



PowerPoint Slides

Charged-particle nuclear modification factor in PbPb collisions using the ANGANTYR model

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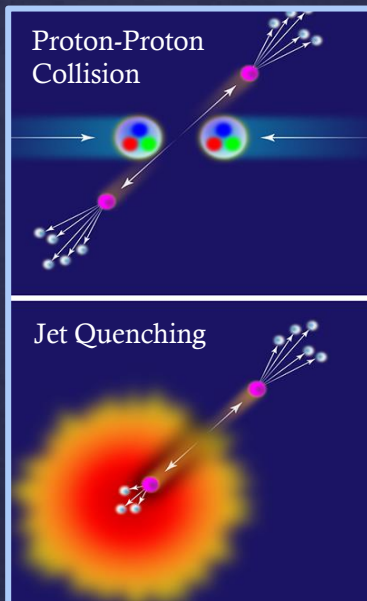


Research Paper

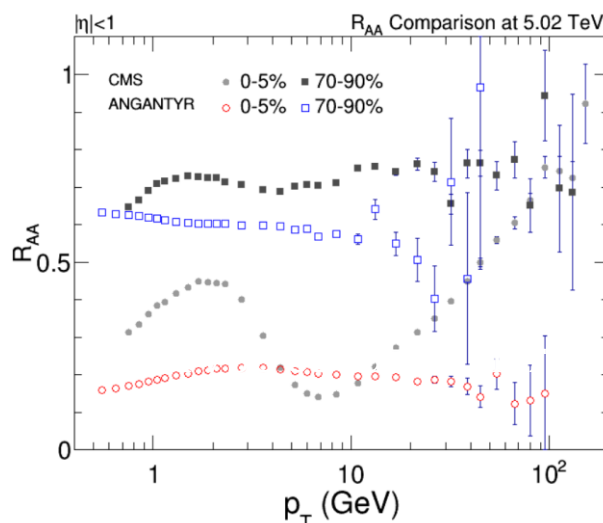
1 Quark Gluon Plasma (QGP)

- Exotic state of matter generated under extreme temperatures
- Particles are “free” from the strong nuclear force.
- Physically produced through heavy ion collisions at particle accelerators such as RHIC and CERN, but only momentarily.
- The QGP “fireball” quickly expands and “freezes” into a plethora of different particles.

We investigate QGP by measuring these particles, thus pushing the boundaries of our understanding of the theory governing the strong nuclear force (QCD).



<https://physics.aps.org/articles/v7/97>



R_{AA} comparison for most and least central collisions using ANGANTYR and CMS data.

3 Predictions with the ANGANTYR Model

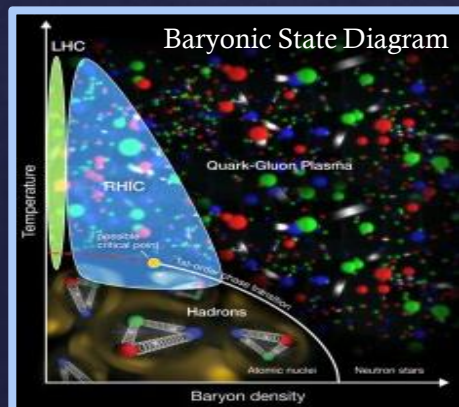
ANGANTYR

- Directly extrapolates pre-existing software for proton-proton collisions (Pythia) to heavy-ion collisions.
- *Does not simulate the production of QGP.*

Other heavy-ion models directly incorporate QGP and its behaviors, such as jet-quenching, into their calculations.

Using ANGANTYR we demonstrate reduced R_{AA} consistent with CMS data (left).

- Reduced R_{AA} is used as a marker for QGP production.
- Our data suggest that reduced R_{AA} could also be explained by mere collision dynamics, disrupting our understanding of QGP.
- We predict the ANGANTYR model has underlying flaws.
 - Impressive accuracy warrants future investigation.

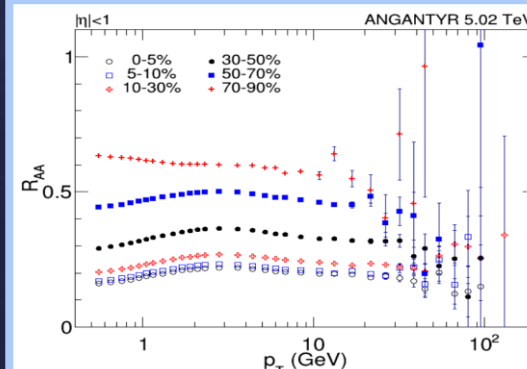


<http://sites.coloradocollege.edu/pc357ml/2014/04/10/the-quark-gluon-plasma/>

2 Nuclear Modification Factor (R_{AA})

- We smash protons together at extremely high speeds.
- Energy is converted directly into mass, detected as a shower of outgoing particles.
- We also smash together lead nuclei.
 - Larger projectiles yield more outgoing particles.

R_{AA} measures the relationship between the different number of outgoing particles. It is unitary under normal circumstances. QGP has been shown to reduce R_{AA} by “catching” some of the outgoing particles in a phenomenon known as jet-quenching (above).



R_{AA} for various centrality bins is less than unitary. Further, differences between centrality bins are consistent with CMS.

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References

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