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Vacuum stability and asymptotic behaviour in Extended Higgs and Leptoquarks

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The status of Standard Model vacuum stability with generic
problems beyond Standard Models (BSM) will be scrutinised.
We will see how addition of scalar from different SU(2) representations, i.e.
Inert Higgs Doublet model (IDM) and Inert Higgs triplet model (ITM) enhance the stability of electroweak vacuum[1]. Addition of fermions can decrease the stability and need additional scalar to get to the stability which would be clear while discussing the extension with Type-I Seesaw and IDM[2]. We also see for Type-III seesaw +IDM due to SU(2) triplet fermions, the impact on g_2 is visible and it increases with energy unlike SM or Type-I Seesaw and IDM losing the asymptotic freedom[3]. This constraints the fermion generation to only two for Planck scale stability. Finally, Vacuum stability and perturbativity for scalar Doublet and Triplet Leptoquarks is also studied. In this scenario, the behaviour of all gauge couplings will be modified. We have also studied the perturbativity of the scalar quartic couplings. Dark matter and collider phenomenologies will also be discussed briefly in IDM and ITM.

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