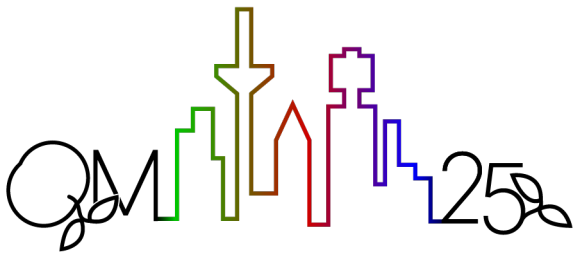

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Constraining the Phases of Hot QCD Matter via Precision Measurement of the Speed of Sound with the CMS Experiment

Thursday 10 April 2025 10:20 (20 minutes)

Ultrarelativistic nuclear collisions have revealed the existence of a hot, dense medium exhibiting collective flow with minimal viscous dissipation, indicative of a strongly interacting quark-gluon plasma. The CMS Collaboration previously measured the speed of sound in this medium, determining a value of approximately 0.241 at an effective temperature of 219 MeV in ultracentral 5.02 TeV PbPb collisions at the LHC, in excellent agreement with lattice quantum chromodynamics (QCD) predictions for a deconfined QCD matter. In this talk, we present new results from measurements using 5.36 TeV PbPb data collected during LHC Run 3 (2023) and 8.16 TeV pPb data from Run 2. The new larger data samples significantly improve precision, enabling more detailed differential studies. We explore the temperature dependence of the speed of sound by analyzing data at different collision energies and the mean transverse momentum at various rapidities. Additionally, the impact of different centrality estimators on the extraction of the speed of sound is examined in detail. These new results provide critical insights into the thermal properties of the quark-gluon plasma and offer stringent tests of lattice QCD predictions.

Category

Experiment

Collaboration (if applicable)

CMS

Author: LI, Wei (Rice University (US))

Presenter: LI, Wei (Rice University (US))

Session Classification: Parallel session 10

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