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Sparse modeling approach to obtaining the shear viscosity from smeared correlation functions

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We propose the sparse modeling method to estimate the spectral function from the smeared correlation functions. We give a description of how to obtain the shear viscosity from the correlation function of the renormalized energy-momentum tensor (EMT) measured by the gradient flow method ($C(t,\tau)$) for the quenched QCD at finite temperature. The measurement of the renormalized EMT in the gradient flow method reduces a statistical uncertainty thanks to its property of the smearing. However, the smearing breaks the sum rule of the spectral function and the over-smeared data in the correlation function may have to be eliminated from the analyzing process of physical observables. In this work, we demonstrate that the sparse modeling analysis in the intermediate-representation basis (IR basis), which connects between the Matsubara frequency data and real frequency data. It works well even using very limited data of $C(t,\tau)$ only in the fiducial window of the gradient flow. We utilize the ADMM algorithm which is useful to solve the LASSO problem under some constraints. We show that the obtained spectral function reproduces the input smeared correlation function at finite flow-time. Several systematic and statistical errors and the flow-time dependence are also discussed.
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