

Higgs Boson Production via Higgs-Strahlung and Associated Higgs Boson-top pair Production, at Future e^+e^- Linear Colliders ILC & CLIC in the Context of a $U(1)$ B-L Extension of the Standard Model

Abstract

The $U(1)_{B-L}$ extension of the Standard Model predicts an additional neutral boson Z' plus a heavy Higgs boson H , and contemplates the neutrino mass with the appearance of three additional heavy Majorana neutrinos, one per family. Within this context we study the phenomenology, of light and heavy Higgs at future e^+e^- linear colliders with center-of-mass energies of $\sqrt{s} = 500 - 3000$ GeV and integrated luminosities of $L = 500 - 2000$ fb $^{-1}$. The study includes the Higgs-strahlung processes $e^+e^- \rightarrow (Z, Z') \rightarrow Zh, ZH$ and associated Higgs boson-top pair production $e^+e^- \rightarrow (Z, Z') \rightarrow t \bar{t}$, considering both the resonant and non-resonant effects. The latter has a distinctive experimental signature and is a direct mechanism that could potentially be used to measure the top quark-Higgs boson Yukawa coupling. Since this coupling can be significantly different in a Supersymmetric model from that in the Standard Model, the measurement would provide a mean of discriminating between models. For the Higgs-strahlung process we find that the total number of expected Zh and ZH events can reach 10^6 and 10^5 , respectively, this optimistic scenario allows us to perform precision measurements for both Higgs bosons h and H , as well as for the Z' boson in future high-energy and high-luminosity e^+e^- colliders experiments. Our study complements other studies on the B-L model and on the Higgs-strahlung processes $e^+e^- \rightarrow (Z, Z') \rightarrow Zh$ and $e^+e^- \rightarrow (Z, Z') \rightarrow ZH$.

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