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Quark mass RG-running for $N_f = 3$ QCD in a χSF setup

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We perform the complete non-perturbative running of the quark mass from hadronic to electroweak scales in $N_f = 3$ massless QCD. In the present work we use the same configuration ensembles used for a similar calculation arXiv 1802.05243, subject to Schrödinger Functional (SF) boundary conditions, whereas we use valence quarks with (χSF) boundary conditions, which results in O(a) improvement for observables after tuning of boundary counterterms. We establish the optimal tuning strategy for the critical hopping parameter $\kappa_{\rm crit}$ and the χSF boundary counterterm coefficient $z_{\rm f}$. Following the recent Alpha strategy, we work in two different energy regimes: at high energies ($\mu >\tilde{}2$GeV) we use a SF-type coupling, while at low energies ($\mu <\tilde{}2$GeV) a Gradient Flow (GF)-type coupling.

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