Объединенный институт ядерных исследований
ЛАБОРАТОРИЯ ТЕОРЕТИЧЕСКОЙ ФИЗИКИ
им. Н. Н. Боголюбова

Семинар
"ТЕОРИЯ АДРОННОГО ВЕЩЕСТВА ПРИ ЭКСТРЕМАЛЬНЫХ УСЛОВИЯХ"

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в аудитории им. Д. И. Блохинцева (4 этаж)

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Study of QCD Phase Diagram by Heavy Ion Experiments and Lattice QCD Experiments

To explore the QCD phase structure, we must study QCD at finite temperature and density. A first-principle calculation, lattice QCD, is expected to provide essential information, but it suffers from the so-called the sign problem. The fundamental tool of lattice QCD is Monte Carlo simulation of a path integral, but the measure is complex at finite chemical potential.

In order to avoid this problem, I propose a canonical approach, in which the grand partition function, $Z(\mu, T)$, is expanded as a polynomial of the fugacity, $\xi = \exp(\mu/T)$, where μ and T are chemical potential and temperature, respectively: $Z(\mu, T) = \sum_n Z_n(T)\xi^n$, and $Z_n(T)$ are the canonical partition functions.

Canonical partition functions are related to the net baryon distribution, which are measured in high energy nuclear reactions, although the experimentally measured quantity is the net-proton distribution. Nevertheless, the net-proton multiplicity may be a proxy of the net baryon distribution. Other observables, such as the net-charge fluctuation and the net-strangeness fluctuation, can be measured both in nuclear and lattice experiments.