

Testing a light Higgs at the LHC and future colliders

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The discovery of the 125 GeV Standard Model (SM) Higgs boson confirmed electroweak symmetry breaking, yet unresolved issues, including the hierarchy problem, dark matter, and baryon asymmetry, point to new physics with extended scalar sectors. Experimental anomalies around 95 GeV in channels like $b\bar{b}$, $\tau^+\tau^-$, and $\gamma\gamma$ have further sparked interest in a potential beyond-SM light Higgs boson. This talk explores prospects for testing this light scalar via signal simulation studies at the HL-LHC, HE-LHC, and future colliders (FCC-hh, CEPC), highlighting how Monte Carlo simulations and machine learning boost detection sensitivity. Representative models, such as Minimal Dilaton Model (MDM), Type-I Two-Higgs-Doublet Model (2HDM), flipped Next-to 2HDM (N2HDM), and Next-to Minimal Supersymmetric SM (NMSSM), are used to illustrate the reach of these colliders.

Primary author: Prof. ZHU, Jingya (Henan University)

Presenter: Prof. ZHU, Jingya (Henan University)

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