



Contribution ID: 60

Type: Poster

QCD phase diagram for nonzero isospin-asymmetry

Monday, 21 May 2018 18:30 (0 minutes)

The QCD phase diagram is studied in the presence of an isospin asymmetry using continuum extrapolated staggered quarks with physical masses. In particular, we investigate the phase boundary between the normal and the pion condensation phases and the chiral/deconfinement transition. The simulations are performed with a small explicit breaking parameter in order to avoid the accumulation of zero modes and thereby stabilize the algorithm. The limit of vanishing explicit breaking is obtained by means of an extrapolation, which is facilitated by a novel improvement program employing the singular value representation of the Dirac operator. Our findings indicate that no pion condensation takes place above T 160 MeV and also suggest that the deconfinement crossover continuously connects to the BEC-BCS crossover at high isospin asymmetries.

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Session Classification: Poster Session