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Fundamental limits for cooling of linear quantum refrigerators

I study the asymptotic dynamics of a network ofoscillators whose frequencies and couplings are periodically driven while coupled with a number of bosonic reservoirs. I obtain exact results for the heat currents coming into the system from each reservoir (valid beyond the usual weak coupling, weak driving or Markovian approximations). I use these expressions to rigorously prove the validity of the dynamical version of the third law of thermodynamics (Nernst unattainability principle) in this context. The fundamental limit for cooling is imposed by a heating process which is present at zero temperature. It consists of the non resonant creation of pairs of excitations in the reservoirs by the driving field. It is intrinsically quantum, it is linked to the dynamical Casimir effect and it is not captured by usual perturbative treatments. Thus, for any cooling strategy there is a minimum attainable temperature, that we estimate for some relevant examples.