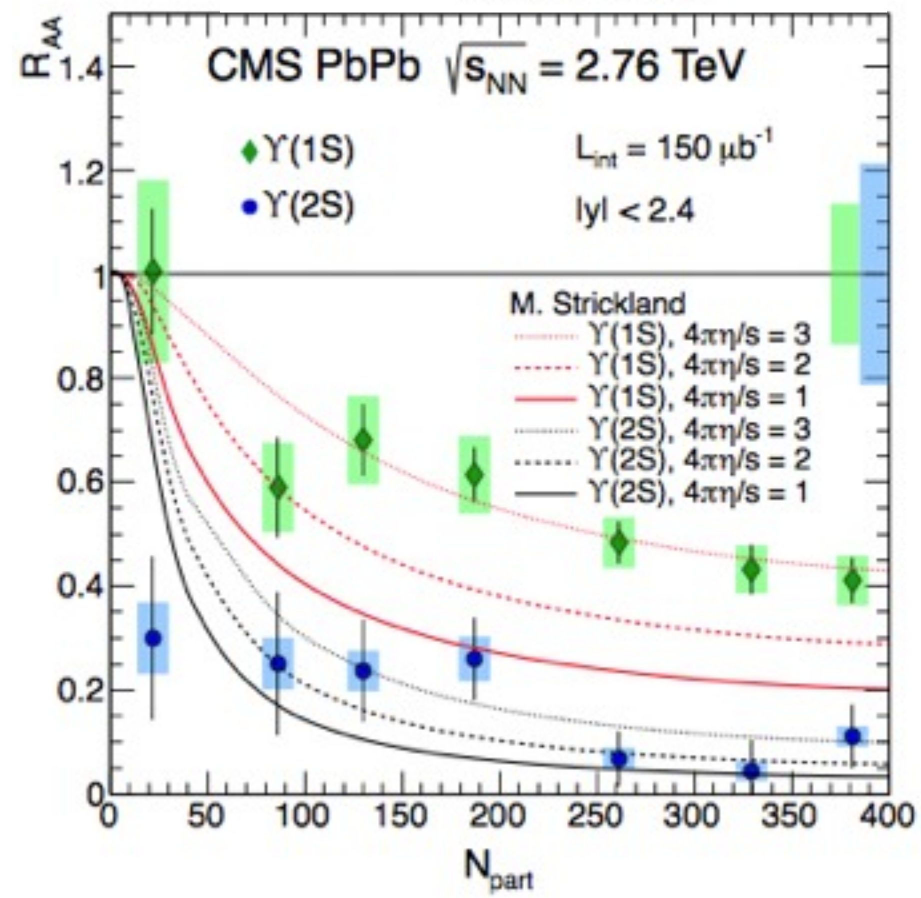
CMS data show dramatic suppression of 2S and 3S states in Pb+Pb at 2.76 TeV. **The data will improve hugely by Run 3 (~2023)**.

For this model (Strickland and Bazow, N.P. A879:25 2012 (& private comm.) the ϒ(1S) data already constrain η/s.

We lack a measurement at RHIC energy with the ability to tightly constrain model parameters. **sPHENIX** can generate such measurements.







Upsilon measurements with sPHENIX

Some simulation estimates for Upsilon mass spectra (0-20% central Au+Au, 1 year run)
- with and without background.

The statistical precision expected for the R_{AA} is illustrated below (assuming $\eta/s = 2/(4\pi)$).

Theory curves - M. Strickland, private communication