

Theoretical interpretations of the diphoton excess

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Summary

Recent reports by the CMS and ATLAS collaborations of a possible $X(750)$ GeV state decaying into two photons may present the strongest indication yet from collider physics of new physics beyond the Standard Model (SM). We investigate the possibilities that the signal is due to a scalar or pseudoscalar electroweak isoscalar state produced by gluon-gluon fusion mediated by loops of new heavy fermions. We present a review of the experimental constraints on such new vector-like fermions. We consider several models of new vector-like fermions that are compatible with these constraints, and may offer the possibility that $X(750)$ is a dark matter mediator, with a neutral vector-like dark matter particle. The decays $X \rightarrow ZZ$, $Z\gamma$ and $W+W\gamma$ are interesting prospective signatures that may help distinguish between different vector-like fermion models.

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