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The anomalous Zbb 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 Zbb interactions through $gg \rightarrow Zh$ production at the LHC, which is sensitive to the axial-vector component of the Zbb couplings. We demonstrate that the Zh data collected at the 13 TeV LHC can already resolve the apparent degeneracy of the anomalous Zbb 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 Zbb 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.

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