Contribution ID: **217** Type: **Talk**

Phase diagram of 4D SU(3) Yang-Mills theory at $\theta = \pi$ via imaginary theta simulations

Tuesday 4 November 2025 15:50 (20 minutes)

It has been predicted that the CP symmetry of the 4D SU(3) Yang-Mills theory at $\theta = \pi$ is spontaneously broken in the confined phase, and it is recovered precisely at the deconfining temperature.
The direct simulation of the theory at $\theta = \pi$ is, however, difficult due to the sign problem.
Thus, we simulate the theory with an imaginary theta parameter and perform analytic continuation to the real theta to study the phase diagram.
We implement the stout smearing technique in the hybrid Monte Carlo simulation to recover the topological property of the gauge field.
The smearing-time dependence of the observable is investigated using the reweighting method with respect to the smearing step parameters, and a clear scaling behavior is observed.
The order parameter of the CP symmetry is then computed in the scaling region to detect symmetry breaking.
We report preliminary results of the expected CP breaking and restoration temperature.

Parallel Session (for talks only)

Vacuum structure and confinement

Author: MATSUMOTO, Akira (Graduate School of Science, Osaka Metropolitan University)

Co-authors: YOSPRAKOB, Atis (Yukawa Institute for Theoretical Physics); NISHIMURA, Jun (KEK, SOKENDAI); HIRASAWA, Mitsuaki (University of Milano-Bicocca)

Presenter: MATSUMOTO, Akira (Graduate School of Science, Osaka Metropolitan University)

Session Classification: Vacuum structure and confinement