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Thermomagnetic correlation lengths of strongly interacting matter in the Nambu–Jona-Lasinio model

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We study the correlation length between test quarks with the same electric and color charges in the Nambu–Jona-Lasinio model, considering thermal and magnetic effects. We extract the correlation length from the quark correlation function. The latter is constructed from the probability amplitude to bring a given quark into the plasma, once a previous one with the same quantum numbers is placed at a given distance apart. For temperatures below the transition temperature, the correlation length starts growing as the field strength increases to then decrease for large magnetic fields. For temperatures above the pseudocritical temperature, the correlation length continues increasing as the field strength increases. We found that such behavior can be understood as a competition between the tightening induced by the classical magnetic force versus the random thermal motion. For large enough temperatures, the increase of the occupation number contributes to the screening of the interaction between the test particles. The growth of the correlation distance with the magnetic field can be understood as due to the closer proximity between one of the test quarks and the ones popped up from vacuum, which in turn appear due to the increase of the occupation number with temperature.

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