QUARK MATTER 2015
Sep. 27 – Oct. 3, 2015 Kobe, Japan

Contribution ID: **669** Type: **Poster**

Baryon number cumulant ratios at finite density in the strong-coupling lattice QCD

Tuesday 29 September 2015 16:30 (2 hours)

Cumulants of conserved charges contain information of fluctuations
across the phase boundary, then can be the signal of criticality of the QCD phase
transition. The net-proton number cumulant ratios observed at RHIC show non-monotonic
behavior as a function of the incident energy.
In order to confirm the conjecture that the non-monotonic behavior could suggest the existence of the QCD critical point [1], we need calculation of cumulant ratios
hopefully in lattice QCD at finite density.

We have recently calculated the cumulant ratios of net baryon numbers
at finite density in the chiral limit in the strong-coupling lattice QCD [2].
Fluctuation effects beyond the mean field treatments are included
in the auxiliary field Monte-Carlo method [3].
We find that $\kappa\sigma^2$ show oscillatory behavior;
one negative valley around the phase boundary is sandwiched by
two positive peaks as a function of T.
With increasing lattice size,
the negative $\kappa\sigma^2$ region is narrowed while the amplitude grows.
This behavior may be in agreement with the potential surface argument [1]
and the scaling function analysis [4].

In the presentation, we will briefly introduce the strong-coupling lattice QCD,
and show results of higher-order cumulant ratios around the phase boundary.
We may also discuss recent developments including $1/g^2$ effects in the strong-coupling expansion.

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Session Classification: Poster Session

Track Classification: Correlations and Fluctuations