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General equilibrium second-order hydrodynamic coefficients for quantum fields

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The quark-gluon plasma created in heavy ion collisions can be described as a relativistic fluid with high values of acceleration and vorticity and, in such extreme local equilibrium conditions, the standard hydrodynamic equations are expected to receive corrections from the non-ideal non-dissipative terms of the stress-energy tensor.

We show how these corrections can be obtained in a systematical way by performing a perturbative expansion around the homogeneous global equilibrium condition for small values of acceleration and vorticity. The final outcome is that the thermodynamic coefficients associated with these corrections can be expressed in term of euclidean correlators of the stress-energy tensor operator and the generators of the Lorentz group.

These correlators can in principle be estimated nonperturbatively by lattice QCD techniques and we will present the analytic results that can be obtained in two cases: a free scalar charged field and a free Dirac field, both massive and massless.

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