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Supersymmetry versus Compositeness: 2-Higgs Doublet Models Tell the Story

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Abstract : Supersymmetry and compositeness are the two prevalent paradigms providing both a solution to the hierarchy problem and motivation for a light Higgs boson state. An open door towards the solution is found in the context of 2-Higgs Doublet Models (2HDMs), which are necessary to supersymmetry and natural within compositeness in order to enable Electro-Weak Symmetry Breaking. In scenarios of compositeness, the two isospin doublets arise as pseudo Nambu-Goldstone bosons from the breaking of SO(6). By calculating the Higgs potential at one-loop level through the Coleman-Weinberg mechanism from the explicit breaking of the global symmetry induced by the partial compositeness of fermions and gauge bosons, we derive the phenomenological properties of the Higgs states and highlight the main signatures of this Composite 2-Higgs Doublet Model at the Large Hadron Collider. These include modifications to the SM-like Higgs couplings as well as production and decay channels of heavier Higgs bosons. We contrast the properties of this composite scenario to the well-known ones established in supersymmetry, with the MSSM being the most notorious example. We show how 2HDM spectra of masses and couplings accessible at the Large Hadron Collider may allow one to distinguish between the two paradigms.

Keywords : beyond the standard model, composite Higgs, supersymmetry, Two-Higgs Doublet Model
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