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Local Polyakov-loop fluctuation and center domains in quark-gluon plasma with many colors

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The deconfinement transition in QCD is understood as the spontaneous breaking of \mathbb{Z}_N symmetry at high temperatures. Accordingly, quark-gluon plasma generally includes some partial cells called center domains, each with a homogeneous Polyakov-loop. In this work, constructing an effective action describing the deconfinement vacuum of QCD with N colors, we discuss the properties of center domains.

First, we evaluate the mass of local Polyakov-loop fluctuation and demonstrate that some fluctuation becomes a Nambu-Goldstone mode in the large- N limit. We also discuss surface tension between two \mathbb{Z}_N center domains. Second, we estimate the global vacuum-to-vacuum transition in a single center domain. We find that some threshold volume exists, where a domain larger than this volume is stable, and vice versa. Identifying the threshold as the lower bound of a stable center domain volume, we quantitatively argue the typical volume scale of center domains.

Topical area

QCD at Non-zero Temperature

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