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New tests of short-distance dynamics in $b \to s\bar{\ell}\ell$ decays

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The rare $B \to K^{(*)}\bar{\ell}\ell$ decays exhibit a long-standing tension with Standard Model (SM) predictions, which can be attributed to a lepton-universal short-distance $b \to s\bar{\ell}\ell$ interaction.
We present two novel methods to disentangle this effect from long-distance dynamics: one based on the determination of the inclusive $b \to s\bar{\ell}\ell$ rate at high dilepton invariant mass ($q^2 \geq 15\ \mathrm{GeV}^2$), the other based on the analysis of the q^2 spectrum of the exclusive mode $B \to K\bar{\ell}\ell$ (in the entire q^2 range).

Using the first method, we show that the SM prediction for the inclusive $b \to s\bar{\ell}\ell$ rate at high dilepton invariant mass is in good agreement with the result obtained summing the SM predictions for one- and two-body modes (K, K^*, $K\pi$). This observation allows us to perform a direct comparison of the inclusive $b \to s\bar{\ell}\ell$ rate with data. This comparison shows a significant deficit ($\sim 2\sigma$) in the data, fully compatible with the deficit observed at low-q^2 on the exclusive modes. This provides independent evidence of an anomalous $b \to s\bar{\ell}\ell$ short-distance interaction, free from uncertainties on the hadronic form factors.
To test the short-distance nature of this effect we use a second method, where we analyze the exclusive $B \to K\bar{\ell}\ell$ differential branching ratio data in the entire q^2 region. Here, after using a dispersive parametrization of the narrow charmonia resonances, we extract the non-SM contribution to the universal Wilson coefficient C_9 for every bin in q^2. The q^2-independence of the result, and its compatibility with the inclusive determination, provide a consistency check of the short-distance nature of this effect.

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Primary author: TINARI, Arianna (University of Zürich)

Presenter: TINARI, Arianna (University of Zürich)

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