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New Physics in Lepton Flavor Violating Higgs Decays

Content :

We investigate possible New Physics interpretations of the recently observed excess in the $h \rightarrow \tau \mu$ decay. We derive a lower bound on the Higgs boson coupling strength to a tau and a muon, even in presence of the most general new physics affecting other Higgs properties. Then we reevaluate complementary indirect constraints coming from low energy observables as well as from theoretical considerations. In particular, the tentative signal should lead to $\tau \rightarrow \mu \gamma$ at rates which could be observed at Belle II. In turn we show that, barring fine-tuned cancellations, the effect can only be accommodated within models with an extended scalar sector. These general conclusions are demonstrated using a number of explicit new physics models. Finally we show how, given the $h \rightarrow \tau \mu$ signal, the current and future searches for $\mu \rightarrow e \gamma$ and $\mu \rightarrow e$ nuclear conversions unambiguously constrain the allowed rates for $h \rightarrow \tau e$.

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