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Renormalization Group beta function for SU(3) gauge-fermion systems

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The renormalization group (RG) β function describes the running of the renormalized coupling and connects the ultraviolet and infrared regimes of quantum field theories. Focusing at systems with SU(3) gauge group and fermions in the fundamental representation, we study how the RG β function changes from a QCD-like system with $N_f = 2$ flavors to a conformal system with $N_f = 12$ flavors. Specifically we report on new results for simulations with $N_f = 4, 6,$ and 8 flavors and compare our findings to existing lattice determinations in the literature as well as perturbative predictions.

Our results are based on gradient flow measurements performed on dynamical gauge field configurations generated using Möbius domain wall fermions and Symanzik gauge action. In the case of $N_f = 4$ and 6 flavor our investigations are limited by the emergence of confinement at stronger gauge couplings, whereas $N_f = 8$ simulations run into an unphysical bulk phase transition.

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