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Quark masses and strong coupling constant with Highly-Improved Staggered Quarks

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We present new results on the charm and bottom quark masses as well as the strong coupling constant in 2+1-flavor QCD using Highly Improved Staggered Quark action and gauge configurations generated by HotQCD Collaboration.

Our approach is based on calculating the moments of meson correlators and we use a wide range of lattice spacing up to $a^{-1} \sim 4.9$ GeV in our study.

The ratios of quark masses m_c/m_s and m_b/m_c are obtained from the combinations of the pseudo-scalar and vector meson masses and found to be $m_c/m_s = 11.871(96)$ and $m_b/m_c = 4.528(57)$ in the continuum limit.

The lattice results of the hyper-fine splitting of the charmonium can reproduce the experimental value in the continuum.

We also perform the determination of the strong coupling constant in the $\overline{\text{MS}}$ scheme from the moments of pseudo-scalar charmonium correlators and find $\alpha_s(\mu = m_c) = 0.3697(56)$, which is the determination of α_s

at lowest energy scale so far.

For the charm quark mass we obtain $m_c(\mu = m_c) = 1.2668(10)$ GeV.

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