

Interplay between Fermi gamma-ray lines and collider searches

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We explore the interplay between lines in the gamma-ray spectrum and LHC searches involving missing energy and photons. As an example, we consider a singlet Dirac fermion dark matter with the mediator for Fermi gamma-ray line at 130 GeV. A new chiral or local $U(1)$ symmetry makes weak-scale dark matter natural and provides the axion or Z' gauge boson as the mediator connecting between dark matter and electroweak gauge bosons. In these models, the mediator particle can be produced in association with a monophoton at colliders and it produces large missing energy through the decays into a DM pair or ZZ Z gamma with at least one Z decaying into a neutrino pair. We adopt the monophoton searches with large missing energy at the LHC and impose the bounds on the coupling and mass of the mediator field in the models. We show that the parameter space of the Z' mediation model is already strongly constrained by the LHC 8 TeV data, whereas a certain region of the parameter space away from the resonance in axion-like mediator models are bounded. We foresee the monophoton bounds on the Z' and axion mediation models at the LHC 14 TeV.

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