

Flavor dependence of chiral symmetry breaking and the conformal window

We investigate the phase structure of Quantum Chromodynamics (QCD) in the vacuum as a function of quark flavor number N_f within the chiral limit. By self-consistently solving the coupled DSEs for the quark and gluon propagators in a minimal QCD scheme, we elucidate the nonperturbative dynamics governing dynamical chiral symmetry breaking. Our calculations determine a critical flavor number of $N_f^c = 6.81$ which marks the chiral symmetry restoration of quarks. Further analysis reveals the critical exponents of the chiral condensate as $-\langle\bar{\psi}\psi\rangle \sim |N_f - N_f^c|^{0.53(9)}$, characterized the second order feature of this phase transition of chiral symmetry. Additionally, we discuss the implications for the walking regime towards the conformal window at larger flavor.

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