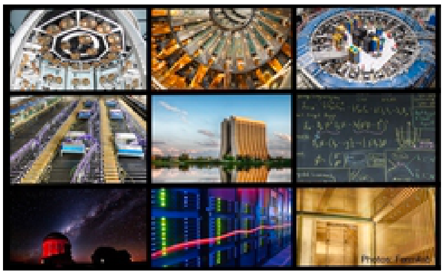

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The muon g-2 and $\Delta\alpha$ connection

Monday, 24 August 2020 16:30 (15 minutes)

The discrepancy between the Standard Model prediction and experimental measurement of the muon magnetic moment anomaly, $\alpha_\mu = (_\mu - 2)/2$, is connected to precision electroweak (EW) measurements via their common dependence on hadronic vacuum polarization effects. The same data for the total $e^+e^- \to$ hadrons cross section, $\sigma_had()$, are used as input into dispersion relations to estimate the leading hadronic vacuum polarization contribution $\alpha_\mu^{\text{had,LO VP}}$, as well as the five-flavor hadronic contribution to the running QED coupling at the ⊠-pole, $\Delta\alpha_{\text{had}}^{(5)}(M_Z^2)$, which enters natural relations and global EW fits. The EW fit prediction of $\Delta\alpha_{had}^{(5)}(M_Z^2)$=0.02722(41) agrees well with $\Delta\alpha_{had}^{(5)}(M_Z^2)$=0.02761(11) from the dispersion relation approach, but is suggestive of a larger discrepancy $\Delta\alpha_\mu = \alpha_\mu^{exp} - \alpha_\mu^{SM}$ than currently expected. Postulating that the $\Delta\alpha_\mu$ difference may be due to unforeseen missing $\sigma_{\text{had}}(s)$ contributions, implications for M_W, $\sin^2\theta_{\text{eff}}^{\text{lep}}$ and MH obtained from global EW fits are investigated. Shifts in $\sigma_{\text{had}}(s)$ needed to bridge $\Delta\alpha_\mu$ are found to be excluded above $\sqrt{s} \sim$ 0.7 GeV at 95\%CL. Moreover, prospects for $\Delta\alpha_\mu$ originating below that energy are deemed improbable given the required increases in the hadronic cross section. Such hypothetical changes to the hadronic data are also found to adversely affect other related observables, such as the electron anomaly (α_e), the rescaled ratio $R_{e/\mu} = (m_\mu/m_e)^2(\alpha_e^{\text{had, LOVP}}/\alpha_\mu^{\text{had, LOVP}})$, and the running of the weak mixing angle at low energies.

Primary authors: Dr KESHAVARZI, Alexander (University of Manchester); PASSERA, Massimo (INFN Padova); MARCIANO, William J. (Brookhaven National Laboratory); SIRLIN , Alberto (New York University)

Presenter: Dr KESHAVARZI, Alexander (University of Manchester)

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