The 38th International Symposium on Lattice Field Theory

LATTICE 21

JULY 26-30 2021, ZOOM/GATHER@MIT

Contribution ID: **243** Type: **Oral presentation**

New approach to lattice QCD at finite density: reweighting without an overlap problem

Tuesday 27 July 2021 05:30 (15 minutes)

All methods currently used to study finite baryon density lattice QCD suffer from uncontrolled systematic uncertainties in addition to the well-known sign problem. We formulate and test a method - sign reweighting - that works directly at finite chemical potential and is yet free from any such uncontrolled systematics: with this approach the only problem is the sign problem itself. In practice the approach involves the generation of configurations with the positive fermionic weights $|\mathrm{Redet}\mathrm{D}(\mu)|$ where $D(\mu)$ is the Dirac matrix and the signs $\mathrm{sign}\,(\mathrm{Redet}\mathrm{D}(\mu)) = \pm 1$ are handled by a discrete reweighting. Hence there are only two sectors, $+1$ and -1 and as long as the average $\langle \pm 1 \rangle \neq 0$ (with respect to the positive weight) this discrete reweighting has no overlap problem - unlike other reweighting methods - and the results are reliable. We will also present results based on this algorithm on the phase diagram of lattice QCD with two different actions: as a first test, we apply the method to calculate the position of the critical endpoint with unimproved staggered fermions at $N_\tau = 4$; as a second application, we study the phase diagram with 2stout improved staggered fermions at $N_\tau = 6$. This second one is already a reasonably fine lattice - relevant for phenomenology.

Primary authors: PASZTOR, Attila (Eötvös University); BORSANYI, Szabolcs (University of Wuppertal); FODOR, Zoltan (BUW); GIORDANO, Matteo (Eötvös Loránd University, Budapest); KAPAS, Kornel (Eotvos University); KATZ, Sandor (Eotvos University); NOGRADI, Daniel

Presenter: PASZTOR, Attila (Eötvös University)

Session Classification: QCD at nonzero Temperature and Density

Track Classification: QCD at nonzero Temperature and Density