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Charge fluctuations at LHC with local charge conservation as a signature of QGP

The D-measure of the event-by-event net charge fluctuations was introduced over 20 years ago as a potential signal of quark-gluon plasma (QGP) in heavy-ion collisions, based on the fractional charges of quarks leading to suppression of fluctuations relative to hadron gas baseline. Measurements have been performed at RHIC and LHC, but in the absence of quantitative calculations for both scenarios, the conclusion has been elusive.

Here, we employ a recently developed formalism of density correlations to incorporate the effects of resonance decays, local charge conservation, and experimental kinematical cuts to perform quantitative calculations of charge fluctuations in central Pb-Pb collisions at LHC energies. We find that the hadron gas scenario is in fair agreement with the experimental data of the ALICE Collaboration only when a very short rapidity range of local charge conservation is enforced. On the other hand, the QGP scenario predictions show small sensitivity to the range of local charge conservation and yield excellent agreement with experimental data. We present predictions for LHC Run 2 as a precision test of the two scenarios.

Category

Theory

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