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The path optimization for the sign problem of low dimensional QCD

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The path optimization has been proposed to weaken the sign problem which appears in some field theories such as finite density QCD. In this method, we optimize the integral path in the complex plain to enhance the average phase factor. This method has been applied to a one dimensional integral [1], finite density complex scalar field [2], and the Polyakov loop extended Nambu-Jona-Lasinio model with and without vector type interaction [3, 4]. In these cases, the average phase factor is enhanced significantly. In this talk, we discuss the application of this method to low dimensional QCD as a first step towards finite density QCD.

[1] Y. Mori, K. Kashiwa, A. Ohnishi, Phys. Rev. D 96 (2017), 111501(R).

[2] Y. Mori, K. Kashiwa, A. Ohnishi, PTEP 2018 (2018), 023B04.

[3] K. Kashiwa, Y. Mori, A. Ohnishi, Phys. Rev. D 99, no. 1, 014033 (2019).

[4] K. Kashiwa, Y. Mori, A. Ohnishi, arXiv:1903.03679 [hep-lat].

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