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Long-Lived Colour-Triplet Scalars from Unnaturalness

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Long-lived, colour-triplet scalars are a prediction of unnatural, or split, composite Higgs models where the spontaneous global-symmetry breaking scale ~ 10 TeV and an unbroken $SU(5)$ symmetry is preserved. Since the triplet scalars are pseudo Nambu-Goldstone bosons, they are split from the much heavier composite-sector resonances and are the lightest exotic, coloured states. Due to discrete symmetries and the large suppression scale f , the triplet scalar is often metastable. We show that existing searches for collider-stable R-hadrons from Run-I at the LHC forbid triplet scalars below 845 GeV. In the future with 300/fb at 13 TeV, triplet scalar masses up to 1.4 TeV can be discovered, whereas for shorter lifetimes displaced-vertex searches provide a discovery reach of up to 1.8 TeV. Just like the role of long-lived gluinos in supersymmetry, long-lived color-triplets will therefore provide a sign of unnaturalness in composite Higgs models.

Auteur principal: GHERGHETTA, Tony (University of Minnesota)

Orateur: GHERGHETTA, Tony (University of Minnesota)

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