# The Exploration of Bottom-quark-phillic Semi-visible Jets Scenario in ATLAS

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**Abstract**

When we account for the mass of the Universe, using the mass-to-luminosity ratio, it clearly necessities the existence of non-luminous matter known as dark matter. The origin of dark matter is merely a collective of pedantic astronomical inspections [1], that led to information known today, that close to one quarter of the mass of the universe is non-luminous. By trying to understanding dark matter during the early universe, it introduces a particle model called weakly interacting particles [2]. Weakly interacting massive particles are new particles which are not part of the Standard Model with no charge and are governed by weak interactions. This means that Weakly interacting massive particles are weakly coupled to the Standard Model [2]. The idea around their existence is they would be thermally produced [3] in large amounts to account for non-luminous mass in the early universe. The reason as to why weakly interacting massive particles are such an attractive signature of dark matter is because they directly solve all the challenges that we face with dark matter in the Standard Model. Weakly interacting massive particles are the most searched beyond the Standard Model signature for dark matter in colliders. No experimental evidence confirming the existence of dark matter has been found thus far. The existence of a weakly interacting massive particles scenario does not rule out the possibility of a strongly interacting massive particles scenario. Proposing dark matter to be strongly interacting massive particles gives rise to unexplored collider topologies, which are not completely impossible. The new proposed existence of dark matter in the form of strongly interacting massive particles means that new signatures would need to be explored such as semi-visible jets. This scenario has been motivated by theoretical papers [4, 5, 6, 7], and offers a novel probe of this totally uncovered signature at the Large Hadron Collider. A result for the resonant channel production has been conferred by the CMS collaboration [8] which successfully set the lower limit up to 4 TeV on mediator masses. In Ref. [9], our WITS ATLAS group presented the first search a first search for non-resonant production of SVJs setting the first upper limits for strongly coupled dark sectors for a bi-fundamental mediator mass up to 2.7 TeV. This study focuses on semi-visible jet production but rather than looking at democratic production of all five quark flavors along with dark matter particles, the focus on semi-visible jet production along with just bottom quarks. An initial feasibility study involving exploring its sensitivity with simulated signal and background samples was done with an intention to gain a better understanding of the event characteristics. The results obtained validated that this scenario is feasible. The next step that will be presented is exploring if this signal has been excluded by any current search at the LHC, involving missing transverse energy and $b$-jets and deciding on an optimal search strategy for this new signature.

# References


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