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Various corners of QCD phase diagram

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QCD phase diagram and in particular color superconducting phenomnon has been considered with non-zero chiral imbalance in the framework of effective model. Isospin as well as two types of chiral imbalance has been considered. It is a continuation of our studies of the same situation but in 2 color QCD, JHEP 06 (2020) 148, Phys.Rev.D 106 (2022) 4, 045008.

It was investigated how the chiral imbalance affects the phase of the color superconductivity. It has been shown that chiral imbalance leads to the appearance of color superconductivity in dense quark matter at lower values of baryon chemical potentials than in a chirally symmetric medium.

It is shown that the behavior of the color superconductivity phase in QCD, in the three color case N_c=3 qualitatively coincides with the behavior of diquark condensation in the 2 color case N_c=2 in a more complex mode when there are several different non-zero chemical potentials.

It was shown that the phenomenon of color superconductivity, which plays an important role in region of high baryonic densities, does not violate the previously found duality between chiral symmetry breaking and charged pion condensation.
Moreover, in connection with this duality, the chiral imbalance mu_I5 and the isotopic mu_I imbalances have exactly the same effect on the diquark condensation phenomenon.
Despite the fact that the thermodynamic potential in the case of N_c=3 does not have properties of dualities between the phenomena of pion and diquark condensation and between chiral symmetry breaking and diquark condensation phenomena found at study of the phase portrait in the two-color case, it turned out (that it is enough
surprising) that the phase portrait qualitatively contains duality (the dualities are not exact as in N_c=2, but they are unambiguously guessed in the phase portrait).

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