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# Non-dissipative corrections to energy-momentum tensor for a relativistic fluid

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We show that the stress-energy tensor has additional terms with respect to the ideal form in states of global thermodynamic equilibrium in flat spacetime with non-vanishing acceleration and vorticity. These corrections are of quantum origin and their leading terms are second order in the gradients of the thermodynamic fields. Their relevant coefficients can be expressed in terms of correlators of the stress-energy tensor operator and the generators of the Lorentz group. With respect to previous assessments, we find that there are more second-order coefficients and that all thermodynamic functions including energy density receive acceleration and vorticity dependent corrections. We have calculated the corrections for a free real scalar field—both massive and massless- and also for complex scalar field and Dirac field with finite chemical potential, and are generally non-vanishing also for a free theory.
Finally, these nonideal terms depend on the explicit form of the stress-energy operator, implying that different stress-energy tensors are thermodynamically inequivalent.

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