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Kinetic theory and quantum electrodynamics at high temperature

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Abstract

We show that, in the limit of high temperature, long-wavelength excitations of an ultra-relativistic plasma composed of electrons, positrons and photons, are described by simple kinetic equations. In this limit, polarization effects are entirely due to particles carrying momenta of order T , while the typical momentum of a collective excitation is of order $eT \hat{a}^3 T$. In ordinary plasmas, collective oscillations can be described in terms of fluctuations of the particle number densities. In the case of ultrarelativistic plasmas, it appears natural to consider also fluctuations in an amplitude which mixes photonic and electronic degrees of freedom. In leading order the theory yields the effective action of hard thermal loops by Taylor and Wong.



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- 1 CNRS.

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