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Determination of the CP restoration temperature at $\theta = \pi$ in 4D SU(2) Yang-Mills theory through simulations at imaginary θ

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The 't Hooft anomaly matching condition provides constraints on the phase structure at $\theta = \pi$ in 4D SU(N) Yang-Mills theory. In particular, assuming that the CP symmetry is spontaneously broken at low temperature, it cannot be restored below the deconfining temperature at $\theta = \pi$. Here we investigate the CP restoration at $\theta = \pi$ in the 4D SU(2) case and provide numerical evidence that the CP restoration occurs at a temperature higher than the deconfining temperature unlike the known results in the large- N limit, where the CP restoration occurs precisely at the deconfining temperature. The severe sign problem at $\theta = \pi$ is avoided by focusing on the tail of the topological charge distribution at $\theta = 0$, which can be probed by performing simulations at imaginary θ . In addition to this analysis, we carry out an alternative analysis based on the analytical continuation with respect to θ and discuss the consistency of the obtained results.

Topical area

QCD at Non-zero Temperature

Primary author: HIRASAWA, Mitsuaki (INFN Milano Bicocca)

Co-authors: MATSUMOTO, Akira (Yukawa Institute for Theoretical Physics, Kyoto University); YOSPRAKOB, Atis (Niigata University); NISHIMURA, Jun (KEK, SOKENDAI); HATAKEYAMA, Kohta (Hirosaki University); HONDA, Masazumi (Yukawa Institute for Theoretical Physics)

Presenter: HIRASAWA, Mitsuaki (INFN Milano Bicocca)

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