Contribution ID: **38** Type: **Talk**

Direct numerical simulation of 't Hooft partition function and (de)confining phase

Tuesday 4 November 2025 17:00 (20 minutes)

We propose a novel approach to directly simulate the 't Hooft partition function and revisit the (de)confining phase structure of an $SU(N)$ gauge theory with the $\mathbb{Z}_N$ 1-form symmetry. We develop a hybrid Monte Carlo algorithm (the halfway HMC) for the $SU(N)/\mathbb{Z}_N$ gauge theory. The usual partition function $\mathcal{Z}[B]$ with 't Hooft flux B can be numerically computed by it. By regarding spatial-temporal components of B as electric fluxes E, the 't Hooft partition function $\mathcal{Z}_{\mathrm{tH}}[E;B]$ detects the quantum phase of the system. The numerical result shows that non-electric fluxes are light in the confining phase, while at finite temperature a nontrivial finite-size scaling and deconfining of $\mathcal{Z}_{\mathrm{tH}}[E;B]$ can be observed. The Witten effect also indicates the oblique confinement at $\theta = 2\pi$.

Parallel Session (for talks only)

Vacuum structure and confinement

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