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Light Scalars in Custodial Symmetric Higgs Triplet Models

In the LHC regime, the mixing between doublet and triplet scalars enriches the phenomenology of the scalar sector. However, electroweak precision observables place stringent constraints on scalar multiplets larger than doublets under the SU(2)_L gauge group. Notable exceptions are the well-established Georgi-Machacek (GM) model and the recently proposed extended Georgi-Machacek (eGM) model –both of which are triplet scalar extensions of the Standard Model (SM) that preserve custodial symmetry at tree level. We investigate whether the GM and eGM models can accommodate a light Higgs boson, motivated by a series of results from the LHC and LEP suggesting the presence of a light scalar around 95 GeV. Taking into account the recently improved next-to-leading order (NLO) unitarity and positivity constraints, we perform a global fit to these LHC and LEP data on 95 GeV Higgs in addition to the flavor physics data, LHC data on the SM-like Higgs and on the direct searches of heavy Higgs bosons. The fit results indicate that NLO unitarity and vacuum stability place significant constraints on the allowed parameter regions for both models. Additionally, we find that recent flavor physics data, particularly the branching ratio of the $b \to s\gamma$ transition, impose stringent constraints on scenarios involving a light Higgs boson. In this talk, I will present the latest constraints on the model parameters in the presence of a 95 GeV scalar in both models. Finally, I will discuss the potential for studying new decay modes in the eGM model and present the bounds on their branching ratios from the global fit, which could be probed at the LHC and future colliders.

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