

Effective field theory techniques applied to the hard scales of the plasmas

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We show that effective field theory techniques can be applied in the high temperature T plasmas to improve the accuracy of the physics of the hard scales (or scales of order T). At leading order in the coupling constant the hard scales of the plasma can be viewed as on-shell classical particles. Based on this observation, and without any reference to the state of the system, we derive an effective field theory describing the quantum fluctuations around an on-shell fermion with energy p , described as a set of high dimension operators over the on-shell energy p . When applied to systems close to equilibrium, when for most on-shell particles $p \sim T$, we show that the on-shell effective field theory (OSEFT) properly describes the HTL photon polarization tensor of QED, and its $1/T$ corrections. We also show how with the OSEFT one can derive quantum corrections to classical transport equations.

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