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Progress on the QCD chiral phase transition for various numbers of flavors and imaginary chemical potential

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The order of the thermal chiral phase transition in lattice QCD is strongly cutoff-dependent. A recent study from our group using mass-degenerate, unimproved staggered quarks on $N_\tau = \{4, 6, 8\}$ lattices found that the first-order regions shrink to zero for $N_\mathrm{f} \in [2, 6]$ as the continuum limit is approached for zero chemical potential. Here we present the progress of an analogous study at a fixed value of imaginary baryon chemical potential of $\mu_i = 0.81\frac{\pi T}{3}$. The same qualitative behavior as for zero chemical potential is found: The first-order regions disappear with decreasing lattice spacing in tricritical points and they are bounded by Z_2-critical lines which exhibit tricritical scaling for sufficiently small quark masses. The results predict a second order chiral phase transition in the continuum limit for $N_\mathrm{f} \in [2, 6]$ for both cases, at zero and imaginary chemical potential. Additionally an effective Ginzburg-Landau theory is developed around the tricritical point in the chiral limit. The possibility to encode the dependence of the Landau potential on the parameters of the lattice theory is explored.

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