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Origin of mass scales in scale-symmetric extension of Standard Model

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The hierarchy problem arises from quantum corrections at ultraviolet scales, which drive the Higgs boson mass to values higher than observed experimentally. One potential solution is to impose conformal or scale symmetry. However, the Higgs mass must still be generated, which can occur through spontaneous breaking of scale symmetry. In this work, we propose a scale-symmetric extension of the Standard Model Higgs sector, where mass scales emerge not through radiative corrections but through the spontaneous breaking of scale symmetry, triggered when the Goldstone boson (dilaton) acquires a vacuum expectation value (VEV). We demonstrate how this VEV is reached through the evolution of fields in the hot early Universe, and show that coupling this theory to gravity provides a stable solution.

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