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Temperature and net baryochemical potential dependence of η/s in a hybrid approach

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In this work, the qualitative impact of the net baryochemical potential dependence of the shear viscosity to entropy density ratio η/s in hydrodynamical simulations is studied. The effect of a predicted non-constant $\eta/s(\mu_B)$ is largely unexplored in hydrodynamic simulations. Previous studies focus only on a temperature dependence[1-3] or even only a constant effective shear viscosity[4]. This work addresses this issue by studying qualitatively the effect of a generalized $\eta/s(T, \mu_B)$ in the novel hybrid approach SMASH-vHLLE, composed of the hadronic transport approach SMASH[5] and the (3+1)d viscous hydrodynamic code vHLLE[6]. In order to reduce the bias of the result on the equation of state used in the hydrodynamic part of the model, η/s is parameterized directly in the energy density and baryon number density. The parameterization takes into account the constraints of matching to the transport coefficients in the hadronic phase[7], as well as of recent Bayesian analysis results. This work compares the impact of the density dependence for different system sizes and energies and constrains the behaviour of $\eta/s(T, \mu_B)$ by ruling out regions of the parameter space. This is achieved by comparing the observables with experimental results in the RHIC - BES region $\sqrt{s_{NN}}$ = 4.3 - 17.3 GeV, as the effect of this generalisation is especially relevant for intermediate collision energies, for which the system is in equilibrium for a relevant amount of time, but the net baryochemical potential does not vanish.

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Primary authors: GÖTZ, Niklas (Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany; Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany); ELFNER, Hannah (GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany;Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany; Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany)

Presenter: GÖTZ, Niklas (Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany; Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany)

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