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Determining the chiral crossover by the Mott transition of Goldstone bosons

Summary

In the physical world, the chiral restoration is a smooth crossover. We discuss the proper definition for the chiral crossover, based on the Goldstone's theorem. Different from the usually used maximum change of chiral condensate, we propose to define crossover temperature by the Mott transition of Goldstone bosons. The order parameter and Goldstone mode of chiral symmetry at finite temperature, chemical potential and magnetic field are investigated in frame of a Pauli-Villars regularized NJL model. It is observed that the chiral crossover occurs in the whole $T - \mu_q$ plane, without the critical end point. A stable inverse magnetic catalysis for the chiral crossover temperature is obtained under external magnetic field. We suggest Lattice QCD considering the meson Mott transition at finite temperature and magnetic field in the future, which has no difficulty in principle.

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