

APR08-2008-020028

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

Testing the Standard Model in the quark flavor sector using lattice QCD

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Recent advances in both computers and algorithms now allow realistic calculations of Quantum Chromodynamics (QCD) interactions using the numerical technique of lattice QCD. The methods used in so-called “2+1 flavor” lattice calculations have been verified both by post-dictions of quantities that were already experimentally well- known and by predictions that occurred before the relevant experimental determinations were sufficiently precise. This suggests that the sources of systematic error in lattice calculations are under control, and that lattice QCD can now be reliably used to calculate those weak matrix elements that cannot be measured experimentally but are necessary to interpret the results of many high-energy physics experiments. These same calculations also allow stringent tests of the Standard Model of particle physics, and may therefore lead to the discovery of new physics in the future.