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Shear Viscosity: Renormalization of the EMT in Full QCD

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The determination of shear viscosity in quark-gluon plasma from first principle has remained one of the most challenging problems for decades, despite its significant importance in research fields such as hydrodynamics and cosmology. It has been studied in pure-gluon theory on the lattice, but its investigation in full QCD is particularly complex. One of the main reasons for this complexity is the renormalization of the energy-momentum tensor (EMT) on the lattice. In this work, we use the gradient flow method to construct the renormalized EMT. In full QCD, the shear viscosity requires one extra renormalization coefficient, arising from the fermionic component of the EMT. We use enthalpy density to fix these renormalization coefficients using an imaginary isospin chemical potential. We measure the number density to obtain the pressure and then the interaction measure to determine the enthalpy density on the lattice. The corresponding EMT component is then measured to fix the lattice renormalization. Finally, we report progress on extracting the renormalization coefficients and discuss their connection to shear viscosity.

Parallel Session (for talks only)

QCD at nonzero temperature and density

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