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Dilepton production rates by pion-pair annihilation in inhomogeneous chiral condensed phase

One of the major themes in QCD is to elucidate the QCD phase diagram with temperature and density. The possibility of inhomogeneous chiral condensation in low-temperature and high-density regions has been discussed using effective models such as the Nambu-Jona-Lasinio model. It has also been pointed out that the dispersion relation of Nambu-Goldstone bosons may change in this phase. Therefore, we focus on the dilepton production by charged pion-pair annihilation in heavy ion collision experiments, as an approach that may be possible experimentally.

In this study, we assume a dual chiral density wave as an inhomogeneous chiral condensate, and start from a low energy effective Lagrangian expanded with respect to the order parameter based on $O(4)$ symmetry. We, then, derive the dispersion relation of the Nambu-Goldstone modes in inhomogeneous chiral condensed phase. The derived dispersion relations have an angular dependence on the modulation wave number vector, and the corresponding modes appear as mixings of modes of broken symmetries due to inhomogeneous condensation.

Using the obtained dispersion relation of the modes corresponding to charged pions, we calculate dilepton production rates by charged pion-pair annihilation for an invariant mass. We compare obtained results with the results of the dilepton production rates of homogeneous chiral condensed phase and show how it changes.

session

G. Heavy Ion Physics

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