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$\tau^- \to \pi^- \eta \nu_\tau$ decay induced by QED one-loop effects.

Content

The $\tau^- \to \pi^- \eta \nu_\tau$ decay is forbidden in the Standard Model in the limit of exact G-parity, it becomes a rare decay due to isospin symmetry breaking and it is very sensitive to the effects of effective scalar interactions. Since the parameters driving isospin breaking, $(m_d - m_u)/(m_s - \bar{m})$ and α, are of the same order, one may expect their G-parity breaking effects in this decay can be of similar magnitudes. In this work, we evaluate the effects of isospin-breaking amplitudes originated from a virtual photon at one-loop in a resonance dominance model to describe photon-hadron interactions. We find that these effects can shift the leading SM predictions for the decay rate based on the $u - d$ quark mass difference by roughly (13.5)% , and should be taken into consideration in a precision comparison of theory and experiment in order to draw meaningful conclusions on New Physics. The effects in the decay rate of the analogous $\tau^- \to \pi^- \eta' \nu_\tau$ decay can be larger, $(78 \pm 38)\%$, within the approximations assumed in this model. The uncertainty in the former channel is dominated by the input parameters of the resonance model, while the uncertainty in the latter is due to the $\pi^0 \eta'$ mixing parameter.

Summary

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