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(Non-)Critical fluctuation signals and their fate in heavy-ion collisions

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A major goal of ongoing experiments in heavy-ion physics is the exploration of the QCD phase diagram with the potential discovery of the QCD critical point. Here, fluctuation observables are considered to be promising quantities for achieving this goal. Present experimental results alone are however inconclusive and need to be accompanied by advanced theoretical calculations which capture the relevant aspects of heavy-ion collisions.

In this talk we address two main topics in this context: the dynamical modelling of fluctuations within fluid dynamics and the impact of late stage effects on the (non-)critical signals in the fluctuation observables. In the first part we report on the inclusion of fluctuations into the fluid dynamical evolution equations. We show that (thermal) noise can be consistently incorporated in fluid dynamics and check our results against known equilibrium fluctuations and analytical results for Bjorken flow. This framework also allows one to study the evolution of critical fluctuations, for example by applying transport coefficients with critical behavior or by coupling the sigma-field to a fluid dynamical background. In the second part we assume that critical fluctuations have formed in the collision dynamics according to universality arguments and parametrizations of the correlation length. We study how resonance decay and regeneration as well as the distance of the system's trajectory and the chemical freeze-out from the critical point alter the signals that are expected to be seen in net-proton and net-charge fluctuations.

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