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Phase Diagram of Two-Color lattice QCD in the chiral limit

SHAILESH CHANDRASEKHARAN, FU-JIUN JIANG, Duke University — We study thermodynamics of strongly coupled lattice QCD with two colors of massless staggered fermions as a function of the baryon chemical potential μ in $3+1$ dimensions using a new cluster algorithm. We find evidence that the model undergoes a weak first order phase transition at $\mu = 0$ which becomes second order at a finite μ . Symmetry considerations suggest that the universality class of these phase transition should be governed by a $O(N) \times O(2)$ field theory with collinear order, with $N = 3$ at $\mu = 0$ and $N = 2$ at $\mu \neq 0$. The universality class of the second order phase transition at $\mu \neq 0$ appears to be governed by the decoupled XY fixed point present in the $O(2) \times O(2)$ field theory. Finally we show that the quantum ($T = 0$) phase transition as a function of μ is also second order and can be understood as a mean field transition.

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