\[ \Delta R_{Xs} = -4.3\% \]

\[ \Delta R_{Xs} = +14.1\% \]

[UH unpublished]
The graph shows the ratio $R_K$ as a function of $q^2$ in $\text{GeV}^2/c^4$. The data points from LHCb, BaBar, and Belle are plotted. The graph indicates a significant deviation from the Standard Model (SM) prediction at $2.6\sigma$ confidence.
Figure 1: Distribution of $\mu^+\mu^-$ versus $K^+\pi^-\mu^+\mu^-$ invariant mass of selected $B_0^0 \to K^\ast_0 \mu^+\mu^-$ candidates. The vertical lines indicate a $\pm 50$ MeV/$c^2$ signal mass window around the nominal $B_0^0$ mass. The horizontal lines indicate the two veto regions that are used to remove $J/\psi$ and $(2S)\to \mu^+\mu^-$ decays. The $B_0^0 \to K^\ast_0 \mu^+\mu^-$ signal is clearly visible outside of the $J/\psi$ and $(2S)\to \mu^+\mu^-$ windows. Invariant masses below the nominal $B_0^0$ mass contain a significant contribution from partially reconstructed $B$ decays and are not used in the BDT training or in the subsequent analysis. They are removed by requiring that candidates have $m(K^+\pi^-\mu^+\mu^-) > 5150$ MeV/$c^2$. The BDT uses predominantly geometric variables, including the variables used in the above pre-selection. It also includes information on the quality of the $B_0^0$ vertex and the fit of the four tracks. Finally, the BDT includes information from the RICH and muon systems on the likelihood that the kaon, pion, and muons are correctly identified. Care has been taken to ensure that the BDT does not preferentially select regions of $q^2$, $K^+\pi^-\mu^+\mu^-$ invariant mass or of the $K^+\pi^-\mu^+\mu^-$ angular distribution. The multivariate selection retains 78% of the signal and 12% of the background that remains after the pre-selection.

[Figure 1: Distribution of $\mu^+\mu^-$ versus $K^+\pi^-\mu^+\mu^-$ invariant mass of selected $B_0^0 \to K^\ast_0 \mu^+\mu^-$ candidates.]

[Reference: LHCb, 1304.6325]
[UH unpublished]
Hypothesis

\[ \beta \in [-1.9, 0.3] \]

\[ \lambda \in [-0.1, 0.9], [8.0, 8.8] \]

\[ \lambda \in [-4.2, -1.2] \]

\[ \lambda \in [-4.2, -1.4] \]

\[ \lambda \in [-7.4, -5.9], [-1.3, 0.2] \]

\[ \lambda \in [-1.0, 0.4] \]

\[ \lambda \in [-1.7, 1.2] \]

\[ \lambda \in [-4.2, -1.4] \]

\[ \lambda \in [-0.7, -0.4] \]

\[ \lambda \in [-0.5, 0.4], [-8.2, -7.4] \]

\[ \lambda \in [-2.4, -1.5], [2.2, 3.4] \]

\[ \text{TABLE III: Same as table II but with two WC's turned on simultaneously.} \]

\[ R_K \]

\[ \text{global} \]

\[ \text{Br}(B^+ \rightarrow K^+ \mu^+ \mu^-) \]

\[ C_{10}^\mu \]

\[ C_{9}^\mu \]

\[ C_{9}^\mu' \]

\[ [\text{Ghosh et al., 1408.4097}] \]

\[ [\text{Descotes-Genon et al., 1307.5683}] \]

\[ [\text{Altmannshofer & Straub, 1308.1501}] \]

\[ [\text{Ghosh et al., 1408.4097}] \]
Hypothesis

Fit

BE

C

$\mu$

[-1.9, 0.3]

3.0: 1

C

$\mu$

[-0.1, 0.9], [8.0, 8.8]

C

$\mu$

[-4.2, -1.2]

3.95: 1

C

$\mu$

[-1.7, 1.2]

C

$\mu$

[-4.2, -1.4]

5.59: 1

C

e

[-7.4, -5.9], [-1.3, 0.2]

C

$\mu$

=$

C

$\mu$

[-1.0, 0.4]

0.89: 1

C

e

=[-0.5, 0.4], [-8.2, -7.4]

C

$\mu$

=-

C

$\mu$

[0.1, 0.9]

0.16: 1

C

e

=[0.3, 1.1]

C

$\mu$

=[0.1, 0.9]

0.47: 1

C

e

=[-2.4, -1.5], [2.2, 3.4]

TABLE III: Same as table II but with two WC's turned on simultaneously.

[FIG. 2: Two dimensional posterior probability distributions for the two hypotheses: 1. $C_9^{\mu}$ and $C_{10}^{\mu}$ (left panel), 2. $C_9^{\mu}$ and $C_0^{\mu}$ (right panel). The red and green contours are 68% and 95% C.L. regions respectively.]

[Altmannshofer & Straub, 1308.1501]

[Mahmoudi, unpublished]

[Ghosh et al., 1408.4097]
FIG. 4. Example one-loop box diagram that gives a correction to the muonic branching ratio of the tau as we now discuss.

In Fig. 3, the region of parameter space favored by the constraint on the model parameter space from the different leptonic processes discussed in Section IV. The region of parameter space favored by the various facilities.

The corrections to the vector and axial-vector couplings of the SM Z vector-boson to muons, the lepton legs, and CLEO [41], results in additional corrections can arise in the presence of kinetic mixing. This should be compared to the SM prediction [35] where

\[
\partial \frac{1}{m_Z^2} \sim \text{NP e}^{10 \%} \text{NP} \quad 0.10 \leq g' \leq 0.30
\]

Importantly, the sign of the correction to the muonic branching ratio of the tau as we now discuss.

\[
\text{BR}(\tau \rightarrow \nu \bar{\nu}) = \text{NP e}^{10 \%} \text{NP} \quad 0.10 \leq g' \leq 0.30
\]

This should be compared to the SM prediction [35] where

\[
\frac{\text{BR}(\tau \rightarrow \nu \bar{\nu})}{\text{BR}(\tau \rightarrow \nu \bar{\nu})_{\text{SM}}} \sim \text{NP e}^{10 \%} \text{NP} \quad 0.10 \leq g' \leq 0.30
\]