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The temperature of the chiral phase transition in LQCD at its tricritical point

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The nature of the QCD phase transition in the chiral limit constitutes a challenging problem for lattice QCD as it is not directly simulable. Its study, however, provides constraints on the phase diagram at the physical point. Recently, the thermal transition for massless fermions was shown to be of second order for all numbers of flavours N_f
$lesssim 7$. For this, the lattice chiral limit was approached by mapping out the chiral critical surface separating the first-order region from the crossover region in an enlarged parameter space which consists of the gauge coupling, a variable number of quark flavours, their masses, and the lattice spacing. Based on simulations of lattice QCD with standard staggered quarks, it was found that for all N_f
$lesssim 7$ there exists a tricritical lattice spacing $a^{tric}(N_f)$, where the chiral transition changes from first order (above) to second order (below). The first-order region thus constitutes a cutoff effect and the transition in the continuum chiral limit is of second order for all N_f
$lesssim 7$. In the current work we determine the associated temperatures $T(N_f^{tric}, a^{tric})$ at these tricritical points. We confirm an expected decrease in the temperature for increasing number of flavours. Running simulations on finer lattices and for larger N_f will allow us to determine the location of the tricritical point in the continuum limit and let us resolve the question whether the conformal window is approached by a first or second order phase transition.

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