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Perturbatively Confined Phase of QCD under Imaginary Rotation

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In this talk, I will report our recent achievements based on refs. [1,2]. Below are highlights from our results.

Perturbative Confinement under Imaginary Rotation
We perturbatively calculated the Polyakov loop potential at high T with *imaginary* angular velocity. Under the rapid imaginary rotation, the potential favors zero Polyakov loop, i.e. confinement. In ref. [1], we found a phase transition to confinement around $\omega/T = i\pi/2$. Furthermore, we argued that this perturbatively confined phase can be smoothly connected to the hadronic phase.

Chiral Symmetry Breaking
In ref. [2], we introduced fermions and investigated the chiral phase transition. Our results show the spontaneous breaking of chiral symmetry in our previously found confined phase with imaginary angular velocity for any high T.

Inhomogeneity
In ref. [2], we also showed that the Polyakov loop potential exhibits an inhomogeneous distribution of the Polyakov loop. There should appear a spatial interface separating the confined phase and the deconfined phase in imaginary rotating systems. Although the analytical continuation to real rotation has some subtle points, the inhomogeneity can presumably persist in real rotating systems.

[1] S. Chen, K. Fukushima, and Y. Shimada, Phys.Rev.Lett. 129 (2022)
[2] S. Chen, K. Fukushima, and Y. Shimada, arXiv:2404.00965

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