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A precise and high-quality determination of $\alpha_s(m_Z)$

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Starting from low energy hadronic input from the particle data book,
we perform a non-perturbative lattice computation of running couplings
up to scales of around 100GeV. The continuum limit is controlled in all
stages. These non-perturbative computations are performed in the
three-flavor theory, yielding $\Lambda^{(3)}$ with around 4% precision.
Matching accross flavor thresholds with 4-loop perturbation theory then yields
$\alpha_s^{(5)}(m_Z)$ with sub-percent precision where an error estimated
as the contribution of the two highest orders of perturbation theory is
a small component in the overall error budget.

Experimental Collaboration

Primary authors: FRITZSCH, Patrick (CERN); RAMOS MARTINEZ, Alberto (CERN); SIMMA, Hubert (DESY); BRUNO, Mattia; DALLA BRIDA, Mattia (DESY - Zeuthen); SOMMER, Rainer Paul (DESY); SCHAEFER, Stefan (Deutsches Elektronen-Synchrotron Campus Zeuthen (DE)); SINT, Stefan (Trinity College Dublin (IE)); KORZEC, Tomasz

Presenter: FRITZSCH, Patrick (CERN)

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