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# Temperature dependence of $\eta/s$: Constraints from Xe+Xe collisions and uncertainties from the equation of state

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Recent advancements in multi-parameter model-to-data comparison have provided notable constraints on the temperature dependence of the shear viscosity over entropy density ratio $\eta/s$ in the matter produced in the Pb+Pb collisions at the LHC. Bayesian analysis with a flexible initial state parametrization [1,2] supports a linear temperature dependence of $\eta/s$ found in the earlier study using the EKRT pQCD + saturation + hydrodynamics model [3]. However, some open issues yet remain. The uncertainties regarding the value of $\eta/s$ increase quickly towards higher temperatures, and it remains unexplored how much the choice of the equation of state affects the final outcome of the global analysis.

The recently performed LHC Xe+Xe run at $\sqrt{s_{NN}} = 5.44$ TeV introduces a new nuclear mass number and a new maximum collision energy for the heavy ion collisions, and consequently adding Xe+Xe data to the analysis has potential to further constrain $\eta/s(T)$. We perform a global model-to-data comparison on Au+Au, Pb+Pb, and Xe+Xe collisions at $\sqrt{s_{NN}} = 200$ GeV, $2.76$ TeV, $5.02$ TeV and $5.44$ TeV, respectively, using a hydrodynamics model with the EKRT initial state, and the same parametric form for $\eta/s(T)$ as in Ref. [3]. Furthermore, to quantify the amount of uncertainty incorporated in the choice of EoS, we compare analysis results based on three different equations of state: the well known s95p parametrisation [4], an updated parametrisation based on the same list of particles, but recent lattice results [5] for the partonic EoS, and an updated parametrisation based on the Particle Data Group 2016 particle list and the recent lattice results.

References:

[1] Bernhard et al., PRC 94, 024907 (2016)
[2] Bass et al., NPA 967, 67 (2017)
[3] Niemi et al., PRC 93, 024907 (2016)
[4] Huovinen and Petreczky, NPA 837, 26 (2010)
[5] Bazavov et al., arXiv:1710.05024 and
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