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Hydrodynamic description of heavy ion collisions using the EKRT model with dynamical decoupling

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In the EKRT model for ultrarelativistic heavy-ion collisions, we compute the initial fluctuating QCD-matter energy densities from NLO pQCD and saturation, and describe the subsequent space-time evolution of the system with dissipative fluid dynamics, event by event [1,2,3]. This model agrees remarkably well with the low-p_T flow observables measured in Pb+Pb and Xe+Xe collisions at the LHC, and Au+Au collisions at RHIC, in the centrality range 0-50 %. To extend this validity range further, and to perform a simultaneous comparison of the centrality dependence of hadronic multiplicities, p_T spectra and various flow correlators against the latest LHC and RHIC data, we have now improved the fluid-dynamics part of the model significantly [4]. An essential new feature is the dynamical freeze-out that accounts both for a local Knudsen-number based criterion, and for a global criterion set by the overall size of the system. Importantly, our model is based purely on hydrodynamics also in the hadronic phase, so that a continuous parametrization of the temperature dependence of transport coefficients is possible. Adding a non-zero bulk viscosity and taking the chemical freeze-out at $T = 155$ MeV, we obtain a good simultaneous description of the average p_T and the proton multiplicity, and at the same time we show that the setup clearly improves the agreement with the $v_n\{2\}$ LHC measurements in peripheral collisions while maintaining the earlier good agreement with other flow correlations. We also show that bulk viscosity together with the dynamical freeze-out clearly improves the quantitative description of the recently measured p_T, v_n correlations.

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[4] H. Hirvonen, K. J. Eskola, H. Niemi, in preparation

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