

Higgs to four leptons searches at the LHC : constraints on Abelian Hidden sector models

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Recent results on Higgs searches at the LHC by the ATLAS and CMS collaborations claim the observation of a new boson with properties compatible with the Standard Model (SM) Higgs boson, at a mass of about 126 GeV. The production rate of the new particle seems compatible with the SM prediction. In some models beyond the SM, an Abelian Hidden sector is coupled to the Standard Model, and the resulting exotic Higgs and new gauge (Z') fields are allowed to mix with the corresponding SM fields. This admits new processes such as the decay of the lightest Higgs boson (after mixing) to a pair of new gauge bosons, and the decay of the new gauge bosons to pairs of leptons : $H \rightarrow Z'Z' \rightarrow \text{l}\text{l}\text{l}\text{l}$. This modifies the rate of 4-lepton events sought for in the usual SM $H \rightarrow ZZ^* \rightarrow \text{l}\text{l}\text{l}\text{l}$ search. Assuming the observed particle is a Higgs boson of a mass of 126 GeV, we investigate the consequences of the addition of this new process to the search for a SM Higgs boson decaying to 4 leptons, and the resulting constraints on the Abelian Hidden sector model parameters. The constraints are drawn in terms of Higgs mixing angle and new gauge boson mass.

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