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A 125 Gev Higgs boson with enhanced gamma gamma rate in Supersymmetry

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We confront the discovery of a boson decaying to two photons, as reported recently by ATLAS and CMS, with the corresponding predictions in the Minimal Supersymmetric Standard Model (MSSM) and the Next-to-Minimal Supersymmetric Standard Model (NMSSM). We show that a Higgs with a mass around 125 GeV and a significant enhancement of the rate in the two photon channel, compatible with the observed signal strenghts, is possible in both the MSSM and the NMSSM and we analyse in detail different mechanisms that can give rise to such an enhancement. We find that besides the interpretation of a possible signal at about 125 GeV in terms of the lightest CP-even Higgs boson, both the MSSM and the NMSSM permit also a viable interpretation where an observed state at about 125 GeV would correspond to the second-lightest CP-even Higgs boson in the spectrum.

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