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Vector mesons spectrum in a medium with a chiral imbalance induced by the vacuum of fermions

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The chiral imbalance defined as a difference between the numbers of RH and LH quarks may occur in the fireball after a heavy-ion collision at high energy. It can lead to the formation of a local parity breaking LPB in a quark-hadron medium and adiabatically characterized by a topological charge and, accordingly, a topological (chiral) chemical potential μ_5 . In the field theory, it can be considered as a time-like axial-vector b_μ coupled to a fermion field with its zero component associated with μ_5 . The consistent way for the construction of the Lagrangian in the presence of constant axial-vector background has been obtained in [1, 2] for QED theory.

In this report, for the description of the properties of light vector mesons in the presence of LPB in a fireball, the vector-meson dominance model is applied in the lightest SU(2) sector. Employing the approach, developed in [1, 2], to the vector ρ and ω mesons, we obtain the mass spectrum as a function of momentum and chiral chemical potential μ_5 . We show that in addition to the Chern-Simons term [3], splitting the transverse polarisations of the mesons, there is an additional contribution that becomes important at momentum and μ_5 around a few hundred MeV.

References:

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