Mass modification of D-meson at finite density in QCD sum rule

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Abstract

We evaluate the mass shift of isospin-averaged D-meson in the nuclear medium. Borel-transformed QCD sum rules are used to describe an interaction between the D-meson and a nucleon by taking into account all the lowest dimension-4 operators in the operator product expansion (OPE). We find at normal matter density the D-meson mass shift is about 10 times (~ 50 MeV) larger than that of J/ψ. This originates from the fact that the dominant contribution in the OPE for the D-meson is the nucleon matrix element of $m_c\bar{q}q$, where m_c is the charm-quark mass and q denotes light quarks. We also discuss that the mass shift of the D-meson in nuclear matter may cause the level crossings of the charmonium states and the $D\bar{D}$ threshold. This suggests an additional mechanism of the J/ψ suppression in high energy heavy-ion collisions.