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The curvature of the chiral phase transition line at small values of the quark chemical potentials

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One of the goals of the ongoing Beam Energy Scan program at RHIC is to look for evidence of the conjectured QCD Critical Point. The feasibility of detecting the critical point however depends on how close the QCD chiral phase transition line is to the freeze-out curve. In the two-flavor chiral limit, this transition is expected to be second-order at zero and small values of μ, the quark chemical potential. The critical temperature T_c however, tends to decrease as μ is increased; this shift is characterized, for small values of μ, by the curvature of the transition line κ.

While the current lattice QCD results [1-5] on the curvature are significantly smaller than the phenomenological parametrization of the freeze-out line given by Cleymans and Redlich [6], it must be noted that they differ by more than a factor of two among themselves. In this talk, we will present an upper bound for the light and strange curvatures κ_q through extrapolation to the chiral limit. We work in 2+1-flavor QCD and with five different pion masses between 80 MeV $\leq m_\pi \leq$ 160 MeV. Our new results improve on our earlier result [1], both by working at a smaller lattice spacing and through the use of the HISQ action, which has considerably smaller cutoff effects than the actions that were previously used.

References

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