Contribution ID: **77** Type: **Poster**

Time-evolution of fluctuations as signal of the phase transition dynamics in a QCD-assisted transport approach

Monday, 21 May 2018 18:30 (0 minutes)

For the understanding of the fluctuation measurements in heavy-ion collisions it is crucial to develop quantitatively reliable dynamical descriptions. In order to study the phase transition, both in crossover regime as well as near the conjectured QCD critical point, the non-perturbative nature needs to be fully included. In this talk, we outline a novel QCD-assisted transport approach based on non-equilibrium chiral fluid dynamics and the effective action of low energy QCD. This approach makes use of the full equilibrium correlation functions and includes dissipation and stochastic noise.

We test the new framework within a low energy effective mesonic theory. For this case, we discuss the time evolution of fluctuation observables based on the higher-order moments such as the skewness and kurtosis as the system passes through the phase boundary. In this way, we can study details of the equilibration of the order parameter and of higher-order correlations, as well as the impact of critical slowing down on the correlation length. The underlying theory naturally includes critical and non-critical contributions. We can, therefore, explicitly test the size of the critical region, where scaling and dynamical scaling hold. Finally, the relative effect of critical versus baseline contributions to the fluctuation dynamics is quantified.

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Session Classification: Poster Session