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# The dark side of the photon, ongoing ATLAS search for dark matter through a dark photon

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## Abstract

A collider search for dark matter through dark photons based on a phenomenological study [1, 2] is presented. Where simulated samples with the ATLAS detector at the CERN LHC with a center-of-mass energy of 13 TeV are used. A dark photon is a hypothetical dark matter particle which may be detected through its kinetic mixing with the general photon. In which it couples weakly to electrically charged particles and allows a non-gravitational window into the detection of dark matter. We will be considering a hypothetical heavy top like quark decaying to a top quark and dark photon. The dark photon will decay to a lepton pair, while we typically look at jets from hadrons, two energetic and collimated photons or leptons can give to jet-like signatures in calorimeters. These lepton jet final states are an unusual topology and have scarcely been studied. We have focused on the hadronic decay of the top quark which gives a final state consisting of a heavy top quark jet. The search is for a large radius jet in the mass range of the top quark and a small radius jet close to the produced lepton both with high transverse momenta. The mass of the small radius jet is that of the dark photon. The main backgrounds are multijet, hadronic and semileptonic top quark pair production, which will be estimated using simulation. The aim of this talk is to discuss the search strategy of this dark photon with the ATLAS detector.

## References

- [1] K. du Plessis, M. Flores, D. Kar, S. Sinha, and H. van der Schyf, “Hitting two bsm particles with one lepton-jet: search for a top partner decaying to a dark photon, resulting in a lepton-jet,” *SciPost Physics*, vol. 13, no. 2, p. 018, 2022.
- [2] J. H. Kim, S. D. Lane, H.-S. Lee, I. M. Lewis, and M. Sullivan, “Searching for dark photons with maverick top partners,” *Physical Review D*, vol. 101, no. 3, p. 035041, 2020.