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Search for Emerging jets in the ATLAS detector and reinterpretation of the LHC results

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The Standard Model (SM) cannot explain the composition of Dark Matter in the Universe. Some Beyond Standard Model theories predict the existence of a dark hidden sector which contain new hypothetical particles : stable particles in this sector are Dark Matter candidates. The new particles could weakly interact with Standard Model ones through a new interaction, and thus can be produced in proton-proton collision at the LHC.
In the search for Emerging jets, we are looking for invisible particles from this sector decaying to SM particles with a certain lifetime, producing displaced signals in the detector called emerging jets. The challenge of this analysis is to be able to detect these very rare interactions among the data, by understanding the signature of such particles and by selecting a maximum of events that may contain emerging jets, while rejecting non interesting events.
Moreover, there is a need to test and study many other theoretical models in the data taken at the LHC, but a given LHC analysis cannot test all possible related models. This is why reinterpretation frameworks are useful because they allow to study constraints on new models that have not been considered by existing analysis. There exist several of such frameworks, in particular MadAnalysis which will be discussed here.

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