

Recent ATLAS results of Dark Matter and Dark Photon combinations, and Dark Higgs searches

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Ref: <https://arxiv.org/abs/2306.00641>

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Results from a wide range of searches targeting different experimental signatures with and without missing transverse momentum (\cancel{E}_T) are used to constrain a Two-Higgs-Doublet Model (2HDM) with an additional pseudo-scalar mediating the interaction between ordinary and dark matter (2HDM+a). The analyses use up to 139 fb^{-1} of proton-proton collision data at a centre-of-mass energy $\sqrt{s} = 13 \text{ TeV}$ recorded with the ATLAS detector at the Large Hadron Collider between 2015-2018. The results from three of the most sensitive searches are combined statistically. These searches target signatures with large E_{miss} and a leptonically decaying Z boson; large \cancel{E}_T and a Higgs boson decaying to bottom quarks; and production of charged Higgs bosons in final states with top and bottom quarks, respectively. Constraints are derived for several common as well as new benchmark scenarios within the 2HDM+a.

Ref. <https://arxiv.org/abs/2406.01656>

JHEP 08 (2024) 153

A combination of searches for Higgs boson decaying into a visible photon and a massless dark photon ($H \rightarrow_d$) is presented using 139 fb^{-1} of proton-proton collision data at a centre-of-mass energy of $\sqrt{s} = 13 \text{ TeV}$ recorded by the ATLAS detector at the Large Hadron Collider. The observed (expected) 95% confidence level upper limit on the Standard Model Higgs boson decay branching ratio is determined to be $\text{Br}(H \rightarrow_d) < 1.3\%$ (1.5%). The search is also sensitive to higher-mass Higgs bosons decaying into the same final state. The observed (expected) 95% CL limit on the cross section times branching ratio ranges from 16 fb (26 fb) for $m_H = 400 \text{ GeV}$ and 1.0 fb (1.5 fb) for $m_H = 3 \text{ TeV}$. Results are also interpreted in the context of a minimal simplified model.

Ref. <https://arxiv.org/abs/2407.10549> & ATLAS-CONF-2024-004

A first dedicated search is performed for dark matter particles produced in association with a resonantly produced pair of b-quarks with $m(bb) < 150 \text{ GeV}$ using 140 fb^{-1} of proton-proton collisions recorded by the ATLAS detector at a center-of-mass energy of 13 TeV. This signature is expected in extensions of the Standard Model predicting the production of dark matter particles, in particular those containing dark Higgs bosons. This search uses a novel experimental method to extend the experimental reach to lower bb -pair invariant masses, considers a wider range of dark Higgs boson interpretations and excludes new regions of parameter space for this model. For dark Higgs boson masses between 30 and 150 GeV, Z' mediator masses up to 3.4 TeV and 4.8 TeV are excluded for benchmark scenarios.

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