

Complex Langevin analysis of four-dimensional SU(2) gauge theory with a theta term

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Gauge theory with a theta term has recently been of great interest, especially at $\theta = \pi$, where nontrivial phase structure is expected from the 't Hooft anomaly matching condition. However, it is difficult to study the theory numerically due to the severe sign problem. We try to overcome this by using the complex Langevin method. In our previous work, we apply the technique to the 2d U(1) gauge theory. We were able to reproduce the exact result by introducing a puncture on the torus. We also show that the effect of the puncture disappears in the infinite volume limit in the region $|\theta| < \pi$. In this study, we attempt to apply the method in the 4d SU(2) gauge theory and present some preliminary results.

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