ON THE APPLICATION OF THE NONLINEAR CHIRAL σ-MODEL IN HOT AND DENSE MATTER

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There are several advantages to look upon the linear chiral Lagrangian as the starting point in describing hot and dense matter [1,2]. We follow the approach introduced by Weinberg and Schwinger [3,4]. Starting with the renormalizable linear theory, we redefine the fields using a highly nonlinear transformation of the Weinberg type. To this new representation we add an expression whose shape is motivated by Ref. [5].

$$\begin{aligned}\mathcal{L} = \overline{N}\Big[i\gamma_\mu\partial^\mu - g\phi' + \left(1+\xi^2\right)^{-1}\left(\gamma_5\gamma_\mu\vec{\tau}\partial^\mu\vec{\xi} - \gamma_\mu\vec{\tau}\left(\vec{\xi}\times\partial^\mu\vec{\xi}\right)\right)\Big]N + \\ + 2^{-1}\left[\left(\partial^\mu\phi'\right)^2 + 4\phi'\left(\partial^\mu\vec{\xi}\right)^2\left(1+\xi^2\right)^{-2}\right] - \\ - 2^{-1}\mu^2\phi'^2 - 2^{-2}\lambda^2\phi'^4 + \left(1+\xi^2\right)^{-1}\left(1-\xi^2\right)^2 c\phi' + \delta\alpha c^2\phi'^{-2}\end{aligned}$$

N corresponds to the transformed nucleon, ϕ' and $\vec{\xi}$ to the transformed scalar and pseudoscalar fields, respectively.

It is our goal to determine the renormalized effective action in one-loop approximation. Furthermore, we compare the meson propagators of the scalar and the pseudoscalar field in the linear theory with those in the nonlinear representation to discuss their equivalence.

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