



Contribution ID: 75

Type: **Talk**

Determining the QCD coupling from lattice vacuum polarization

Wednesday, 15 July 2015 17:10 (20 minutes)

The QCD coupling appears in the perturbative expansion of the current-current two-point (vacuum polarization) function. Any lattice calculation of vacuum polarization is plagued by several competing non-perturbative effects at small momenta and by discretization errors at large momenta. We work in an intermediate region and compute vacuum polarization for many off-axis momentum directions on the lattice. Having many momentum directions provides a way to monitor and account for lattice artifacts. Our results are competitive with, and have certain systematic advantages over, the alternate phenomenological determination of the strong coupling from the same light quark vacuum polarization produced by sum rule analyses of hadronic tau decay data.

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Session Classification: Standard Model Parameters and Renormalization

Track Classification: Standard Model Parameters and Renormalization