

Classical illustration of the Three $S(3)$ Higgs Doublet Model

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Abstract content

Small vibrations of a mechanical system consisting of three particles connected by springs and placed in each vertex of the equilateral triangle is appropriate for illustrating the gauge symmetry breaking and the vacuum stability conditions of a minimal S_3 -invariant extended Higgs potential. In the $S(3)$ extended Standard Model, there are three $SU(2)$ Higgs doublets that belong to a singlet H_S and a doublet representation H_1, H_2 of the S_3 - flavour group, which is isomorphic to the equilateral triangle symmetry group. It is possible to describe the $S(3)$ Higgs model in terms of nine invariants x_i , the configuration or state of a classical mechanical vibrating triangle consisting of three masses connected by springs and placed in each vertex of the equilateral triangle may be conveniently described by a 9-dimensional vector $\mathbf{X}$ where 9 is the number of degrees of freedom. In the present article we explore the parallels between the classical mechanical system and the Three $S(3)$ Higgs Potential. The parallel is completed adding effective $O(2)$ operators to the $S(3)$ SM lagrangian, the extra terms analog to the classical kinetic energy T play the role of Weakly Interacting Massive Particles.

Summary

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