Baryon number strangeness and electric charge fluctuations at zero and non-zero chemical potential

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We present results on baryon number, strangeness and electric charge fluctuations in QCD at non-zero density and temperature obtained from lattice calculations with almost physical quark masses. We evaluate these fluctuations on lines of constant entropy per baryon number (S/N_B) that characterize the expansion of dense matter created in heavy ion collisions and discuss different choices for the strangeness and electric charge chemical potential which might be appropriate to simulate the conditions met in heavy ion experiments. Furthermore, we will present the isentropic equation of state and comment on the phase diagram at finite chemical potential. We find that various hadronic fluctuations develop a peak with increasing baryon chemical potential. This seems to hold true also for strangeness fluctuations, although the peak is much less pronounced in this case. Moreover, at vanishing chemical potential, i.e. under conditions almost realized at RHIC and the LHC, quartic fluctuations of net baryon number and strangeness are large in a narrow temperature interval characterizing the transition region from the low to high temperature phase. Our results are based on Taylor expansions in light and strange quark chemical potentials, i.e. we rigorously compute corrections to bulk thermodynamic quantities at non vanishing chemical potential, by performing a Taylor expansion in μ/T. At present we calculate Taylor expansion coefficients up to the 8th order. The analysis is based on data generated in the context of the recent equation of state calculation of the RBC-Bielefeld Collaboration, preliminary results have been presented at the lattice conference, LATTICE 2007 [1].

References

[1] C. Miao and C. Schmidt, *"Bulk thermodynamics and charge fluctuations at non-vanishing baryon density," PoS(LATTICE 2007)* **175**, `arXiv:0710.4312 [hep-lat]`.

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