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Fluctuations and correlations of net-conserved quantities at LHC energies with ALICE

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Fluctuations and correlations of net-conserved quantities, including net-baryon, net-charge, and net-strangeness, are pivotal for exploring the QCD phase structure, as they are directly related to thermodynamic susceptibility ratios in lattice QCD (LQCD) calculations. These quantities probe the thermal properties of the medium and shed light on the nature of the strongly interacting matter created in high-energy nuclear collisions

We present results on second-order diagonal and off-diagonal cumulants of net-charge, net-proton, and net-kaon, with the net-proton and net-kaon serving as proxies for the net-baryon and net-strangeness number, respectively. The measurements are performed at mid-rapidity, as a function of centrality in Pb−Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV using data recorded by the ALICE detector. The results are compared with corresponding results at lower collision energies from the STAR experiment at RHIC, and with theoretical predictions from the HIJING, EPOS and Hadron Resonance Gas model (Thermal-FIST).

Recent lattice QCD studies have highlighted the significant impact of magnetic field (eB) on these thermodynamic susceptibility ratios. Interesting experimental results for observables that are claimed to be sensitive to initial magnetic field effects will also be discussed in this presentation.

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