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The anomalous $Zb\bar{b}$ couplings: From LEP to LHC

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The bottom quark forward-backward asymmetry (A_{FB}^b) data at LEP exhibits a long-standing discrepancy with the standard model prediction.

We propose a novel method to probe the $Zb\bar{b}$ interactions through $gg \rightarrow Zh$ production at the LHC, which is sensitive to the axial-vector component of the $Zb\bar{b}$ couplings. We demonstrate that the Zh data collected at the 13 TeV LHC can already resolve the apparent degeneracy of the anomalous $Zb\bar{b}$ couplings implied by the LEP precision electroweak measurements, with a strong dependence on the observed distribution of the Z boson transverse momentum.

We also show the potential of the HL-LHC to either verify or exclude the anomalous $Zb\bar{b}$ couplings observed at LEP through measuring the Zh production rate at the HL-LHC, and this conclusion is not sensitive to possible new physics contribution induced by top quark or Higgs boson anomalous couplings in the loop.

Summary

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