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Hydrodynamic matrix for Yukawa Fluids in the Generalized Hydrodynamics Framework

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A hydrodynamic matrix is a coefficient matrix in the system of equations relating the microscopic density, current and temperature to their respective equilibrium values in terms of various transport coefficients such as thermal diffusion, viscosity and acoustic speeds etc. The hydrodynamic matrix for a fluid can be derived from the fluid momentum equation supplemented with energy and density conservation laws. An autocorrelation function of the quantities such as density and current can be derived analytically from the hydrodynamic matrix which can be used in various Green-Kubo relations and MD simulations. In the present work, we present the derivation of the hydrodynamic matrix for Yukawa fluids using the generalized hydrodynamic model which properly includes the strong coupling and visco-elastic memory effects. A method to obtain the density autocorrelation function (DAF) for Yukawa fluids from the hydrodynamics matrix is also presented. The extension of the present approach to other fluids has also been discussed along with applications of analytically obtained DAF to Molecular dynamics simulations to estimate thermodynamic parameters of the system.

References

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