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The 152 GeV Candidate at the LHC

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Based on several features observed in the data collected during Run 1 of the LHC, a simplified model was proposed in which a heavy scalar, H, decays into a combination of the SM Higgs boson (h) and a new Higgs-like scalar, S. One implication of this model is the appearance of excesses in lepton production when the decay S →WW dominates. These excesses, referred to as the multi-lepton anomalies at the LHC, were subsequently identified. They include events with two or more leptons, missing transverse energy, and (b)-jets in the final state. Based on the invariant mass of lepton pairs, the mass of the new scalar is predicted to be mS = 150 ±5 GeV.
The analysis of γγ, Zγ, and WW sideband spectra in Run 2 data confirms the presence of a resonance at mS = 152 ±1 GeV, with a global significance of 5.3σ. This represents the strongest excess observed at the LHC to date that is consistent with a narrow resonance beyond the SM. These findings strongly motivate further investigation at future high-precision facilities such as the CEPC.

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