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Searching for new Particles at 95 GeV

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Recent observations by the CMS and ATLAS experiments at the LHC have reported anomalies in the production of tau-lepton and photon pairs over expected background at an invariant mass of ~ 95 GeV. Taken with an older result from LEP data showing a similar anomaly in the production of b-quark pairs, these results raise the possibility of an as-yet unknown resonance at 95 GeV causing each of these anomalies. We investigate the possibility of the 2HDM+a/s - extensions of the SM containing an additional Higgs doublet as well as a singlet scalar (s) or pseudoscalar (a) - as an explanation for these anomalies. These models are well-motivated as minimal extensions of the Standard Model that can potentially resolve longstanding issues such as the baryon asymmetry problem and provide a portal to a hypothetical dark sector. We additionally analyse relevant constraints on these models such as those from collider searches and rare B-meson decays. We find that while both models are able to account for the CMS and ATLAS excesses in the diphoton and ditau channels, neither can explain the LEP anomaly while satisfying all required constraints. It remains to be seen if these anomalies are statistical artefacts, or true hints of physics beyond the Standard Model.

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