

Towards Lefschetz thimbles regularization of heavy-dense QCD

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At finite density, lattice simulations are hindered by the well-known sign problem: for finite chemical potentials, the QCD action becomes complex and the Boltzmann weight e^{-S} cannot be interpreted as a probability distribution to determine expectation values by Monte Carlo techniques. Different workarounds have been devised to study the QCD phase diagram, but their application is mostly limited to the region of small chemical potentials.

The Lefschetz thimbles method takes a new approach in which one complexifies the theory and deforms the integration paths. By integrating over Lefschetz thimbles, the imaginary part of the action is kept constant and can be factored out, while $e^{-\text{Re}(S)}$ can be interpreted as a probability measure. The method has been applied in recent years to more or less difficult problems. Here we report preliminary results on Lefschetz thimbles regularization of heavy-dense QCD. While still simple, this is a very interesting problem. It is a first look at thimbles for QCD, although in a simplified, effective version. From an algorithmic point of view, it is a nice ground to test effectiveness of techniques we developed for multi thimbles simulations.

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