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Dynamical fluctuations near the QCD critical point and their impact on the net-proton kurtosis

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We investigate the kurtosis of the net-proton number and the chiral order parameter within the model of nonequilibrium chiral fluid dynamics for a crossover scenario near the critical point. Our model describes the interplay between a dynamical order parameter and a quark-gluon fluid during the expansion of the hot fireball created in a heavy-ion collision. A subsequent particlization process allows us to study experimental observables via an event-by-event analysis. We aim at understanding the different impact of two distinct sources of fluctuations: First, initial state fluctuations and second, critical fluctuations created at the phase transition. Our results show that only the latter ones help develop a characteristic signal in the net-proton kurtosis around the crossover transition. We demonstrate that a suppression of the kurtosis is related to the equilibrium signal for criticality as seen in the net-baryon number susceptibility. Although effects of finite size and inhomogeneity are present, the signal in the net-proton kurtosis develops clearly.

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