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Discovery Potential of Future Electron-Positron Colliders for a 95 GeV Scalar

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The observed indications of a new scalar resonance around 95 GeV, initially reported by LEP and supported by CMS and ATLAS in di-photon, $\tau\tau$, and W^+W^- channels, motivate exploring its discovery potential at future electron-positron colliders. This study focuses on the production of the new scalar (S) in $e^+e^- \rightarrow ZS$ process with $Z \rightarrow \mu^+\mu^-$ and $S \rightarrow b\bar{b}$ and optimize the signal using the recoil-mass method. By employing deep neural networks for signal-background discrimination, we demonstrate that a 95 GeV scalar, mixing with the Standard Model Higgs by an angle of ~ 0.1 , can be observed with 5σ significance at $\sqrt{s} = 250$ GeV and 200 GeV for 5 ab^{-1} of integrated luminosity.

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