Published for SISSA by Springer

Received: *August 29, 2014*
Accepted: *August 29, 2014*
Published: *September 25, 2014*

JHEP09(2014)155

Erratum: Testing the muon g-2 anomaly at the LHC

A. Freitas,[a] J. Lykken,[b] S. Kell[a] and S. Westhoff[a]

[a] *PITTsburgh Particle-physics Astro-physics & Cosmology Center (PITT-PACC), Department of Physics & Astronomy, University of Pittsburgh, Pittsburgh, PA 15260, U.S.A.*

[b] *Theoretical Physics Department, Fermilab, P.O. Box 500, Batavia, IL 60510, U.S.A.*

E-mail: afreitas@pitt.edu, lykken@fnal.gov, sds61@pitt.edu, suw22@pitt.edu

Erratum to: JHEP05(2014)145

ArXiv ePrint: 1402.7065

doi:10.1007/JHEP09(2014)155

We wish to correct an error in the application of the bound from the electron anomalous moment, a_e, in section 4 of ref. [1]. As a result, the phenomenological discussion in this section also changes. The text after eq. (4.6) and until the end of section 4 should read:

> Within the framework of MFV, effects of mixing vector leptons on a_μ and a_e are tightly related. The dominant contribution to a_ℓ in scenario 2 is proportional to $\delta a_\ell \sim m_\ell Y_1 Y_2 Y_{12}$, where either of the couplings to SM leptons is suppressed by the Yukawa coupling, $Y_i \sim y_\ell$, depending on the chosen flavor representations for ψ_1 and ψ_2. This leads to a quadratic scaling of vector-lepton effects on a_ℓ with the lepton masses, and in particular to $\delta a_e/\delta a_\mu = m_e^2/m_\mu^2$. However, LEP constraints on Y_i are stronger than the MFV suppression $Y_i \sim y_\ell$ for masses below the TeV scale in the muon sector, but not in the electron sector. The maximal effect of mixing vector fermions in MFV therefore scales as
>
> $$\frac{\delta a_e}{\delta a_\mu} = \frac{m_e^2}{m_\mu^2} \times \max\left[\frac{\sqrt{4\pi}y_\mu/y_\tau}{|\epsilon_i|^{\max} M_i/v}, 1\right] \approx \frac{m_e^2}{m_\mu^2} \times \max\left[8.6 \times \left(\frac{0.03 \times 200\ \text{GeV}}{|\epsilon_i|^{\max} \times M_i}\right), 1\right]. \tag{4.7}$$
>
> In figure 1, we show the parameter space of mixing vector leptons that can explain Δa_μ at the 1σ (green) and 2σ (yellow) level in the flavor scenario 2, where both vector leptons are in the same representation of the flavor group. We choose the representation $(3,1)$, where both vector leptons are triplets under $\mathrm{SU}(3)_L$, so that only the coupling Y_D of ψ_D to SM leptons is constrained by MFV. In the displayed parameter space, MFV bounds are visible only for the scenario $\psi_D + \psi_T$ as a kink in the one-sigma (two-sigma) region around $M_T \sim 500$ GeV (270 GeV). Since the viable parameter space for Δa_μ below $M \lesssim 2$ TeV is largely dominated by LEP bounds, similar bounds apply for the flavor representation $(1,3)$.
>
> Bounds from a_e are sensitive to the flavor representation, since MFV bounds compete with LEP bounds already in the low-mass region. For the case $(3,1)$, a_e bounds exclude the gray area of low fermion-doublet masses. For the representation $(1,3)$, bounds from a_e are of similar strength, but sensitive to the region with low singlet or triplet masses.
>
> In the scenarios $\psi_D + \psi^\pm$, $\psi_D + \psi_A$ and $\psi_D + \psi_T$, the dominant contributions to a_μ decouple as $Y_D Y_i Y_{12}/(M_D M_i)$, $i = S, A, T$, for $M_\psi \gg M_{\text{EW}}$. However, since LEP constraints on $Y_{1,2} = \epsilon_{1,2} M_{1,2}/v$ weaken as $M_{1,2}$ become large, the *maximal* contribution to a_μ is asymptotically constant. In the scenario $\psi_D + \psi^0$, the dominant contribution due to vector fermion mixing decouples as $Y_N Y_D Y_{12}/M_D^2$ for $M_D \gg M_{\text{EW}}$ and as $Y_N Y_D Y_{12}/M_N$ for $M_N \gg M_{\text{EW}}$. The maximal δa_μ therefore decreases as $1/M_D$ for large doublet masses, but is constant in the limit of large singlet masses. In MFV, constraints on $Y_D \sim y_\mu$ exclude the parameter space with $M_D \gtrsim 4$ TeV in the scenario $\psi_D + \psi^\pm$, $M_D \gtrsim 7.6$ TeV in $\psi_D + \psi_A$, and $M_D \gtrsim 2.8$ TeV in $\psi_D + \psi_T$, and some of the parameter space with light singlets or triplets. Direct searches for vector fermions at the LHC are not able to probe the mass regime far above $M_{1,2} \sim 500 - 600$ GeV (see section 6). Therefore an explanation of Δa_μ with mixing vector fermions, be it within or beyond MFV, cannot be excluded at the 14-TeV LHC.

JHEP09(2014)155

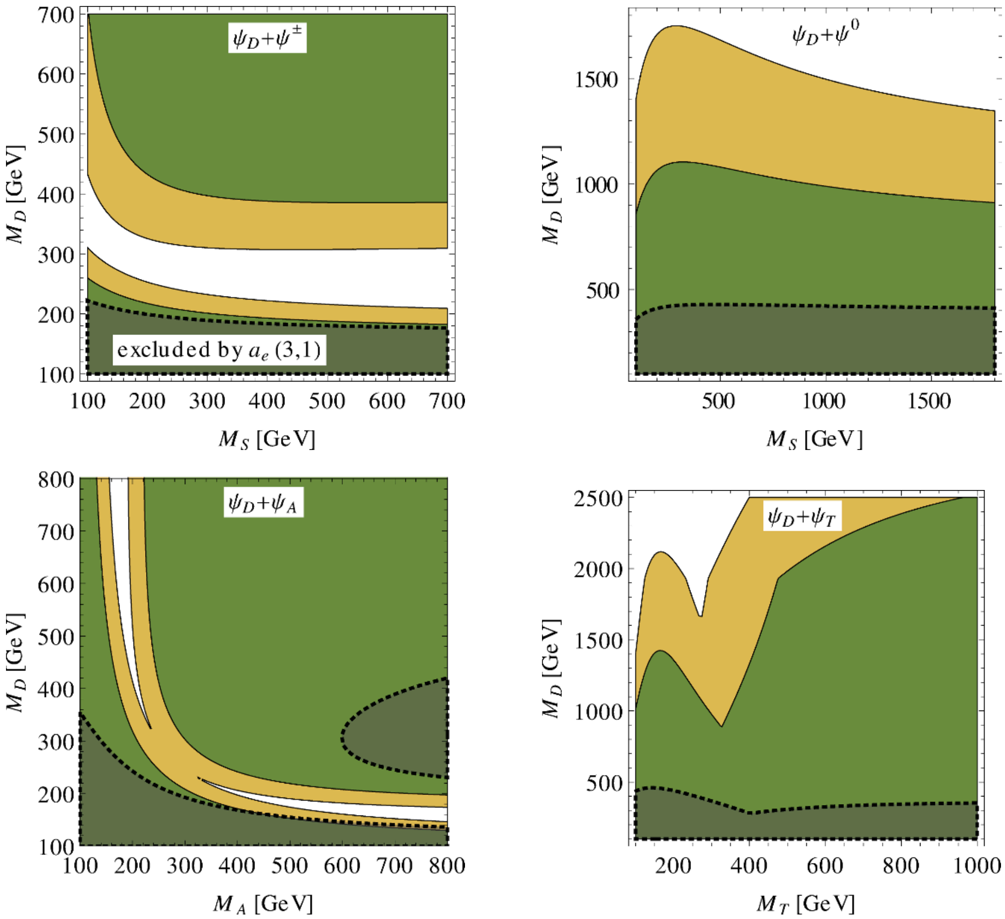

Figure 1. Contributions to a_μ from mixing vector leptons in the flavor scenario $(3,1)$. Regions that accommodate Δa_μ at the 1σ (2σ) level are displayed in green (yellow). Gray regions with dotted boundaries are excluded by a_e at the 95% C.L. in the flavor scenario $(3,1)$.

Since the LHC can only cover a small portion of the viable parameter space in this scenario, we refrain from a detailed discussion of its collider phenomenology.

We thank Michele Redi for pointing out the MFV suppression of effects from mixing vector leptons in a_e.

References

[1] A. Freitas, J. Lykken, S. Kell and S. Westhoff, *Testing the Muon g-2 Anomaly at the LHC*, *JHEP* **05** (2014) 145 [arXiv:1402.7065] [INSPIRE].