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The W-boson contribution to the decays $H \rightarrow Z/\gamma + \gamma$ in the Standard Model revisited

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We have calculated the W-loop SM contribution to the amplitude of the decay $H \rightarrow Z + \gamma$ and also for $H \rightarrow \gamma + \gamma$ in the $R\xi$ -gauge using dimensional regularization (DimReg) and in the unitary gauge through the dispersion method. We show that the results of the calculations with DimReg and the dispersion method, adopting the boundary condition at the limit $M_W \rightarrow 0$ defined by the Goldstone boson equivalence theorem (GBET), completely coincide. This implies that DimReg is compatible with the dispersion method obeying the GBET. Thus, our results also agree with the “classical” ones. The advantage of the applied dispersion method is that we work with finite quantities and no regularization is required.

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