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Reduced hadronic uncertainty in the determination of V_{ud}

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We propose a novel dispersion relations-based evaluation of the γW-box correction to the universal radiative correction Δ_R^V to the neutron and nuclear β decay. This correction is the main source of the theoretical uncertainty in extracting the value of V_{ud} from those decay processes. We relate the needed input into the dispersion integral to the data on neutrino and antineutrino scattering. This leads to a significant shift in the central value accompanied by a reduction of the uncertainty due to hadronic structure. Applied to the superallowed nuclear β decays, these two effect create a tension in the first row CKM unitarity if assuming all other ingredients remain unchanged, $|V_{ud}|^2 + |V_{us}|^2 + |V_{ub}|^2 = 0.9983(4)$. We discuss further ways to improve the precision of the calculation of the γW-box, and point out that dispersion relations provide a unified formalism for hadronic and nuclear corrections to nuclear beta decay.

Primary author: Dr GORSHTEYN, Mikhail (Mainz University)

Presenter: Dr GORSHTEYN, Mikhail (Mainz University)

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