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Overview of Dark Matter Searches by the ATLAS Experiment

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One of the main focuses of the ATLAS experiment is the search for dark matter (DM) production in proton-proton collisions at the Large Hadron Collider (LHC). These searches are commonly interpreted in terms of simplified models with a spin-0 or spin-1 mediator particle propagating interactions between the visible and dark sectors. Simplified models lead to familiar Mono-X signatures where the presence of non-interacting DM can be inferred as missing transverse momentum caused by DM particles recoiling against a visible particle, X, (i.e. a jet, a photon, or a W, Z or Higgs boson). Since the mediators couple to SM particles, they can also be directly searched for though their decays to jets, top-quark pairs, and potentially even leptons. Simplified models describe dark-matter production kinematics with a minimal number of free parameters, but they do not represent complete theories. Recent theoretical efforts have focused on producing complete, renormalizable models of DM. In particular models involving extended Higgs sectors with an additional vector or pseudo-scalar mediator. These models offer rich phenomenologies and new experimental signatures. ATLAS has recently released summary plots gathering the results of more than 20 experimental DM searches. As well as first results utilizing the full 139 fb^{-1} of 13 TeV proton-proton collision collected during Run 2 (2015-2018). ATLAS limits are compared to those set by direct detection experiments, and relic densities for the different DM models are calculated.

Primary author: ANELLI, Christopher Ryan (University of Victoria (CA))

Presenter: ANELLI, Christopher Ryan (University of Victoria (CA))

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