Monte Carlo studies of the phase transition of finite-temperature large-N gauge theory

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with Takeshi Morita and Shingo Takeuchi

Finite-temperature matrix quantum mechanics:

$$Z = \int dX_i dA e^{-S_{\rm YM}}, \quad \text{where}$$

$$S_{\rm YM} = N \int_0^{\frac{1}{T}} dt \left\{ \frac{1}{2}{\rm tr} \sum_{i=1}^{D} (D_t X_i(t))^2 - \frac{1}{4}{\rm tr} \sum_{i,j=1}^{D} [X_i(t), X_j(t)]^2 \right\}.$$

So far, difficult to understand analytically.
⇒ Calculation by $1/D$ expansion was proposed.

G. Mandal, M. Mahato and T. Morita, arXiv:0910.4526,

G. Mandal and T. Morita, arXiv:1103.1558

$1/D$ expansion ⇒ approximation at $D \to +\infty$, finite N (N=matrix size).
How reliable is $1/D$ expansion?

- **Behavior of small D ⇒ is it explained by $1/D$ expansion?**
- **Dependence of the order of phase transition and critical temperature on D.**