

On Higgs decay to a photon and a massless dark photon

Many attempts have been made to observe the decay of the Higgs boson to a photon and an invisible massless dark photon. For this decay to be potentially observable at the LHC, new mediators that communicate between the standard model and the dark photon must exist. In this Letter, we study bounds on such mediators coming from the Higgs signal strengths, oblique parameters, electric dipole moment of the electron, and unitarity. We find that the branching ratio of the Higgs boson to a photon and a dark photon is constrained to be far smaller than the sensitivity of current collider searches except for more contrived models, thus calling for a reconsideration of current experimental efforts.

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