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Renormalization constants of quark bilinear operators in QCD with dynamical up, down, strange and charm quarks

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We present a calculation of the QCD renormalization constants (RCs) for quark bilinear operators, evaluated non-perturbatively on the lattice in the RI'-MOM scheme. The calculation is performed by using dedicated ensembles with $N_f = 4$ degenerate dynamical twisted mass (clover) fermions and the Iwasaki gauge action. A detailed analysis is reported, with emphasis on the control or subtraction of the hadronic contaminations occurring in the lattice estimators of RCs and the check of proper scaling with a^2 of the final RC results. Such a careful study of systematic errors is the counterpart of the high statistical precision reached by current calculations of RC's in the RI'-MOM scheme and is important in order to quote accurate results in phenomenological applications, such as the computation of quark masses.

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