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Erratum: Two viable large scalar multiplet models with a Z_2 symmetry [Phys. Rev. D 90, 055029 (2014)]

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We correct Eqs. (27), (32), (36), (44), and (A7) of Ref. [1]. All results and conclusions are unaffected.

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Equation (27) gives the formula for the oblique parameter S in the Z_2 models. Its correct form is given by

$$S = \frac{2s_W^2 c_W^2}{\pi} \sum_{i,j} \left(|C_{ijZ}|^2 - \frac{c_W^2 - s_W^2}{s_W c_W} C_{ijZ} C_{ij\gamma}^* - |C_{ij\gamma}|^2 \right) f_1(m_i, m_j), \tag{1}$$

where the couplings C_{ijV} and indices i, j are defined as in the original publication. An overall factor of 2 was missing from the original equation.

Equation (32) gives the formula for the oblique parameter U in the Z_2 models. Its correct form is given by

$$U = \frac{2s_W^2}{\pi} \left[\sum_{s,t} |C_{stW^+}|^2 f_1(m_s, m_t) - \sum_{i,j} (c_W^2 |C_{ijZ}|^2 + 2s_W c_W C_{ijZ} C_{ij\gamma}^* + s_W^2 |C_{ij\gamma}|^2) f_1(m_i, m_j) \right], \tag{2}$$

where the couplings C_{ijV} and indices i, j, s, t are defined as in the original publication. An overall factor of 2 was missing from the original equation.

Equation (36) is an auxiliary equation used in the calculation of the decay of $h \to \gamma\gamma$. Its correct form is given by Ref. [2],

$$f(\tau) = \begin{cases} \left[\arcsin\left(\sqrt{\frac{1}{\tau}}\right)\right]^2 & \text{if } \tau \geq 1, \\ -\frac{1}{4}\left[\log\left(\frac{\eta_+}{\eta_-}\right) - i\pi\right]^2 & \text{if } \tau < 1, \end{cases} \tag{3}$$

with $\eta_\pm \equiv 1 \pm \sqrt{1-\tau}$ and $\tau_i \equiv 4m_i^2/m_h^2$. A bracket was misplaced in the original equation.

Equation (44) is an auxiliary equation used in the calculation of the decay of $h \to Z\gamma$. Its correct form is given by

$$g(\tau) = \begin{cases} \sqrt{\tau - 1}\arcsin\left(\sqrt{\frac{1}{\tau}}\right) & \text{if } \tau \geq 1, \\ \frac{1}{2}\sqrt{1-\tau}\left[\log\left(\frac{\eta_+}{\eta_-}\right) - i\pi\right] & \text{if } \tau < 1, \end{cases} \tag{4}$$

with $\eta_\pm$ and τ as above. A bracket was misplaced in the original equation.

Equation (A7) of Ref. [1] gives the mixing angle $\alpha_Q \in [-\frac{\pi}{2}, \frac{\pi}{2}]$ between the charged states in the weak basis $\{\zeta^{+Q}, \zeta^{-Q*}\}$ and in the mass basis $\{H_1^{+Q}, H_2^{+Q}\}$. Here we give the correct form,

$$\begin{aligned} \tan\alpha_Q &= (-1)^{n/2+Q+1} \frac{Q\lambda_3 - \sqrt{Q^2\lambda_3^2 + (n^2 - 4Q^2)\lambda_4^2}}{\sqrt{n^2 - 4Q^2}\lambda_4} \\ &= (-1)^{n/2+Q} \frac{\sqrt{n^2 - 4Q^2}\lambda_4}{Q\lambda_3 + \sqrt{Q^2\lambda_3^2 + (n^2 - 4Q^2)\lambda_4^2}}. \end{aligned} \tag{5}$$

The specific cases given in Eqs. (7) and (14) have the correct form. The form given in Eq. (A7) of Ref. [1] could result in an incorrect sign, due to the placement of λ_4 under the square root in the numerator. However, numerical results were calculated using Eqs. (7) and (14) and so remain unchanged.

[1] K. Earl, K. Hartling, H. E. Logan, and T. Pilkington, Phys. Rev. D **90**, 055029 (2014).
[2] J. F. Gunion, H. E. Haber, G. L. Kane, and S. Dawson, *The Higgs Hunter's Guide* (Westview Press, Boulder, CO, 2000).

