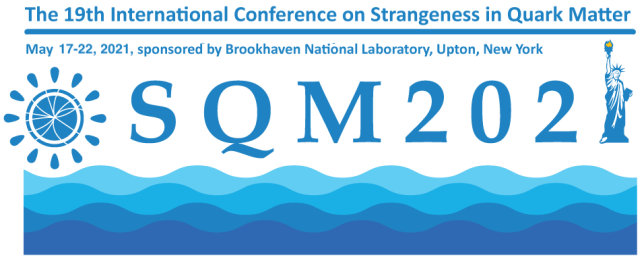

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Repulsive properties of hadrons in lattice QCD data and neutron stars

Thursday, May 20, 2021 10:30 AM (20 minutes)

Second order susceptibilities χ_{ij}^{11} of baryon, electric, and strangeness, B, Q, and S, charges, are calculated in the Chiral Mean Field (CMF) model and compared to available lattice QCD data. The susceptibilities are sensitive to the short range repulsive interactions between different hadron species, especially to the hardcore repulsion of hyperons. Decreasing the hyperons size, as compared to the size of the non-strange baryons, does improve significantly the agreement of the CMF model results with the Lattice QCD data. The electric charge-dependent susceptibilities are sensitive to the short range repulsive volume of mesons. The comparison with lattice QCD data suggests that strange baryons, non-strange mesons and strange mesons have significantly smaller excluded volumes than non-strange baryons.
The CMF model with these modified hadron volumes allows for a mainly hadronic description of the QCD susceptibilities significantly above the chiral pseudo-critical temperature.
This improved CMF model which is based on the lattice QCD data, has been used to study the properties of both cold QCD matter and neutron star matter.
The phase structure in both cases is essentially unchanged, i.e. a chiral first order phase transition occurs at low temperatures ($T_{\rm CP} \approx 17$ MeV), and hyperons survive deconfinement to higher densities than non-strange hadrons. The neutron star maximal mass remains close to $2.1 M_\odot$ and the mass-radius diagram is only modified slightly due to the appearance of hyperons and is in agreement with astrophysical observations.

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Collaboration

Primary author: Mr MOTORNENKO, Anton (Frankfurt Institute for Advanced Studies)

Co-authors: Mr PAL, Somenath (Department of Physics, University of Calcutta); Dr BHATTACHARYYA, Abhijit (University of Calcutta); Dr STEINHEIMER, Jan; STOECKER, Horst (GSI)

Presenter: Mr MOTORNENKO, Anton (Frankfurt Institute for Advanced Studies)

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