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"PARTICLE STATES"OF LATTICE QCD

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The results from HI collisions at RHIC and LHC indicate that the quark-gluon state formed is a strongly interacting one. Hagedorn had suggested that a strongly interacting system can be equivalently described as a system of non-interacting entities with corresponding masses. Given the above, we seek "particle/mass states", which could equivalently describe the equation of state of QCD matter.
Taking as input lattice calculations for (2+1) flavours, as well as for SU(3) gauge field, we develop an effective description of the lattice QCD pressure and specific entropy at zero baryon-chemical potential. We use two parameters: the number of states 'gt' and the average particle mass. The description is carried out for the inclusive 3-flavour system, as well as the gauge field sector and the quark sector.
The calculated parameters of the total and the quark systems have as their low temperature limit the corresponding parameters of the Hadron Resonance Gas (HRG). The number of states for all sectors (total, gluon and quark) converge, above T ≈ 230 MeV, close to the number of states of an ideal quark-gluon phase, indicating the existence of colour states at these conditions. The corresponding high average masses, however, suggest that the entities are strongly interacting.
The number of states 'gt' and the average mass of the system containing only quarks are found to decrease steeply with increasing temperature between T ≈ 150 and 160 MeV, an interval contained within the region of the chiral transition. The quality of the fit (value of $\chi 2$) can be used as a tool to locate regions of best effective descriptions in terms of the parameters 'gt' and average mass, as well as points of transition between them.

List of tracks

QCD phase diagram (BES)

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