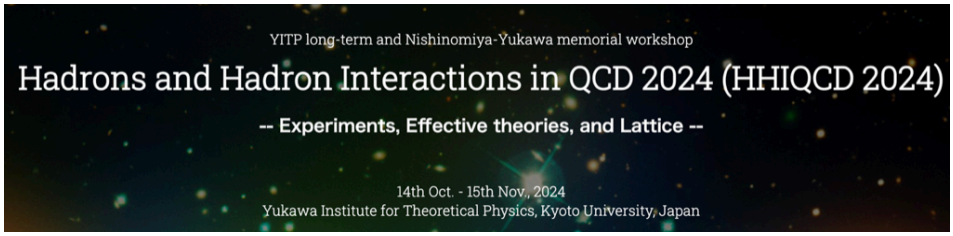


Contribution ID: **47** Type: **3rd week (Nishinomiya-Yukawa symposium)**

# Interplay between the weak-coupling results and the lattice data in dense QCD

*Thursday, October 31, 2024 3:30 PM (30 minutes)*

We discuss the interplay between two first-principles calculations of QCD at high density: perturbative results in the weak-coupling regime and the recent lattice-QCD result at finite isospin density. By comparing these two results, we verify empirically that the weak-coupling calculations of the bulk thermodynamics and the gap parameter for Cooper pairing between quarks can be applicable down to the quark chemical potential $\mu \sim 1$ GeV. Having verified the validity of the weak-coupling results in QCD at finite isospin density, we discuss possible effects on QCD at finite baryon density, which is relevant for the application to realistic environments such as neutron stars, by using the fact that QCD at finite baryon and isospin density have the common weak-coupling expansions. First, we show the size of the color-superconducting gap at finite baryon density is as small as a few MeV at $\mu = 1$ GeV, which implies that the color-flavor locked phase may be unstable against unpairing up to $\sim 1.4$ GeV even in the weak-coupling regime. We also introduce a prescription to reduce the ambiguity arising from the undetermined renormalization scale in the weak-coupling calculation by matching with the lattice-QCD data. We demonstrate the effect of such reduction on neutron-star phenomenology by performing the Bayesian analysis.

References:
[1] Y. Fujimoto, Phys. Rev. D 109, 054035 (2024)
[2] Y. Fujimoto, arXiv:2408.12514 [hep-ph]

**Primary author:** FUJIMOTO, Yuki (INT, University of Washington)

**Presenter:** FUJIMOTO, Yuki (INT, University of Washington)

**Session Classification:** Nishinomiya-Yukawa workshop