

Classical scale invariance, Physical Naturalness and the stability of scales

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The discovery of Higgs boson, apparent absence of any new physics at EW scale and the existence of perturbative physics at and above Planck scale, as hinted by BICEP2, require rethinking the paradigm of naturalness. I suggest that no explicit mass terms exist in fundamental Lagrangian (the concept of classical scale invariance) and all scales are generated via logarithmic dimensional transmutation, explaining their vast differences. Physical Naturalness principle, involving very small couplings that are natural by 't Hooft criteria, explains the stability of this setup. I illustrate the general principles with simple models beyond the SM explaining the EW scale, Dark Matter, Planck scale and inflation with minimal new degrees of freedom. In this context, the Planck scale is just a "low scale" imprint of transplanckian (inflationary) physics.

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