Erratum: Constraining *CPT*-odd nonminimal interactions in the electroweak sector [Phys. Rev. D **95**, 071701(R) (2017)]

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We have proposed nonminimal couplings in the electroweak sector and evaluated decay rates for the processes ($Z_0 \rightarrow \bar{l} + l$ and $W^- \rightarrow l + \bar{\nu}_l$). We have found a mistake in the decay rates expressions, which do not present first order contributions in the Lorentz-violating (LV) parameters, but second order LV contributions. As a consequence, the previous upper bounds on the magnitude of the LV parameters were also modified, becoming less severe by 1 order of magnitude. In this erratum, we correct the decay rates and the corresponding upper bounds.

The decay rate for the process ($Z_0 \rightarrow \bar{l} + l$) is proportional to the squared amplitude,

$$|S|^2 = S_0 S_0^\dagger + S_0 S_{LV(1)}^\dagger + S_{LV(1)} S_0^\dagger + S_0 S_{LV(2)}^\dagger + S_{LV(2)} S_0^\dagger + S_{LV(1)} S_{LV(1)}^\dagger + S_{LV(1)} S_{LV(2)}^\dagger + S_{LV(2)} S_{LV(1)}^\dagger + S_{LV(2)} S_{LV(2)}^\dagger. \quad (1)$$

The correct evaluation shows that the first order contribution actually vanishes, $S_0 S_{LV(1)}^\dagger + S_{LV(1)} S_0^\dagger + S_0 S_{LV(2)}^\dagger + S_{LV(2)} S_0^\dagger = 0$, remaining only the second order pieces,

$$\Gamma_{ll} = \Gamma_{S_0 S_0^\dagger} + \Gamma_{S_{LV(1)} S_{LV(1)}^\dagger} + \Gamma_{S_{LV(1)} S_{LV(2)}^\dagger} + \Gamma_{S_{LV(2)} S_{LV(1)}^\dagger} + \Gamma_{S_{LV(2)} S_{LV(2)}^\dagger}. \quad (2)$$

As $\Gamma_{S_{LV(1)} S_{LV(2)}^\dagger} = 0$, $\Gamma_{S_{LV(2)} S_{LV(1)}^\dagger} = 0$, the total decay rate is reduced to $\Gamma = \Gamma_{S_0 S_0^\dagger} + \Gamma_{S_{LV(1)} S_{LV(1)}^\dagger} + \Gamma_{S_{LV(2)} S_{LV(2)}^\dagger}$, or

$$\Gamma_{ll} = \frac{g^2(g_V^2 + 1)M_Z}{192\pi\cos^2\theta} \left[1 + g_2^2 C_0^2 \frac{10M_Z^2 \sin^2 2\theta}{g^2(g_V^2 + 1)} \right] \times \Theta(M_Z - 2m_l), \quad (3)$$

which is different from Eqs. (34) and (35) of page 4. Here, we have used $k^2 = M_Z^2$ and $C \cdot k = C_0 M_Z$ (in the Z boson rest frame).

As a consequence, the upper bound (36) is now corrected to

$$|g_2' C_0| < 2 \times 10^{-14} \text{ (eV)}^{-1}, \quad (4)$$

$$|g_2' C_0| < 2 \times 10^{-5} \text{ (GeV)}^{-1}. \quad (5)$$

The decay rate for the process ($W^- \rightarrow l + \bar{\nu}_l$) analogously to the previous case is proportional to the squared amplitude,

$$|S|^2 = S_0 S_0^\dagger + S_0 S_{LV(1)}^\dagger + S_{LV(1)} S_0^\dagger + S_0 S_{LV(2)}^\dagger + S_{LV(2)} S_0^\dagger + S_{LV(1)} S_{LV(1)}^\dagger + S_{LV(1)} S_{LV(2)}^\dagger + S_{LV(2)} S_{LV(1)}^\dagger + S_{LV(2)} S_{LV(2)}^\dagger. \quad (6)$$

The correct evaluation shows that the first order contribution vanishes, $S_0 S_{LV(1)}^\dagger + S_{LV(1)} S_0^\dagger + S_0 S_{LV(2)}^\dagger + S_{LV(2)} S_0^\dagger = 0$, remaining only the second order pieces

$$\Gamma = \Gamma_{S_0 S_0^\dagger} + \Gamma_{S_{LV(1)} S_{LV(1)}^\dagger} + \Gamma_{S_{LV(1)} S_{LV(2)}^\dagger} + \Gamma_{S_{LV(2)} S_{LV(1)}^\dagger} + \Gamma_{S_{LV(2)} S_{LV(2)}^\dagger}. \quad (7)$$

The quantities $\Gamma_{\mathcal{S}_{LV(1)}\mathcal{S}_{LV(2)}^\dagger}$, $\Gamma_{\mathcal{S}_{LV(2)}\mathcal{S}_{LV(1)}^\dagger}$ also vanish, so that the correct total decay rate is written as

$$\Gamma = \frac{g^2 M_W}{48\pi} \left[1 + g_3'^2 V_0^2 \frac{M_W^2}{g^2} \right] \Theta(M_W - m_l), \quad (8)$$

which differs from Eqs. (48) and (49). We have also used $V \cdot k = V_0 M_W$ (the rest frame of the W^- mediator) and neglected the contributions in m_l^2/M_W^2 , m_l^4/M_W^4 .

Considering that the experimental uncertainty in the measures of this decay is at the level of $\sim 4 \times 10^{-2}$, and using $g = e/\sin\theta$, $\sin^2\theta = 0.23$, we correct the limit (50) as

$$|g_3' V_0| < 4 \times 10^{-13} \text{ (eV)}^{-1}, \quad (9)$$

$$|g_3' V_0| < 4 \times 10^{-4} \text{ (GeV)}^{-1}. \quad (10)$$

Finally, considering sidereal analysis, limits (52) and (53) can now be corrected as

$$|g_2'(C_T^0 + \alpha^i C_T^i)| \lesssim 1 \times 10^{-5} \text{ (GeV)}^{-1}, \quad (11)$$

$$|g_3'(V_T^0 + \alpha^i V_T^i)| \lesssim 1 \times 10^{-4} \text{ (GeV)}^{-1}. \quad (12)$$

Such upper limits are less restrictive by 1 order of magnitude and are in agreement with the ones obtained in Ref. [1].

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[1] P. C. Malta, Y. M. P. Gomes, and M. J. Neves, Testing Lorentz-symmetry violation via electroweak decays, [arXiv:1909.10398](https://arxiv.org/abs/1909.10398).