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Finite density QFT from a density-of-states perspective

Wednesday, March 9, 2016 5:00 PM (30 minutes)

For more than three decades, finite density quantum field theories have evaded first principle Monte-Carlo simulations due to the notorious sign-problem. The recent years have seen some remarkable progress towards the understanding of cold and dense quantum matter. The density-of-states approach aims to calculate the probability distribution of the imaginary part of the action. The partition function then appears as a Fourier integral of this density, which is carried out (semi-)analytically. The LLR method [1] is a Wang-Landau type of approach. We established that it features an exponential error suppression [2], which allows us to reliably estimate the density-of-states over hundreds of orders of magnitude. I review the results for a Z3 spin theory at finite densities [3], which serves as proof that the LLR method amasses enough precision to solve a strong sign problem. I will also address new results for QCD at finite densities of heavy quarks.

[1] Langfeld, Lucini and Rago, PRL 109 (2012) 111601, arXiv:1204.3243

[2] Langfeld, Lucini, Pellegrini and Rago, arXiv:1509.08391

[3] Langfeld, Lucini, PRD D90 (2014) 9, 094502, arXiv:1404.7187.

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