EXTRACTION OF ANOMALOUS ZZγ, Zγγ, AND ZZV COUPLINGS

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In the reaction $e^+e^- \rightarrow Z\gamma$, deviations from the Standard Model for the $Z\gamma V$ couplings may be described in terms of 8 parameters, $h^V_i (i = 1, 4; V = \gamma, Z)$ [1]. In this formalism $h^\gamma_1$ and $h^\gamma_2$ lead to $CP$-violating and $h^\gamma_3$ and $h^\gamma_4$ to $CP$-conserving effects. All these anomalous contributions to the cross section increase rapidly with center-of-mass energy. In order to ensure unitarity, these parameters are usually described by a form-factor representation, $h^V_i(s) = h^V_i(s_0)/(1 + s/\Lambda^2)^n$, where $\Lambda$ is the energy scale for the manifestation of a new phenomenon and $n$ is a sufficiently large power. By convention one uses $n = 3$ for $h^\gamma_{1,3}$ and $n = 4$ for $h^\gamma_{2,4}$. Usually limits on $h^V_i$'s are put assuming some value of $\Lambda$ (sometimes $\infty$).

Above the $e^+e^- \rightarrow ZZ$ threshold, deviations from the Standard Model may be described by means of four anomalous couplings $f^V_i (i = 4, 5; V = \gamma, Z)$ [2]. The anomalous couplings $f^\gamma_5$ lead to violation of $C$ and $P$ symmetries while $f^\gamma_4$ introduces $CP$ violation. These couplings are zero at tree level in the Standard Model.

Reference