

Exploring the phase diagram of QCD with two massless quarks with an effective theory

Thursday, 17 December 2020 16:15 (0:25)

Content

Nonzero baryon density QCD lattice simulations suffer from the well known sign problem, which has so far prevented the exploration of the QCD phase diagram. In this talk we discuss our results on the phase diagram of the 3d $O(4)$ model. This model is an effective theory of QCD with two flavors in the chiral limit, which can be simulated at nonzero baryon density without sign problem. In this model the baryon number is represented by the topological charge of its field configurations. The global symmetry of this model is spontaneously broken down to $O(3)$, which is locally isomorphic to and presumably in the same universality class as the chiral symmetry breaking in QCD with two massless quarks, $SU(2)_L \otimes SU(2)_R \rightarrow SU(2)_{L=R}$. At vanishing m_B we obtain the critical temperature $T_c = 154.6(4)$ MeV, consistent with previous lattice studies. We could follow the line of the second order phase transition up to $m_B = 363$ MeV and $T_c = 125$ MeV. At this point, we observed possible indications of a transition to first order. We did not find solid evidence for any m_B -dependence of the critical exponents.

Area of contribution

Theory and Phenomenology

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Session Classification : Theory and Phenomenology