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Transport coefficients of causal dissipative relativistic hydrodynamics in quenched lattice simulations

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The viscous coefficients are input of the calculation of the relativistic dissipative hydrodynamics and should be given by a microscopic theory.

It is known that the coefficients will be calculated by the Green-Kubo-Nakano (GKN) formula if the fluid is described by the relativistic Navier-Stokes (RNS) equation.
However, we cannot apply the RNS theory because this theory is acausal and unstable.
To avoid these difficulties, we have to consider the effect of retardation by introducing the relaxation time.
Theories of this type are called causal dissipative relativistic fluid dynamics (CDRF).
Thus, to implement numerical simulations of CDRF, we have to give not only shear and bulk viscosities but also the relaxation times.

Recently, a new microscopic formula to calculate the transport coefficients of CDRF from time-correlation functions was proposed [1].
This formula is the analogue of the GKN formula in Navier-Stokes fluids.
In this work, we study the transport coefficients of CDFR using the new formula in lattice simulations of SU(3) gauge theory.
The simulations are performed on 24^3x4–8 lattices with bare coupling \beta = 6.0, which corresponds to the temperature range of 260–520 MeV.
We will discuss temperature dependence of the transport coefficients.

[1] T. Koide, E. Nakano and T. Kodama, PRL103, 052301 (2009); G. S. Denicol, X. G. Huang, T. Koide and D.H.Rischke, arXiv:1003.0780.

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