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Search for new particles decaying to a jet and an emerging jet

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Abstract

A search is performed for events consistent with the pair production of a new heavy particle that acts as a mediator between a dark sector and normal matter, and that decays to a light quark and a new fermion called a dark quark. The search is based on data corresponding to an integrated luminosity of 16.1 fb⁻¹ from proton-proton collisions at $\sqrt{s}=13$ TeV collected by the CMS experiment at the LHC in 2016. The dark quark is charged only under a new quantum-chromodynamics-like force, and forms an emerging jet via a parton shower, containing long-lived dark hadrons that give rise to displaced vertices when decaying to standard model hadrons. The data are consistent with the expectation from standard model processes. Limits are set at 95% confidence level excluding dark pion decay lengths between 5 and 225 mm for dark mediators with masses between 400 and 1250 GeV. Decay lengths smaller than 5 and greater than 225 mm are also excluded in the lower part of this mass range. The dependence of the limit on the dark pion mass is weak for masses between 1 and 10 GeV. This analysis is the first dedicated search for the pair production of a new particle that decays to a jet and an emerging jet.

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