



Contribution ID: 216

Type: **Talk**

Renormalized quark masses using gradient flow

Friday 7 November 2025 17:40 (20 minutes)

We propose a new and simple method for determining the renormalized quark masses from lattice simulations. Renormalized quark masses are an important input to many phenomenological applications, including searching/modeling physics beyond the Standard Model. The non-perturbative renormalization is performed using gradient flow combined with the short-flow-time expansion that is improved by renormalization group (RG) running to match to the $\overline{\text{MS}}$ -scheme. RG running connects the lattice scale to higher energies thus improving the $\overline{\text{MS}}$ -scheme matching. Implementing the RG running perturbatively, we demonstrate this method works reliably at least up to the charm-quark mass and is not exhibiting any signs of the usual “window problem”.

Using RBC/UKQCD’s (2+1)-flavor Shamir domain-wall fermion ensembles with Iwasaki gauge action, we find $m_s^{\overline{\text{MS}}}(\mu = 2 \text{ GeV}) = 89.1(3.2) \text{ MeV}$ and $m_c^{\overline{\text{MS}}}(\mu = 3 \text{ GeV}) = 973.4(8.3) \text{ MeV}$. These results predict the scale-independent ratio $m_c/m_s = 12.1(4)$.

Generalization to other observables is possible, providing an efficient approach to determine non-perturbatively renormalized fermionic observables like form factors or bag parameters from lattice simulations.

Parallel Session (for talks only)

Quark and lepton flavor physics

Author: WITZEL, Oliver (Universität Siegen)

Presenter: WITZEL, Oliver (Universität Siegen)

Session Classification: Quark and lepton flavor physics