Dead or Alive? Implications of the Muon Anomalous Magnetic Moment for 3-3-1 Models

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Focus on

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In collaboration with

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Outline

1. Introduction
   ⇒ Muon Anomalous Magnetic Moment
2. 3-3-1 Models
3. General analytical expressions for the corrections to $g_\mu - 2$
4. Implications of $g_\mu - 2$ for 3-3-1 Models
5. Conclusions

$$\overrightarrow{\mu_\mu} = g_\mu \frac{q}{2m_\mu} \overrightarrow{S} \Rightarrow a_\mu \equiv \frac{g_\mu - 2}{2} = 116591802(2)(42)(26) \times 10^{-11}, \quad a_\mu^{\mathrm{SM}} = a_\mu^{\mathrm{QED}} + a_\mu^{\mathrm{EW}} + a_\mu^{\mathrm{QCD}}$$

1) Current discrepancy: $\Delta a_\mu c = a_\mu^{\mathrm{exp}} - a_\mu^{\mathrm{SM}} = (261 \pm 78) \times 10^{-11}$ (3.3σ).[1] Limited by:

Experimental uncertain: FERMILAB and J-PARC and Theoretical uncertain: hadronic effects

2) Projected discrepancy: $\Delta a_\mu p = a_\mu^{\mathrm{exp}} - a_\mu^{\mathrm{SM}} = (261 \pm 34) \times 10^{-11}$ (5σ).

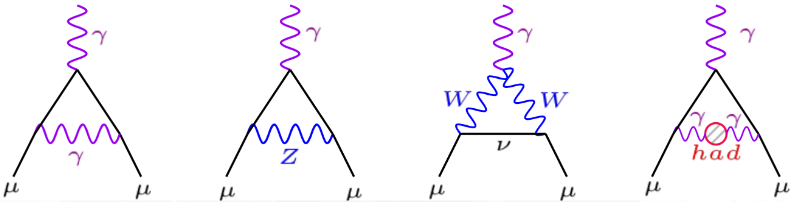

Figure 1: Feynman diagrams of the corrections to a_μ on SM interactions.

[1] M. Tanabashi et al. (Particle Data Group), Phys. Rev. D98, 030001 (2018).

$$\mathbf{SU(3)_C \times SU(3)_L \times U(1)_X} \Rightarrow \frac{Q}{e} = \frac{1}{2}(\lambda_3 + \alpha\lambda_8) + XI, \qquad \alpha = -\sqrt{3},\ \pm\frac{1}{\sqrt{3}}$$

1. MINIMAL 3-3-1 Model, [2] $\alpha = -\sqrt{3}$
2. 3-3-1 R.H.N Model[3], $\alpha = -\frac{1}{\sqrt{3}}$
3. 3-3-1 LHN Model (with neutral lepton)[4], $\alpha = -\frac{1}{\sqrt{3}}$,
4. ECONOMICAL 3-3-1 Model [5]
5. 3-3-1 MODEL WITH EXOTIC LEPTONS, $\alpha = -\sqrt{3}$[6]

$$SU(3)_L \times U(1)_X \xrightarrow{\langle\chi\rangle} SU(2)_L \times U(1)_Y, \text{ and } SU(2)_L \times U(1)_Y \xrightarrow{\langle\eta\rangle,\quad\langle\rho\rangle} U(1)_Q$$

[2] [F. Pisano and V. Pleitez, Phys. Rev. D, 46 (1992), p. 410 arXiv:hep-ph/9206242 [hep-ph]]

[3] [H.N. Long Phys. Rev. D, 54 (1996), p. 4691 arXiv:hep-ph/9607439 [hep-ph]]

[4] M.E. Catano, R. Martinez and F. Ochoa Phys. Rev. D, 86 (2012), Article 073015 arXiv:1206.1966 [hep-ph]

[5] P.V. Dong and H.N. Long Adv. High Energy Phys., 2008 (2008), Article 739492 arXiv:0804.3239 [hep-ph]

[6] W.A. Ponce, J.B. Florez and L.A. Sanchez Int. J. Mod. Phys. A, 17 (2002), p. 643 arXiv:hep-ph/0103100 [hep-ph]

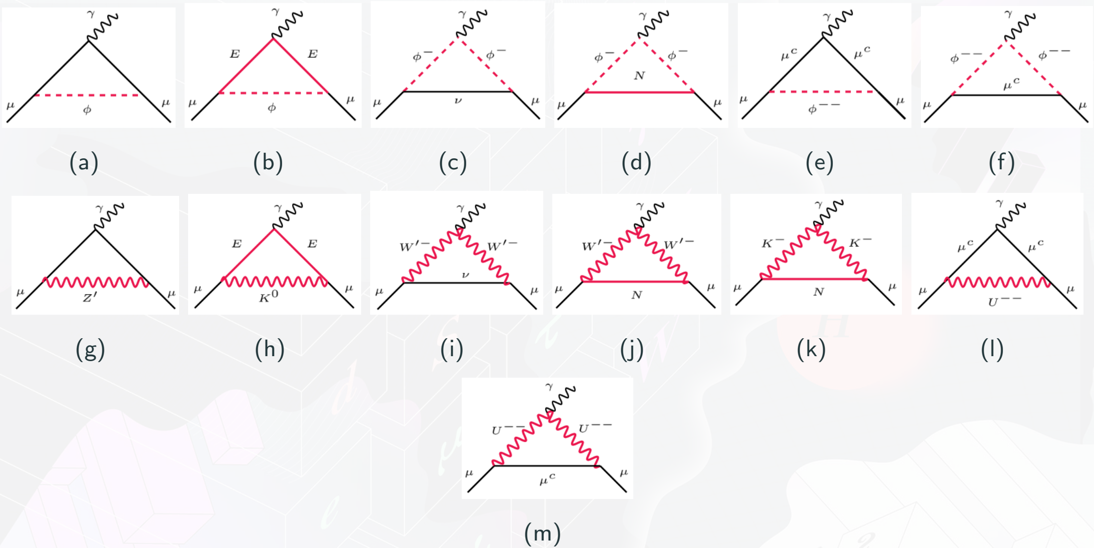

Figure 2: Feynman diagrams that contribute to the muon anomalous magnetic moment in the 3-3-1 models investigated in this work.

$$\chi = \begin{pmatrix} \chi^- \\ \chi^{--} \\ \chi^0 \end{pmatrix}, \rho = \begin{pmatrix} \rho^+ \\ \rho^0 \\ \rho^{++} \end{pmatrix}, \eta = \begin{pmatrix} \eta^0 \\ \eta_1^+ \\ \eta_2^+ \end{pmatrix}$$

$$S = \begin{pmatrix} \sigma_1^0 & h_2^- & h_1^+ \\ h_2^- & H_1^{--} & \sigma_2^0 \\ h_1^+ & \sigma_2^0 & H_1^{++} \end{pmatrix}, \quad f_L^a = \begin{pmatrix} \nu^a \\ \ell^a \\ (\ell^c)^a \end{pmatrix}$$

$$\mathscr{L}_l^{CC} \supset -\frac{g}{2\sqrt{2}} \left[\bar{\nu}\gamma^\mu (1-\gamma_5) C \bar{l}^T W_\mu^{\prime -} - \bar{l}\gamma^\mu \gamma_5 C \bar{l}^T U_\mu^{--} \right]$$

$$\mathscr{L}^{NC} \supset \bar{f}\gamma^\mu [g_V(f) + g_A(f)\gamma_5] f Z'_\mu$$

$$\mathscr{L}_{Yuk} \supset G_l \left[\overline{l_R} \nu_L \eta_1^- + \overline{l_R^c} \nu_L h_1^+ + \overline{l_R} \nu_L h_2^+ + \overline{l_R} l_L R_{\sigma_2} \right] + h.c,$$

$$G_l = m_l \sqrt{2} / v_\eta$$

$$v_\eta^2 + v_\rho^2 + v_{\sigma_2}^2 = v^2, \quad v_\eta = v_\rho = 174 \text{GeV}$$

Masses of the new bosons:

$$M_{W'}^2 = \frac{g^2}{4} \left(v_\eta^2 + v_\chi^2 + v_{\sigma_2}^2 + 2 v_{\sigma_1}^2 \right)$$

$$M_U^2 = \frac{g^2}{4} \left(v_\rho^2 + v_\chi^2 + 4 v_{\sigma_2}^2 \right)$$

$$M_{Z'}^2 \approx \left(\frac{g^2 + \frac{g'^2}{3}}{3} \right) v_\chi^2$$

$$M_{\eta_1^+}^2 \sim f v_\chi$$

$$M_{h_1^+, h_2^+} \sim v_\chi$$

$$M_{R_{\sigma_2}} \sim v_\chi$$

$$f_L^a = \begin{pmatrix} \nu^a \\ l^a \\ (\nu^c)^a \end{pmatrix}; l'_R \quad \chi = \begin{pmatrix} \chi^0 \\ \chi^- \\ \chi^{0\prime} \end{pmatrix}, \rho = \begin{pmatrix} \rho^+ \\ \rho^0 \\ \rho^{+\prime} \end{pmatrix}, \eta = \begin{pmatrix} \eta^0 \\ \eta^- \\ \eta^{0\prime} \end{pmatrix}$$

$$\mathcal{L}^{CC} \supset -\frac{g}{2\sqrt{2}}\left[\overline{\nu_R^c}\gamma^\mu (1-\gamma_5)\, l W_\mu^{\prime -}\right]$$

$$\mathcal{L}_{Yuk} \supset G_{ab}\bar{f}_{a_L}\rho\, e_{b_R} \xRightarrow{\text{leads to}} \mathcal{L} \supset G_s \bar{\mu}\mu S_2, \text{ with } G_s = m_\mu\sqrt{2}/(2v)$$

$$M_{Z'}^2 = \frac{g^2}{4(3-4s_w^2)}\left(4c_W^2 v_\chi^2 + \frac{v_\rho^2}{c_W^2} + \frac{v_\eta^2 (1-2s_W^2)^2}{c_W^2}\right), \quad M_{W'}^2 = M_{X^0}^2 = \frac{g^2}{4}\left(v_\eta^2 + v_\chi^2\right)$$

$$M_{S_2}^2 = \frac{1}{2}\left(v_\chi^2 + 2v^2(2\lambda_2 - \lambda_6)\right) \text{ and } M_{h^+}^2 = \frac{\lambda_8 + \frac{1}{2}}{2}\left(v^2 + v_\chi^2\right)$$

$$v_\eta^2 + v_\rho^2 = v^2 \Rightarrow v_\rho = v_\eta = v/\sqrt{2}$$

3-3-1 LHN Model

$$f_L^a = \begin{pmatrix} \nu^a \\ l^a \\ N^a \end{pmatrix}; l_R^a, N_R^a$$

$$\mathcal{L}^{\text{L.H.N}} \supset -\frac{g}{\sqrt{2}}\left[\overline{N_L}\gamma^\mu \bar{\ell}_L W'^-_\mu\right]$$

$$\mathcal{L}^{\text{L.H.N}}_{Yuk.} \supset G_\ell \overline{\ell_R} N_L h_1^- + G_\ell \overline{\ell_R}\nu_L h_2^+ + G_s \bar{\mu}\mu S_2$$

$$M^2_{h_1^-} = \frac{\lambda_8+\frac{1}{2}}{2}(v^2+v_\chi^2), \quad M^2_{h_2^-} = \frac{v_\chi^2}{2}+\lambda_9 v^2 .$$

ECONOMICAL 3-3-1 Model

$$\chi = \begin{pmatrix} \chi_1^0 \\ \chi_2^- \\ \chi_3^0 \end{pmatrix}, \eta = \begin{pmatrix} \eta_1^+ \\ \eta_2^0 \\ \eta_3^+ \end{pmatrix}$$

$$\langle \eta_2^0 \rangle = v_{\eta_2^0} = v/\sqrt{2}, \langle \chi_1^0 \rangle = v_{\chi_1} = u/\sqrt{2},$$
$$\langle \chi_3^0 \rangle = v_{\chi_3^0} = v_\chi/\sqrt{2} u, v \ll v_\chi$$

$$\mathcal{L} \supset G^\ell_{ij} \bar{f}_{iL} \eta \ell_{jR} + G^\varepsilon_{ij} \varepsilon_{pmn} \left(\bar{f}^c_{iL}\right)_p \left(f_{iL}\right)_m (\eta)_n$$

$$\Rightarrow G_l l_R \nu_L \eta_1^+ \text{ and } G_s \bar{\mu}\mu S_2$$

$$M^2_{\eta_1^+} = \frac{\lambda_4}{2}\left(u^2+v^2+v_\chi^2\right),$$
$$M^2_{S_2} = 2\lambda_1 v_\chi^2$$

3-3-1 LHN Model

$$f_L^a = \begin{pmatrix} \nu^a \\ l^a \\ N^a \end{pmatrix}; l_R^a, N_R^a$$

$$\mathscr{L}^{\mathrm{L.H.N}} \supset -\frac{g}{\sqrt{2}}\left[\overline{N_L}\gamma^\mu \bar{\ell}_L W_\mu'^-\right]$$

$$\mathscr{L}_{Yuk.}^{\mathrm{L.H.N}} \supset G_\ell \overline{\ell_R} N_L h_1^- + G_\ell \overline{\ell_R} \nu_L h_2^+ + G_s \bar{\mu}\mu S_2$$

$$M_{h_1^-}^2 = \frac{\lambda_8 + \frac{1}{2}}{2}(v^2 + v_\chi^2), \quad M_{h_2^-}^2 = \frac{v_\chi^2}{2} + \lambda_9 v^2 .$$

ECONOMICAL 3-3-1 Model

$$\chi = \begin{pmatrix} \chi_1^0 \\ \chi_2^- \\ \chi_3^0 \end{pmatrix}, \eta = \begin{pmatrix} \eta_1^+ \\ \eta_2^0 \\ \eta_3^+ \end{pmatrix}$$

$$\langle \eta_2^0 \rangle = v_{\eta_2^0} = v/\sqrt{2}, \langle \chi_1^0 \rangle = v_{\chi_1} = u/\sqrt{2},$$
$$\langle \chi_3^0 \rangle = v_{\chi_3^0} = v_\chi/\sqrt{2} u, v \ll v_\chi$$

$$\mathscr{L} \supset G_{ij}^\ell \bar{f}_{iL}\eta \ell_{jR} + G_{ij}^\varepsilon \varepsilon_{pmn}\left(\bar{f}_{iL}^c\right)_p (f_{iL})_m (\eta)_n$$
$$\Rightarrow G_l l_R \nu_L \eta_1^+ \text{ and } G_s \bar{\mu}\mu S_2$$

$$M_{\eta_1^+}^2 = \frac{\lambda_4}{2}\left(u^2 + v^2 + v_\chi^2\right),$$
$$M_{S_2}^2 = 2\lambda_1 v_\chi^2$$

$$f_{1L} = \begin{pmatrix} \nu_1 \\ l_1 \\ E_1^- \end{pmatrix}; l_1^c; f_{2,3L} = \begin{pmatrix} \nu_{2,3} \\ l_{2,3} \\ N_{2,3} \end{pmatrix}; l_{2,3}^c \quad f_{4L} = \begin{pmatrix} E_2^- \\ N_3 \\ N_4 \end{pmatrix}; E_2^c; f_{5L} = \begin{pmatrix} N_5 \\ E_3^+ \\ l_3^+ \end{pmatrix}; E_3^c$$

$$\chi_i = \begin{pmatrix} \chi_i^- \\ \chi_i^0 \\ \chi_i^{0\prime} \end{pmatrix}, \chi_3 = \begin{pmatrix} \chi_3^0 \\ \chi_3^+ \\ \chi_3^{\prime +} \end{pmatrix}, \quad i = 1, 2,$$

with $\langle \chi_1 \rangle = (0, 0, v_\chi)^T$, $\langle \chi_2 \rangle = (0, v/\sqrt{2}, 0)^T$ and $\langle \phi_3 \rangle = (v'/\sqrt{2}, 0, 0)^T$, $v_\chi \gg v$, v' , $v' \sim v$

$$\mathscr{L} \supset \frac{g'}{2\sqrt{3} s_W c_W} \bar{\mu} \gamma_\mu (g_V + g_A) \mu Z' - \frac{g}{\sqrt{2}} \left(\overline{N_{1L}} \gamma_\mu \mu_L + \bar{\mu}_L \gamma_\mu N_{4L} \right) K_\mu^+ - \frac{g}{\sqrt{2}} \left(\bar{\mu}_L \gamma_\mu E_L \right) K_\mu^0$$
$$+ h_1 \bar{\mu} (1 - \gamma_5) N \chi^+ + h_2 \bar{\mu} E^- \chi^0 + h_3 \bar{\mu} E_2^- \chi^0 + \mathrm{H.c.}$$

$$M_{Z'}^2 = \frac{2}{9} \left(3g^2 + g'^2 \right) v_\chi^2, \; M_{K^+}^2 = M_{K^0}^2 = \frac{g^2}{4} \left(2v_\chi^2 + v^2 \right)$$

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Physics Reports

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A call for new physics: The muon anomalous magnetic moment and lepton flavor violation

Manfred Lindner, Moritz Platscher, Farinaldo S. Queiroz

New Physics Contributions to the Muon Anomalous Magnetic Moment: A Numerical Code (arXiv:1403.2309)

The corrections to $g_\mu - 2$ arise from the presence of new gauge bosons U^{++}, Z' and W', and charged scalar η_1^-. The contributions for heavy bosons are given as:

$$\Delta a_\mu\left(U^{++}\right) \simeq -2\frac{1}{\pi^2}\frac{m_\mu^2}{M_U^2}\left|\frac{g}{2\sqrt{2}}\right|^2, \text{ with } M_U \gg m_\mu$$

$$\Delta a_\mu\left(v, W'\right) \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_{W'}^2}\left|\frac{g}{2\sqrt{2}}\right|^2\left(\frac{5}{3}\right)$$

$$\Delta a_\mu\left(\mu, Z'\right) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{Z'}^2}\left|\frac{g}{2c_W}\frac{\sqrt{3}\sqrt{1-4s_W^2}}{2}\right|^2\left(-\frac{4}{27}\right)$$

$$\Delta a_\mu\left(\eta_1^+\right) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{\eta_1^+}^2}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\left(\frac{1}{6}\right), \text{ with } M_{\eta_1^+} \gg m_\mu, m_{\nu_L}$$

3-3-1 R.H.N Model

This model induces several corrections to $g-2$, coming from the Z', W', h^+ and S_2.

$$\Delta a_\mu(v, W') \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_W^2}\left|\frac{g}{2\sqrt{2}}\right|^2\left(\frac{5}{3}\right),$$

$$\Delta a_\mu(\mu, Z') \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_Z^2}\frac{1}{3}\left|-\frac{g}{4c_W\sqrt{3-4s_W^2}}\right|\left[-\left|1-4s_W^2\right|^2+5\right],$$

$$\Delta a_\mu(h^+) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{h^+}^2}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\frac{1}{6},$$

$$\Delta a_\mu(S_2) \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_{S_2}^2}\left(\frac{m_\mu\sqrt{2}}{2v_\eta}\right)^2\left[\frac{1}{6}-\left(\frac{3}{4}+\log\left(\frac{m_\mu}{M_{S_2}}\right)\right)\right].$$

3-3-1 L.H.N Model

The contributions to $g-2$ coming from the Z', h_1^- and S_2 fields are identical to the $3-3-1$ r.h.n model.

$$\Delta a_\mu(N, W') \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_W^2}\left|\frac{g}{2\sqrt{2}}\right|^2\frac{5}{3},$$

$$\Delta a_\mu(h_2^+) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{h_2^+}^2}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\frac{1}{6}.$$

3-3-1 R.H.N Model

This model induces several corrections to $g-2$, coming from the Z', W', h^+ and S_2.

$$\Delta a_\mu(v, W') \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_W^2}\left|\frac{g}{2\sqrt{2}}\right|^2\left(\frac{5}{3}\right),$$

$$\Delta a_\mu(\mu, Z') \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_Z^2}\frac{1}{3}\left|-\frac{g}{4c_W\sqrt{3-4s_W^2}}\right|\left[-\left|1-4s_W^2\right|^2+5\right],$$

$$\Delta a_\mu(h^+) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{h^+}^2}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\frac{1}{6},$$

$$\Delta a_\mu(S_2) \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M_{S_2}^2}\left(\frac{m_\mu\sqrt{2}}{2v_\eta}\right)^2\left[\frac{1}{6}-\left(\frac{3}{4}+\log\left(\frac{m_\mu}{M_{S_2}}\right)\right)\right].$$

3-3-1 L.H.N Model

The contributions to $g-2$ coming from the Z', h_1^- and S_2 fields are identical to the $3-3-1$ r.h.n model.

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$$\Delta a_\mu(h_2^+) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M_{h_2^+}^2}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\frac{1}{6}.$$

The corrections to $g_\mu - 2$: Economical 3-3-1 and 3-3-1 with exotic leptons for heavy bosons

ECONOMICAL3-3-1 Model

The corrections to Δa_μ that arise from Z' and W' have nearly the same magnitude as in the $3-3-1$ R.H.N model.

$$\Delta a_\mu\left(\eta_1^+\right) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M^2_{\eta_1^+}}\left|\frac{m_\mu\sqrt{2}}{2v_\eta}\right|^2\frac{1}{6}, \quad \Delta a_\mu\left(S_2\right) \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M^2_{S_2}}\left(\frac{m_\mu\sqrt{2}}{2v_\eta}\right)^2\left[\frac{1}{6}-\left(\frac{3}{4}+\log\left(\frac{m_\mu}{M_{S_2}}\right)\right)\right].$$

3-3-1 Model with exotic leptons

The corrections to $g-2$ coming from the Z', K^0 and K^+ bosons.

$$\Delta a_\mu\left(N, K^+\right) \simeq \frac{1}{4\pi^2}\frac{m_\mu^2}{M^2_{K^+}}\left|\frac{g}{\sqrt{2}}\right|^2\frac{5}{3}, \quad \Delta a_\mu\left(E, K^0\right) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M^2_{K^0}}\left|\frac{g}{\sqrt{2}}\right|^2\left(\frac{4}{3}\right),$$

$$\Delta a_\mu\left(\mu, Z'\right) \simeq \frac{-1}{4\pi^2}\frac{m_\mu^2}{M^2_{Z'}}\left|\frac{g'}{2\sqrt{3}s_W c_W}\right|^2\frac{1}{12}\left[-\left|\left(-c_{2W}+2s_W^2\right)\right|^2+5\left|\left(c_{2W}+2s_W^2\right)\right|^2\right].$$

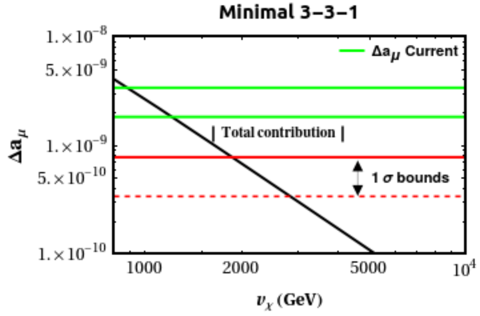

Figure 3: Overall contribution to Δa_μ from the Minimal 3-3-1 model. The green bands are delimited by $\Delta a_\mu = (261 \pm 78) \times 10^{-11}$. The current 1σ bound is found by requiring $\Delta a_\mu < 78 \times 10^{-11}$ while the projected bound is obtained for $\Delta a_\mu < 34 \times 10^{-11}$.

We used $M_{Z'} = 0.395 v_\chi$, $M_{W'} = M_{U^{\pm\pm}} = 0.33 v_\chi$.

LHC-13 TeV:

$M_{Z'} > 3.7$ TeV

$M_{W'} > 3.2$ TeV

Δa_μ Current:

$\mathrm{M}_{Z'} > 434.5$ GeV,

$\mathrm{M}_{W'} > 646$ GeV.

Δa_μp projected:

$\mathrm{M}_{Z'} > 632$ GeV,

$\mathrm{M}_{W'} > 996.1$ GeV.

LHC's limit: A. Nepomuceno and B. Meirose Phys. Rev. D, 101 (2020), Article 035017 arXiv:1911.12783 [hep-ph]

Results: 3-3-1 R.H.N and Economical Model

We used $M_{Z'} = 0.395 v_\chi$, $M_{W'} = 0.33 v_\chi$.

3-3-1 R.H.N Model

LHC-13 TeV:

$M_{Z'} > 2.64$ TeV

Δa_μ Current: $\mathrm{M}_{Z'} > 158$ GeV,
$\mathrm{M}_{W'} > 133$ GeV.

Δa_μp projected: $\mathrm{M}_{Z'} > 276.5$ GeV,
$\mathrm{M}_{W'} > 239$ GeV.

3-3-1 Economical Model

LHC-13 TeV:

$M_{Z'} > 2.64$ TeV

Δa_μ Current: $\mathrm{M}_{Z'} > 59.3$ GeV,
$\mathrm{M}_{W'} > 49.5$ GeV.

Δa_μp projected: $\mathrm{M}_{Z'} > 271.4$ GeV,
$\mathrm{M}_{W'} > 226.7$ GeV.

LHC's limits: M. Lindner, M. Platscher and F.S. Queiroz, Phys. Rep., 731 (2018), p. 1

3-3-1 L.H.N Model: We used $M_{Z'} = 0.395 v_\chi$, $M_{W'} = 0.33 v_\chi$.

LHC-13 TeV[7]: $M_{Z'} > 2$ TeV

$M_N = 1$ GeV:

Δa_μc: $\mathrm{M}_{Z'} > 160$ GeV, $\mathrm{M}_{W'} > 134.3$ GeV.

Δa_μp: $\mathrm{M}_{Z'} > 285$ GeV, $\mathrm{M}_{W'} > 238.3$ GeV.

$M_N = 100$ GeV :

Δa_μc: $\mathrm{M}_{Z'} > 136.7$ GeV, $\mathrm{M}_{W'} > 114.2$ GeV.

Δa_μp: $\mathrm{M}_{Z'} > 276.5$ GeV, $\mathrm{M}_{W'} > 231$ GeV.

Model 3-3-1 with exotic leptons: We used $M_{Z'} = 0.55 v_\chi$, $M_{K'} = M_{K^0} = 0.46 v_\chi$.

LHC-13 TeV[8]: $M_{Z'} > 2.91$ TeV

$M_N = 10$ GeV $M_E = 150$ GeV:

Δa_μc: $\mathrm{M}_{Z'} >$ 429GeV, $\mathrm{M}_{W'} > 359$ GeV.

Δa_μp: $\mathrm{M}_{Z'} > 693$ GeV, $\mathrm{M}_{W'} > 579.6$ GeV.

$M_N = 100$ GeV $M_E = 150$ GeV:

Δa_μc: $\mathrm{M}_{Z'} > 369$ GeV, $\mathrm{M}_{W'} > 309.1$ GeV.

Δa_μp: $\mathrm{M}_{Z'} > 600$ GeV, $\mathrm{M}_{W'} > 501.4$ GeV.

[7] M. Lindner, M. Platscher and F.S. Queiroz, Phys. Rep., 731 (2018), p. 1

[8] C. Salazar, R.H. Benavides, W.A. Ponce and E. Rojas J. High Energy Phys., 07 (2015), Article 096 arXiv:1503.03519 [hep-ph]

Results: Extended version of the 3-3-1 LHN Model

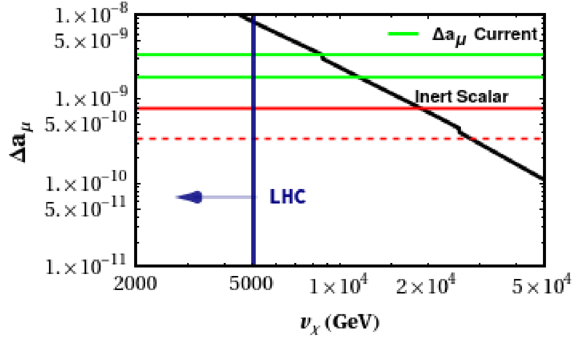

Figure 4: Overall contribution of the 3-3-1 LHN model augmented by an inert scalar triplet ϕ.

The inert triplet scalar allows us to include $\mathscr{L} \supset y_{ab}\bar{f}_a\phi e_{bR}$.

With $y_{22} = 1$

Mass scalar:

come from $\lambda\phi^\dagger\phi\chi^\dagger\chi$

$$M_\phi \sim \lambda v_\chi, \quad \lambda = 0.1$$

.

This extended version successfully accommodates the a_μ anomaly for $v_\chi \sim 10$ TeV.

- We concluded that none of the five models investigated here are capable of accommodating the anomaly.
- We derived robust and complementary 1σ lower mass bounds on the masses of the new gauge bosons, namely the Z' and W' bosons.
- If the anomaly observed in the muon anomalous magnetic moment is confirmed by the g-2 experiment at FERMILAB these models must be extended.
- We presented a plausible extension to the 3-3-1 LHN model, which features an inert scalar triplet.

Another paper you may be interested in!

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Are 3-4-1 models able to explain the upcoming results of the muon anomalous magnetic moment?

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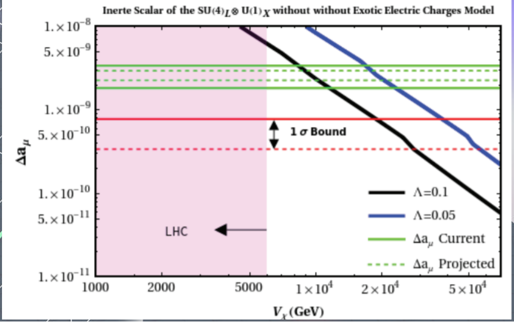

In light of the upcoming measurement of the muon anomalous magnetic moment $(g-2)$, we revisit the corrections to $g-2$ in the context of the $SU(4)_L \times U(1)_X$ gauge symmetry. We investigate three models based on this gauge symmetry and express our results in terms of the energy scale at which the $SU(4)_L \times U(1)_X$ symmetry is broken. To draw solid conclusions we put our findings into perspective with existing collider bounds. Lastly, we highlight the difference between our results and those rising from $SU(3)_L \times U(1)_X$ constructions.

Keywords: Extra gauge bosons; muon anomalous magnetic moment.

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Thank you!