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\phi$ meson mass and decay width in nuclear matter and nuclei

Abstract

The mass and decay width of the ϕ meson in cold nuclear matter are computed in an effective Lagrangian approach. The medium dependence of these properties are obtained by evaluating kaon-antikaon loop contributions to the ϕ self-energy, employing the medium-modified kaon masses, calculated using the quark-meson coupling model. The loop integral is regularized with a dipole form factor, and the sensitivity of the results to the choice of cutoff mass in the form factor is investigated. At normal nuclear matter density we find a downward shift of the ϕ mass by a few percent, while the decay width is enhanced by an order of magnitude. For a large variation of the cutoff mass parameter, the results for the ϕ mass and the decay width turn out to vary very little. Our results support results in the literature which suggest that one should observe a small downward mass shift and a large broadening of the decay width. In order to explore the possibility of studying the binding and absorption of ϕ mesons in nuclei, we also present the single-particle binding energies and half-widths of ϕ-nucleus bound states for some selected nuclei.

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