



Net-conserved charge fluctuations in ALICE and long-term perspectives

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First experimental results on the third-order cumulants of net-proton fluctuations, as well as second-order cumulants of net-pion and net-kaon fluctuations, in Pb-Pb collisions recorded by the ALICE detector at the CERN LHC are presented. Resonance contributions are shown to pose the main challenge in the study of fluctuations in net-electric charge and net-strangeness. The results on second-order cumulants of net-proton fluctuations are also discussed in view of effects due to global/local baryon number conservation. The results exhibit the presence of long-range rapidity correlations between protons and antiprotons. These correlations originate from the early phase of the collision. The experimental results are compared with HIJING and EPOS model calculations, and the dependence of the fluctuation measurements on phase-space coverage is examined in the context of lattice QCD (lQCD) and Hadron Resonance Gas (HRG) model calculations. The data from ALICE agree with the lQCD and HRG expectations up to the third-order cumulants after baryon number conservation is taken into account. The lQCD calculations predict a significant deviation from the HRG model calculations for the 4th and higher order cumulants. The analysis of the 4th order cumulants is ongoing using a factor of 10 more data collected in 2018, while the measurement of the 6th and higher order cumulants will be discussed in view of the High Luminosity LHC (HL-LHC) starting in 2022 and the future ALICE 3 detector scheduled to operate in the 2030s after the Long Shutdown 4 of the LHC.

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