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A 96 GeV Higgs boson in the 2HDMS

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We discuss a $\sim 3\sigma$ signal (local) in the light Higgs-boson search in the diphoton decay mode at ~ 96 GeV as reported by CMS, together with a $\sim 2\sigma$ excess (local) in the $b\bar{b}$ final state at LEP in the same mass range. We interpret this possible signal as a Higgs boson in the 2 Higgs Doublet Model with an additional complex Higgs singlet (2HDMS). We find that the lightest CP-even Higgs boson of the 2HDMS type II can perfectly fit both excesses simultaneously, while the second lightest state is in full agreement with the Higgs-boson measurements at 125 GeV, and the full Higgs-boson sector is in agreement with all Higgs exclusion bounds from LEP, the Tevatron and the LHC as well as other theoretical and experimental constraints. We derive bounds on the 2HDMS Higgs sector from a fit to both excesses and describe how this signal can be further analyzed at the LHC and at future e^+e^- colliders, such as the ILC or CEPC. We analyze in detail the anticipated precision of the coupling measurements of the 96 GeV Higgs boson at the ILC.

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