

Quark Matter and High Energy Heavy Ion Collisions

Conveners: Jaki Noronha-Hostler (Rutgers), Marta Verweij (CERN), Nu Xu (BNL)

Organizing Committee liaison: Helen Caines

Parallel 4 May 30: Nuclear PDFs and Heavy Ion Physics (PGDNN/QMHI)

1. 30': [144] *Recent progress in nuclear parton distributions*
Maria Zurita, BNL
2. 30': [111] *Nuclear PDF, small-x physics results at RHIC*
Xuan Li, LANL
3. 30': [293] *Cold QCD Physics of the STAR Forward Upgrade*
James Drachenberg, Lamar U
4. 30': [355] *EIC at small-x: connections to p+p/A & A+A physics at RHIC and LHC*
Prithwish Tribedy, BNL
5. 20': [30] *Hadron in jet fragmentation*
Felix Ringer, LBL

Parallel 5 May 31: Small systems and the Limits of the QG plasma

1. 20': [313] *Influence of the QCD equation of state by system size*
Jacquelyn Noronha-Hostler, Rutgers
2. 20': [315] *CMS results on small systems*
Zhenyu Chen, Rice
3. 20': [330] *PHENIX results on small systems*
Sylvia Morrow, Vanderbilt
4. 20': [346] *Hydrodynamics in small systems*
Giuliano Giacalone, IPhT
5. 20': [122] *Current status of hydrodynamic modeling from p+p to heavy ions*
Ryan Weller, MIT

Parallel 6 May 31: Heavy ions at the LHC

1. 30': [54] *Overview of recent results from the ATLAS experiment*
Brian Cole, Columbia
2. 30': [363] *Overview of recent results from the CMS experiment*
Manuel Calderon De La Barca Sanchez, UC Davis
3. 20': [250] *The ALICE upgrades for run 3 and physics projections*
Wladyslaw Trzaska, Jyväskylä U
4. 20': [314] *Parton shower modification studied with jet substructure in ALICE*
Davide Caffarri, NIKHEF
5. 20': [289] *b-jet tagging performance with ALICE*
Barbara Trzeciak, Utrecht
6. 20': [327] *The application of deep learning to event-by-event simulations of relativistic hydrodynamics*
LongGang Pan, LBNL

Parallel 8 June 1: Jet Substructure and Quenching/Flavor

1. 30': **[237]** *Jet measurements in heavy ion collisions*
Christine Nattrass, U Tennessee, Knoxville
2. 30': **[361]** *The theory of jets in dense matter*
Abhijit Majumder, Wayne State
3. 20': **[269]** *Using photon-jet analyses to probe the QGP*
Saskia Mioduszewski, Texas A&M
4. 20': **[37]** *Jet mass and inclusive jet production at the LHC*
Kyle Lee, Stony Brook
5. 20': **[240]** *Heavy flavor jet quenching at RHIC and LHC energies*
Shanshan Cao, Wayne State
6. 20': **[112]** *Energy and system-dependent heavy-flavor measurements at PHENIX at RHIC*
Xuan Li, LANL

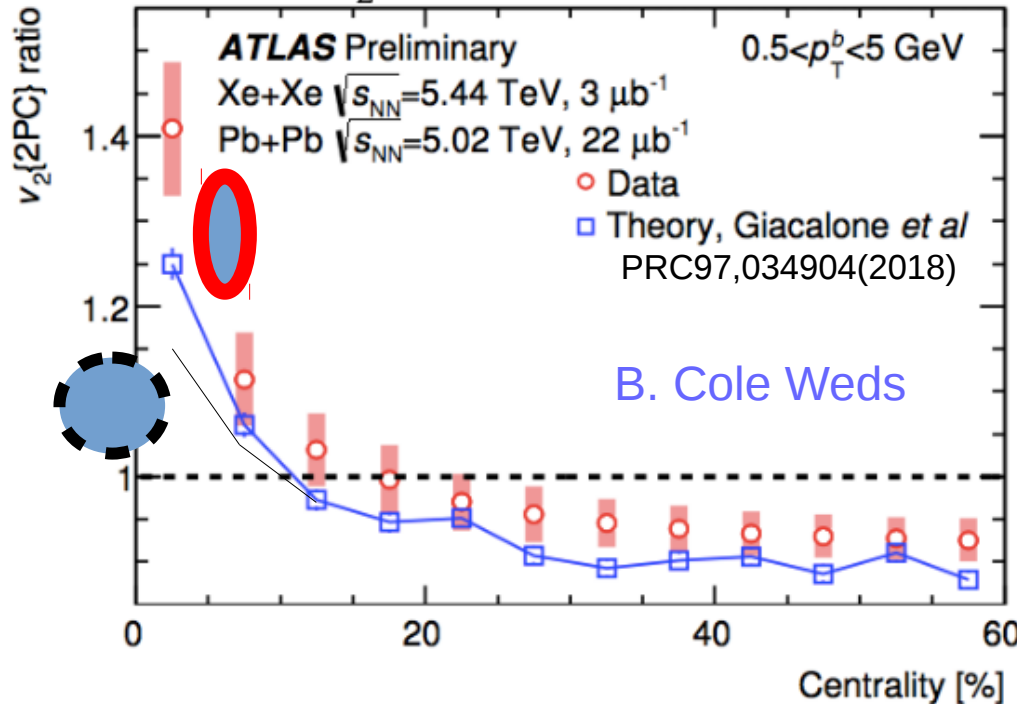
Parallel 9 June 2: QCD Phase Transition/New Instrumentation

1. 30: **[304]** *The QCD phase diagram*
Misha Stephanov, University of Illinois, Chicago
2. 30': **[364]** *Lattice QCD thermodynamics*
Alexei Bazavov, MSU
3. 20': **[227]** *Searching for the QCD Critical Point through Fluctuations at RHIC*
Roli Esha, UCLA
4. 20': **[312]** *What have we learned from quarkonia production in relativistic heavy ion collisions?*
Che Ming Ko, Texas A&M
5. 20': **[362]** *sPHENIX: probing the quark-gluon plasma*
Ron Soltz, LLNL
6. 20': **[230]** *The RHIC STAR Beam Energy Scan Phase II physics and upgrades*
David Tlusty, Rice

Smallest Droplet of the Quark Gluon Plasma?

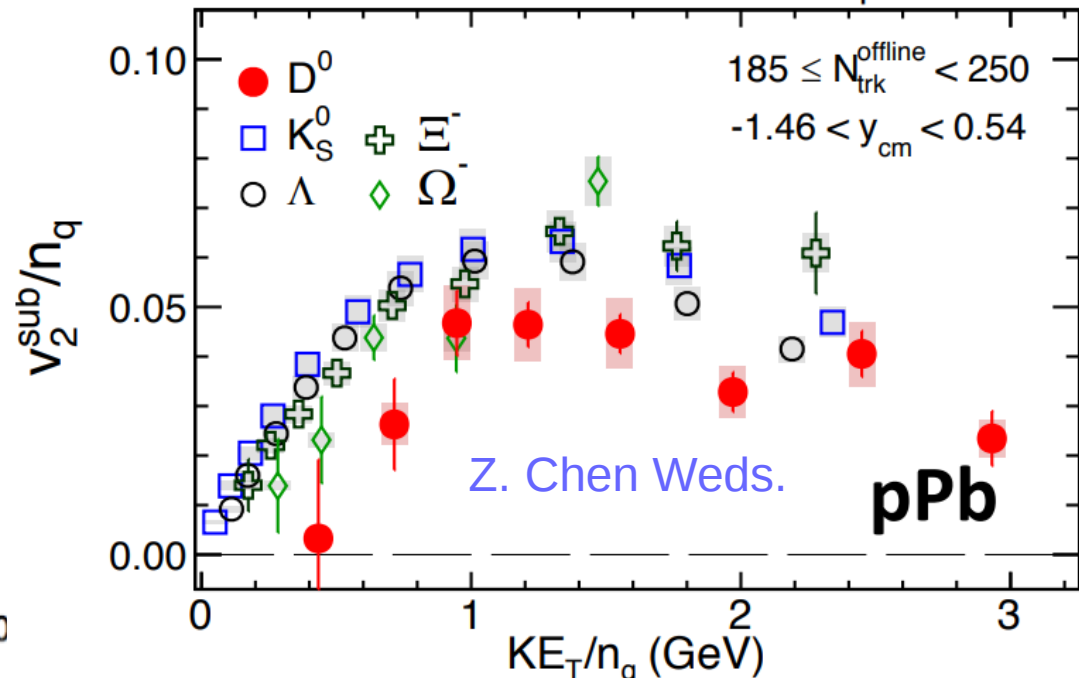
PbPb → XeXe collisions, ~30% ↓ in system size pPb collision ~1/10 size of PbPb (~10⁻¹⁵ m)

QGP signals confirmed in XeXe collisions
Ratio of v₂ for Xe to Pb



Data consistent with using deformed Xenon nucleus in viscous hydrodynamics calculations
 - Confirmed in CMS, ALICE, and ATLAS

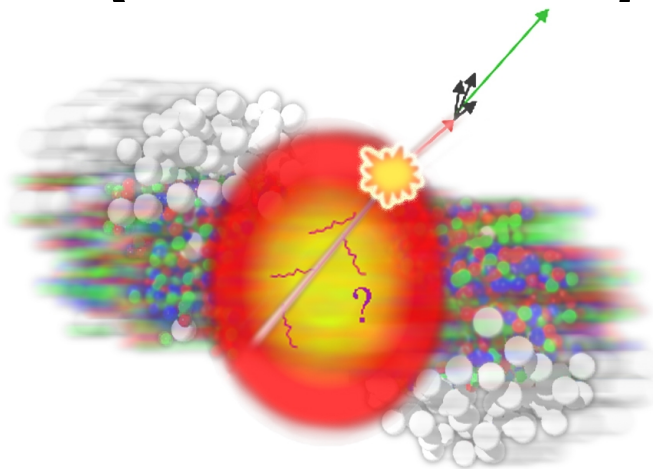
Large flow (signal of Quark Gluon Plasma) seen
CMS arXiv:1804.09767 pPb 8.16TeV



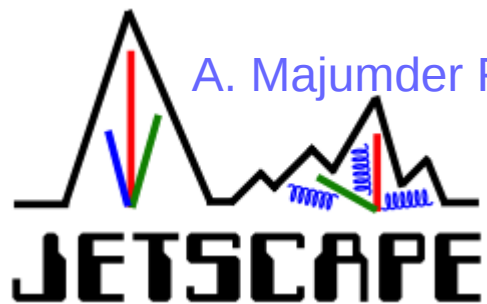
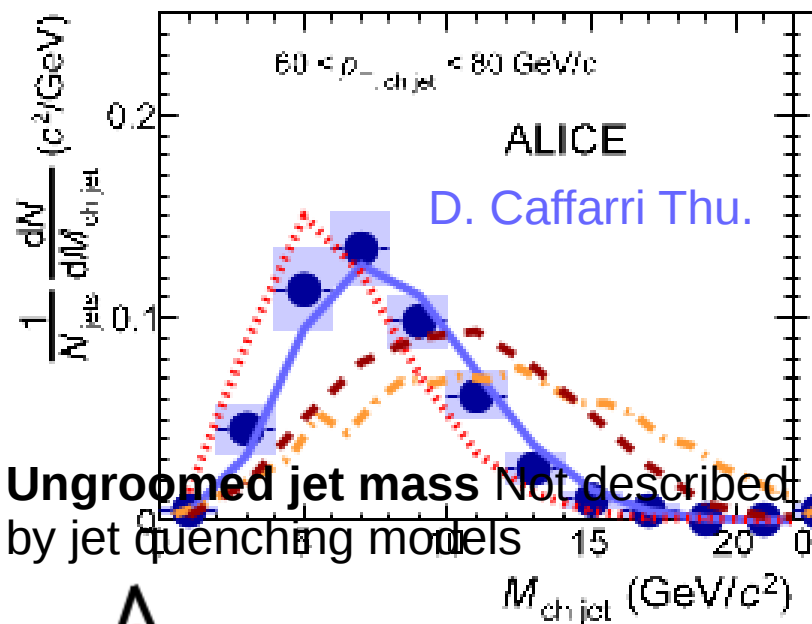
Non-zero flow for D mesons (1 charm quark)
 → thermalized charm or something else?
 - Confirmed in CMS, ATLAS, and PHENIX

See Calderon de la Barca Sanchez, S. Morrow, Giacalone, Weller

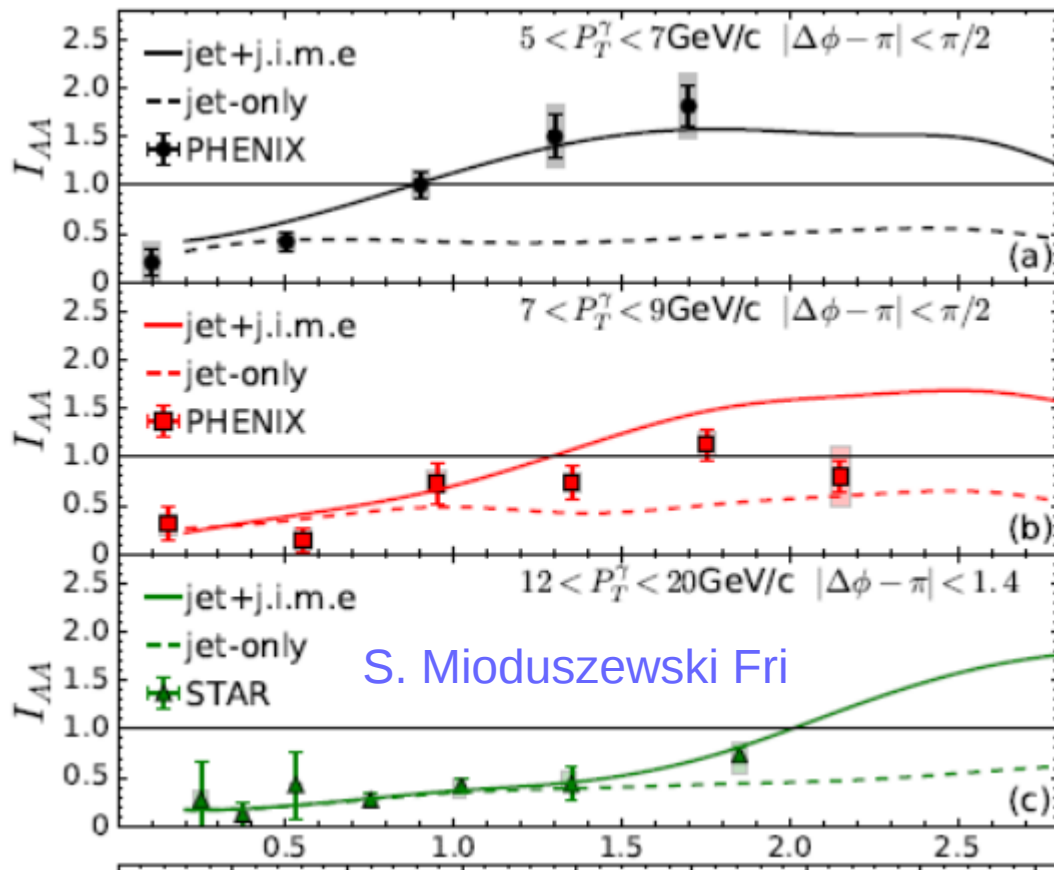
Jet Quenching in Quark Gluon Plasma



ALICE, Phys. Lett. B 776 (2018) 249



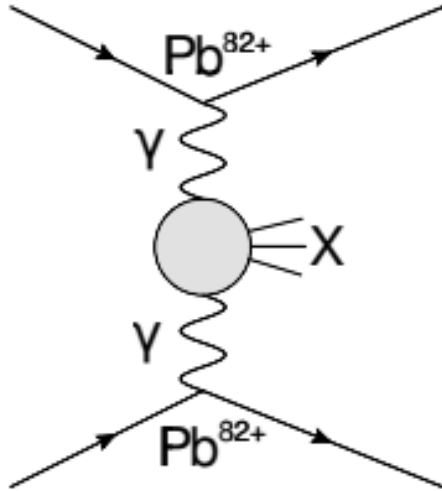
Photon hadron correlation → Excess of low momentum particles
Can only be described by medium response



Similar picture at LHC

JETSCAPE released 1st software package.
Full MC simulation of parton shower in Quark Gluon Plasma

Light by Light Scattering

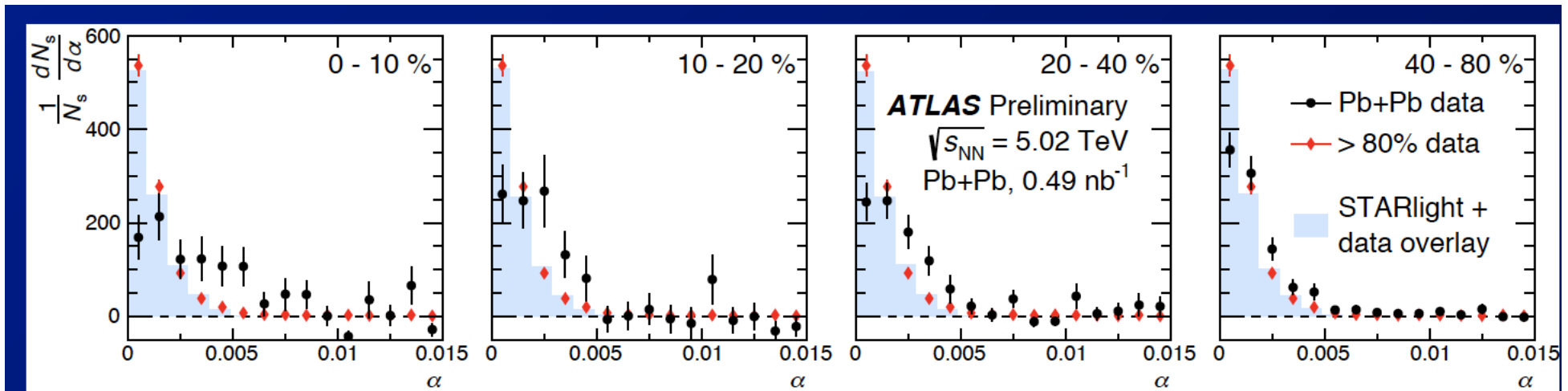


The tight alignment of $\gamma\gamma \rightarrow \mu^+\mu^-$ pairs makes detection possible in non-Ultra Peripheral Collisions PbPb Collisions

Observe a centrality dependent acoplanarity broadening.

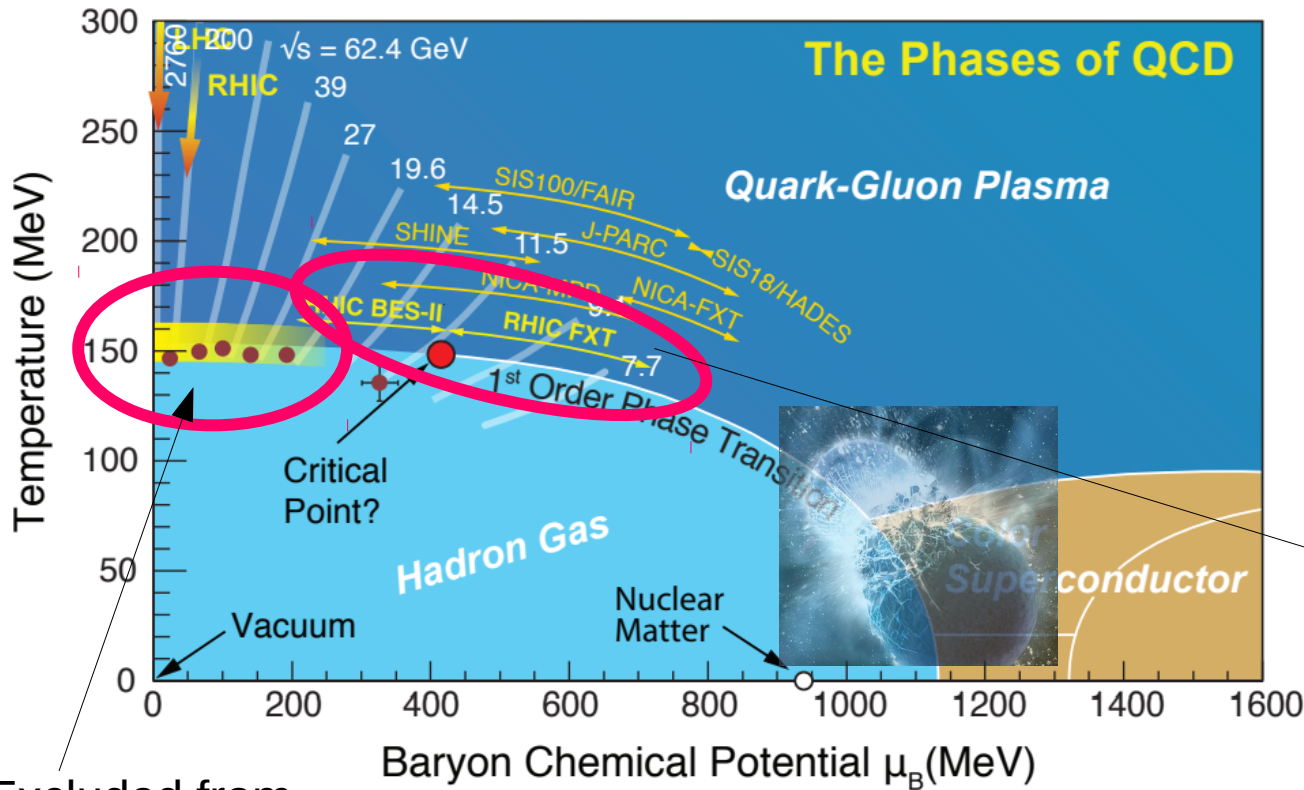
Is there something that is NOT a color charge interacting with the Quark Gluon Plasma?

- **Limits on axion-like particles?** Knapen et al
arXiv:1709.07110



See. B Cole Thu.

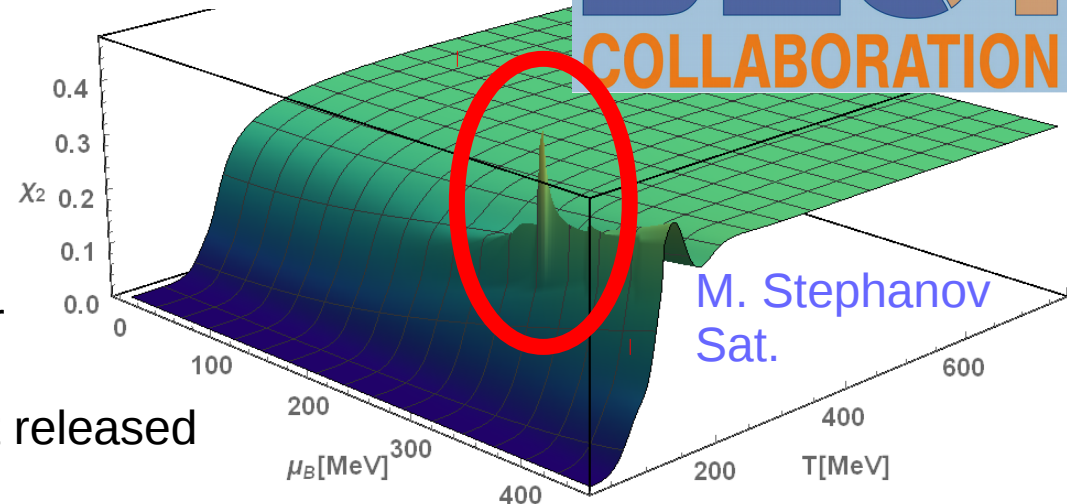
Locating the QCD critical point



Most non-relativistic fluids have critical points.

QCD is a relativistic QFT of a fundamental force, implications of a relativistic critical point?
-M. Stephanov

Measurements of fluctuations of conserved charges at STAR
R. Esha and D. Tlusty Sat



M. Stephanov Sat.

Excluded from Lattice QCD
A. Bazavov Sat

Lattice QCD based + movable critical point equation of state \rightarrow systematic searches for the critical point.

BEST collaboration Software package just released