Effective Kaon Mass in Dense Baryonic Matter: Role of Correlations ◇

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We evaluate the effective kaon masses in dense nuclear matter. Pauli blocking and nucleon-nucleon short-range correlations are incorporated. The effects of short-range correlations are shown to be moderate and figure importantly only at densities larger than 2 times normal nuclear density. We discuss the relations between the present results and the results obtained in next-to-next-to-leading order chiral perturbation theory ($O(Q^3)$, where Q is the characteristic small energy-momentum scale probed). We also discuss mean-field aspects, with some remarks on the relation between the short-range correlations and the four-Fermi contact terms in the chiral effective Lagrangian.

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Hard Exclusive Meson Production and Nonforward Parton Distributions ◇

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We present an analysis of twist-2, leading order QCD amplitudes for hard exclusive leptoproduction of mesons in terms of double/nonforward parton distribution functions. After reviewing some general features of nonforward nucleon matrix elements of twist-2 QCD string operators, we propose a phenomenological model for quark and gluon nonforward distribution functions of nucleons. The corresponding QCD evolution equations are solved in the leading logarithmic approximation for flavor nonsinglet distributions. We derive explicit expressions for hard exclusive π^0, η, and neutral vector meson production amplitudes and discuss general features of the corresponding cross sections.

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Modification of the ϕ-Meson Spectrum in Nuclear Matter ◇

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The vacuum spectrum of the ϕ-meson is characterized by its decay into $\bar{K}K$. Modifications of the $\bar{K}$-loops in baryonic matter change this spectrum. We calculate these in-medium modifications taking both s- and p-wave kaon-nucleon interactions into account. We use results of the in-medium K and $\bar{K}$ spectra determined previously from a coupled channel approach based on a chiral effective Lagrangian. Altogether we find a very small shift of the ϕ-meson mass, by less than 10 MeV at normal nuclear matter density $\rho = \rho_0$ is reduced to less than 5 fm/c. It should therefore be possible to observe medium effects in reactions such as $\pi^- p \to \phi n$ in heavy nuclei, where the ϕ-meson can be produced with small momentum.

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