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The hadronic contribution to the running of α and the electroweak mixing angle

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We report on our update to [JHEP 08 (2022) 220] on the hadronic running of electroweak couplings from $O(a)$-improved Wilson fermions with $N_f = 2 + 1$ flavours. The inclusion of additional ensembles at very fine lattice spacings together with a number of techniques to split the different contributions for a better control of cutoff effects allow us to achieve improved precision. We employ two different discretizations of the vector current to compute the subtracted Hadronic Vacuum Polarization (HVP) functions $\bar{\Pi}^{\gamma\gamma}$ and $\bar{\Pi}^{Z\gamma}$ for Euclidean time momenta up to $Q^2 \leq 9\ \mathrm{GeV}^2$. To reduce cutoff effects in the short distance region we apply a suitable subtraction to the TMR kernel function, which cancels the leading x_0^4 behaviour. The subtracted term is then computed in perturbative QCD using the Adler function and added back to compensate for the subtraction. Chiral-continuum extrapolations are performed with five values of the lattice spacings and several pion masses, including its physical value, and several fit ansätze are explored to estimate the systematics arising from model selection. Our results show excellent prospects for high-precision estimates of $\Delta\alpha^{(5)}_{\mathrm{had}}(M_Z^2)$ at the Z-pole.

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