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Naturalness Sum Rules and Their Collider Tests

Thursday, 20 December 2018 15:30 (15 minutes)

We present the most general sum rules reflecting the cancellation of ultraviolet divergences in the Higgs potential in weakly-coupled, natural extensions of the Standard Model. There is a separate sum rule for the cancellation of the quadratic and logarithmic divergences, and their forms depend on whether the divergences are canceled by same-spin or opposite-spin partners. These sum rules can be applied to mass eigenstates and conveniently used for direct collider tests of naturalness. We study in detail the feasibility of testing these sum rules in the top sector at a future 100 TeV proton collider within two benchmark models, the Little Higgs (LH) and the Maximally Symmetric Composite Higgs (MSCH). We show how the two ingredients of the sum rules, the top partner masses and their Yukawa couplings to the Higgs, can be measured with sufficient accuracy to provide a highly non-trivial quantitative test of the sum rules. In particular, we study observables sensitive to the sign of the top partner Yukawa, which is crucial for verifying the sum rules but is notoriously difficult to measure. We demonstrate that in the benchmark models under study, a statistically significant discrimination between the two possible signs of each Yukawa will be feasible with a 30 ab−1 data set at 100 TeV.

Type

Parallel talk

Sessions (parallel only)

Beyond Stand Model

Primary author: Prof. SHU, Jing (ITP-CAS)

Presenter: Prof. SHU, Jing (ITP-CAS)

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