

L4 bound for the energy density in thermal field theory

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Lower bounds to the energy density are of fundamental importance for physics (laws of thermodynamics, stability of spacetimes, etc) and for mathematics (self-adjointness of quantum fields, etc). In the case of thermal field theory, where particles and holes are both present and contribute to the energy density of the system, it is not expected that the energy density, or rather the Liouvillian density, fulfills energy inequalities in the usual sense.

However, when the estimate is weighted with the modular Hamiltonian of the theory, a certain positivity is retained. We call this a quantum L4 inequality. We will show that in the thermal representation of the free massive scalar field, such an inequality is fulfilled by the quantum generator of the time evolution of the theory in this sector.