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The 750 GeV diphoton LHC excess from Singlets in Exceptional Supersymmetric Standard Model

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The 750-760 GeV diphoton resonance may be identified as one or two scalars and/or one or two pseudoscalars contained in the two singlet superfields $S_{1,2}$ arising from the three 27-dimensional representations of E_6. We study the corresponding collider signature within the exceptional supersymmetric standard model (E_6SSM). This model is based on the SM gauge group together with an extra $U(1)_N$ gauge symmetry under which right–handed neutrinos have zero charge. To ensure anomaly cancellation the low energy matter content of the E_6SSM involve three 27 representations of E_6. Thus E_6SSM predicts Z' boson and extra matter beyond the MSSM. In particular, the low–energy spectrum of the E_6SSM involves three families of Higgs–like doublets,three families of exotic quarks and three SM singlets S_i that carry $U(1)_N$ charges. The E_6SSM Higgs sector contains one family of the Higgs–like doublets and one SM singlet S_3 that develops vacuum expectation values (VEV) breaking $U(1)_N$ gauge symmetry and inducing masses of exotic states mentioned above. The fermion and scalar components of other Higgs–like superfields form Inert Higgsino and Inert Higgs states respectively. Two lighter singlets $S_{1,2}$ with masses around 750 GeV can couple to Inert Higgsino and exotic quarks giving rise to diphoton excess. We calculate the branching ratios and cross-sections for the two scalar and two pseudoscalar states associated with the $S_{1,2}$ singlets, including possible degeneracies and maximal mixing, subject to the constraint that their couplings remain perturbative up to the unification scale.

Primary author: NEVZOROV, Roman (University of Adelaide)

Co-author: KING, Stephen

Presenter: NEVZOROV, Roman (University of Adelaide)

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