

The Cabibbo angle anomalies: indication of new physics at the TeV scale?

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Recent high precision determinations of V_{us} and V_{ud} indicate towards anomalies in the first row of the CKM matrix. Namely, determination of V_{ud} from beta decays and of V_{us} from kaon decays imply a violation of first row unitarity at about 3σ level. Moreover, there is tension between determinations of V_{us} obtained from leptonic $K\mu 2$ and semileptonic $K\ell 3$ kaon decays. These discrepancies can be explained if there exist extra vector-like quarks at the TeV scale, which have large enough mixings with the lighter quarks. However, only one type of extra multiplet cannot entirely explain all the discrepancies, and some their combination is required, e.g. two species of isodoublet, or one isodoublet and one (up or down type) isosinglet. These scenarios are testable with future experiments. A different solution can come from the introduction of the gauge horizontal family symmetry acting between the lepton families and spontaneously broken at the scale of about 6 TeV. Since the gauge bosons of this symmetry contribute to muon decay in interference with Standard Model, the Fermi constant is slightly smaller than the muon decay constant so that unitarity is recovered.

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