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Quantum field corrections to the equation of state of freely streaming matter in the FLRW space-time

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We calculate the energy density and pressure of a scalar field after its decoupling from a thermal bath in the spatially flat Friedman- Lemaître-Robertson-Walker space-time, within the framework of quantum statistical mechanics. By using the density operator determined by the condition of local thermodynamic equilibrium, we calculate the mean value of the stress-energy tensor of a real scalar field by subtracting the vacuum expectation value at the time of the decoupling. The obtained expressions of energy density and pressure involve corrections with respect to the classical free- streaming solution of the relativistic Boltzmann equation, which may become relevant even at long times. We present preliminary numerical and analytical results for the quantum corrections of energy density and pressure for specific expansion rates $a(t)$. From [arXiv:2212.05518 [gr-qc]]

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