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Light hidden mesons inspired by neutral naturalness and SUSY

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Confining hidden sectors are an attractive possibility for physics beyond the Standard Model (SM). They are especially motivated by neutral naturalness theories, which reconcile the lightness of the Higgs with the strong constraints on colored top partners. We study hidden QCD with one light quark flavor, coupled to the SM via effective operators suppressed by the mass of new electroweak-charged particles. This effective field theory is inspired by a new tripled top model of supersymmetric neutral naturalness. The hidden sector is accessed primarily via the Z and Higgs portals, which also mediate the decays of the hidden mesons back to SM particles. We find that exotic Z decays at the LHC and future Z factories provide the strongest sensitivity to this scenario, and we outline a wide array of searches. For a larger hidden confinement scale ˜GeV, the exotic Z decays dominantly produce final states with two hidden mesons. ATLAS and CMS can probe their prompt decays up to 3 TeV at the high luminosity phase, while a TeraZ factory would extend the reach up to 20 TeV through a combination of searches for prompt and displaced signals. For smaller confinement scale, the Z decays to the hidden sector produce jets of hidden mesons, which are long-lived. LHCb will be a powerful probe of these emerging jets. Furthermore, the light hidden vector meson could be detected by proposed dark photon searches.

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