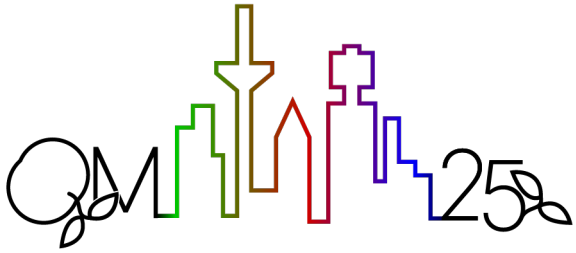

Contribution ID: **472** Type: **Oral**

Higher-Order Fluctuations: Unveiling the Final Frontier of QCD at the LHC with ALICE

Tuesday 8 April 2025 12:10 (20 minutes)

Lattice QCD calculations predict that chiral symmetry is restored in a smooth crossover transition between a quark–gluon plasma and a hadron resonance gas (HRG) at vanishing net-baryon density, a condition realized in heavy-ion collisions at the LHC. In this regime, the net-baryon number cumulants computed using the HRG and lattice QCD partition functions are in good agreement up to third order. However, starting with the fourth-order cumulants, the LQCD results are significantly lower than the corresponding HRG results. This offers a unique opportunity to experimentally verify the full QCD partition function by measuring the fourth-order cumulants of the net-proton number distributions.

In this talk, ALICE data for net-proton number cumulants up to sixth order in proton-proton collisions at top LHC energy are presented to search for effects of a possible chiral phase transition in this small system. An extension of the net-proton measurements in Pb-Pb collisions to fourth order is also presented. In addition to providing experimental access to the full QCD partition function, these measurements will, for the first time, allow to distinguish between different mechanisms of baryon production.

Category

Experiment

Collaboration (if applicable)

ALICE

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Session Classification: Parallel session 20

Track Classification: QCD phase diagram & critical point