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Interpreting the 750 GeV Di-photon Resonance using photon-jets in Hidden-Valley-like models

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Motivated by the di-photon resonance recently reported by the ATLAS and CMS collaborations at 13 TeV, we interpret the resonance as a scalar boson $X(750)$ in hidden-valley-like models. The scalar boson X can mix with the standard model Higgs boson and thus can be produced via gluon fusion. It then decays into a pair of very light hidden particles Y of sub-GeV, each of which in turn decays to a pair of collimated pions, and these two pions decay into photons which then form photon-jets. A photon-jet is a special feature that consists of a cluster of collinear photons from the decay of a fast moving light particle (sub-GeV). Because these photons inside the photon-jet are so collimated that it cannot be distinguished from a single photon, and so in the final state of the decay of $X(750)$ a pair of photon-jets look like a pair of single photons, which the experimentalists observed and formed the 750 GeV di-photon resonance. Prospects for the LHC Run-2 about other new and testable features are also discussed.

Summary

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