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Novel Collider and Dark Matter Phenomenology of a Top-philic Z' (15' + 5')

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We consider extending the Standard Model by including an additional Abelian gauge group broken at low energies under which the right-handed top quark is the only effectively charged Standard Model fermion. The associated gauge boson (Z′) is then naturally top-philic and couples only to the rest of the SM particle content at loop-level or via kinetic mixing with the hypercharge gauge boson which is assumed to be small. Working at the effective theory level, we demonstrate that such a minimal extension allows for an improved fitting of the ~2σ excess observed in $t\bar{t}h$ searches at the LHC in a region of parameter space that satisfies existing collider constraints. We also present the reach of the LHC at 13 TeV in constraining the relevant region of parameter space. Additionally we show that within the same framework a suitably chosen fermion charged only under the exotic Abelian group can, in the region of parameter space preferred by the $t\bar{t}h$ measurements, simultaneously explains the dark matter relic density and the γ-ray excess at the galactic center observed by the Fermi-LAT experiment.

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