The 38th International Symposium on Lattice Field Theory

LATTICE 21

JULY 26-30 2021, ZOOM/GATHER@MIT

Contribution ID: **93** Type: **Oral presentation**

$\mathcal{PT}$ symmetry and patterns in finite-density QCD

Tuesday, 27 July 2021 21:45 (15 minutes)

We study the phase structure of effective models of finite-density QCD using analytic and lattice simulation techniques developed for the study of non-Hermitian and $\mathcal{PT}$-symmetric QFTs. Finite-density QCD is symmetric under the combined operation of the charge and complex conjugation operators $\mathcal{CK}$, which falls into the class of so-called generalized $\mathcal{PT}$ symmetries. We show that $\mathcal{PT}$-symmetric quantum field theories can support patterned ground-state field configurations in the vicinity of a critical endpoint. We apply our methods to a lattice heavy quark model at nonzero chemical potential that displays patterning behavior for a range of parameters. We derive a simple approximate criterion for the formation of these patterns, which can be used with lattice results.

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Session Classification: QCD at nonzero Temperature and Density

Track Classification: QCD at nonzero Temperature and Density