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Long-lived Colored Scalars at the LHC

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We study the collider signatures of a long-lived massive colored scalar transforming trivially under the weak interaction and decaying within the inner sections of a detector such as ATLAS or CMS. In our study, we assume that the colored scalar couples at tree-level to a top quark and a stable fermion, possibly arising from a dark sector or from supersymmetric extensions of the Standard Model. After implementing the latest experimental searches for long-lived colored scalars, we observe a region of parameter space consistent with a colored electroweak-singlet scalar with mass between $100 - 200$ GeV and a lifetime between $0.1 - 10$ mm/ c together with a nearly degenerate dark fermion that may be probed at the $\sqrt{s} = 13$ TeV LHC. We show that our simplified model may naturally arise from the light-stop window regime of the Minimal Supersymmetric Standard Model, where a light mostly right-handed stop has a mass slightly larger than the lightest neutralino and decays through a four-body process.

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