

Tagging "Dark-Jet" at collider

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The phenomenology of dark matter would be complicated if dark matter is a composite particle as a hadron under a dark gauge group. Once a dark parton is produced at a high energy collider, it eventually evolves to a jet-like object and provides a collider signature depending on interactions with the Standard Model particles. For example, a finite lifetime of dark hadron would provide a displaced vertex. Thus by considering features in sub-detectors, one can identify a jet from a dark parton ("dark jet") with analysis methods in conventional exotic searches. However if a lifetime of dark hadron is collider-negligible (too short to manifest a displaced vertex), dark jet would look like a normal QCD jet. In this study, inspired by one-prong jet tagging technologies which have been utilized in a quark-gluon jet discrimination, we propose that a combination of jet substructure variables become useful to tag a dark jet. We study features of several jet substructure variables with a dark jet. As an illustration, we apply jet substructure methods to $O(100)$ GeV dark jet. Our result shows that by combining various jet substructure methods one could get a good discriminant power for a dark jet over QCD jets. We also discuss about a systematic uncertainty from the choice of parameters in a Monte Carlo simulation in estimating the tagging efficiency of a dark jet.

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