



Contribution ID: 40

Type: Talk

Lefschetz-thimble approach to the Silver Blaze problem of one-site fermion model

Wednesday, July 27, 2016 9:20 AM (20 minutes)

Path integral on Lefschetz thimbles gets much attention in the context of the sign problem, because of its usefulness in order to study the system with the complex classical action nonperturbatively. After giving its brief introduction, it is applied for studying the sign problem of the one-site Hubbard model. This model has a severe sign problem, which looks quite similar to that of the finite-density QCD at low temperatures. We present the analytical study of the sign problem using the Lefschetz-thimble method, and also discuss the failure of the complex Langevin method. Furthermore, we give a speculation about the early-onset problem of the baryon number density, called the baryon Silver Blaze problem, based on similarity between the sign problems of one-site Hubbard model and of finite-density QCD.

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Session Classification: Nonzero Temperature and Density

Track Classification: Nonzero Temperature and Density