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Quark flavor violation and axion-like particles from top-quark decays at the LHC

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We study axion-like particles (ALPs) with quark-flavor-violating couplings at the LHC.
Specifically, we focus on the theoretical scenario with ALP-top-up and ALP-top-charm interactions, in addition to the more common quark-flavor-diagonal couplings.
The ALPs can thus originate from decays of top quarks which are pair produced in large numbers at the LHC, and then decay to jets.
If these couplings to the quarks are tiny and the ALPs have $\mathcal{O}(10)$ GeV masses, they are long-lived, leading to signatures of displaced vertex plus multiple jets, which have the advantage of suppression of background events at the LHC.
We recast a recent ATLAS search for the same signature and reinterpret the results in terms of bounds on the long-lived ALP in our theoretical scenario.
We find that the LHC with the full Run 2 dataset can place stringent limits, while at the future high-luminosity LHC with 3 ab^{-1} integrated luminosity stronger sensitivities are expected.

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Quarks

Primary authors: CHUNG, Fei-Tung (National Tsing Hua University); COTTIN, Giovanna; CHEUNG, KINGMAN (NTHU); WANG, Zeren Simon

Presenter: CHUNG, Fei-Tung (National Tsing Hua University)

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