

Study of $e^+e^- \rightarrow \gamma h$ at the ILC

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Abstract

At the ILC [1], in addition to the dominant Higgs production process: $e^+e^- \rightarrow Zh$, the Higgs boson can be produced in association with a photon: $e^+e^- \rightarrow \gamma h$, which is a loop induced process in the Standard Model (SM). Therefore we expect that new physics effects may show up as relatively large deviations from the SM [2]. As one example, the expected deviations on the $e^+e^- \rightarrow \gamma h$ cross section in the Inert Triplet Model [3] are shown in Figure 1, which suggests that depending on model parameters the deviations might exceed 100%.

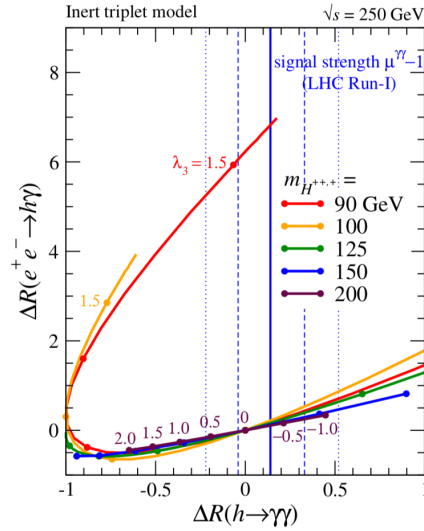


Figure 1: The relative deviations of the $e^+e^- \rightarrow \gamma h$ cross section and the $h \rightarrow \gamma\gamma$ decay rate from the Standard Model values [3]

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This process can be also useful to constrain the dimension 6 EFT operators which can introduce effective anomalous $h\gamma Z$ and $h\gamma\gamma$ couplings [4].

Our interest during this Snowmass: we would like to perform ILD [5] full simulation analysis of the cross section measurement for $e^+e^- \rightarrow \gamma h$ at the ILC, including the Standard model background. We will use dominant signal channels with $h \rightarrow b\bar{b}$ [6] and $h \rightarrow WW^*$ [7]. We will interpret the result in both concrete BSM models and EFT frame work.

References

- [1] T. Behnke *et al.*, “The International Linear Collider Technical Design Report - Volume 1: Executive Summary,” arXiv:1306.6327 [physics.acc-ph].
- [2] A. Djouadi, V. Driesen, W. Hollik and J. Rosiek, Nucl. Phys. B **491**, 68-102 (1997) doi:10.1016/S0550-3213(96)00711-0 [arXiv:hep-ph/9609420 [hep-ph]].
- [3] S. Kanemura, K. Mawatari and K. Sakurai, “Single Higgs production in association with a photon at electron-positron colliders in extended Higgs models,” arXiv:1808.10268 [hep-ph].
- [4] Q. H. Cao, H. R. Wang and Y. Zhang, Chin. Phys. C **39**, no.11, 113102 (2015) doi:10.1088/1674-1137/39/11/113102 [arXiv:1505.00654 [hep-ph]].
- [5] T. Behnke *et al.*, “The International Linear Collider Technical Design Report - Volume 4: Detectors,” arXiv:1306.6329 [physics.ins-det].
- [6] Y Aoki, K Fujii, S Jung, J Lee, J Tian, H Yokoya, “Study of $H \rightarrow Z\gamma$ branching ratio at the ILC 250GeV,” arXiv:1902.06029.
- [7] Y. Aoki, K. Fujii, S. Jung, J. Lee, J. Tian and H. Yokoya, “Study of the $h\gamma Z$ coupling at the ILC,” arXiv:2002.07164 [hep-ex].