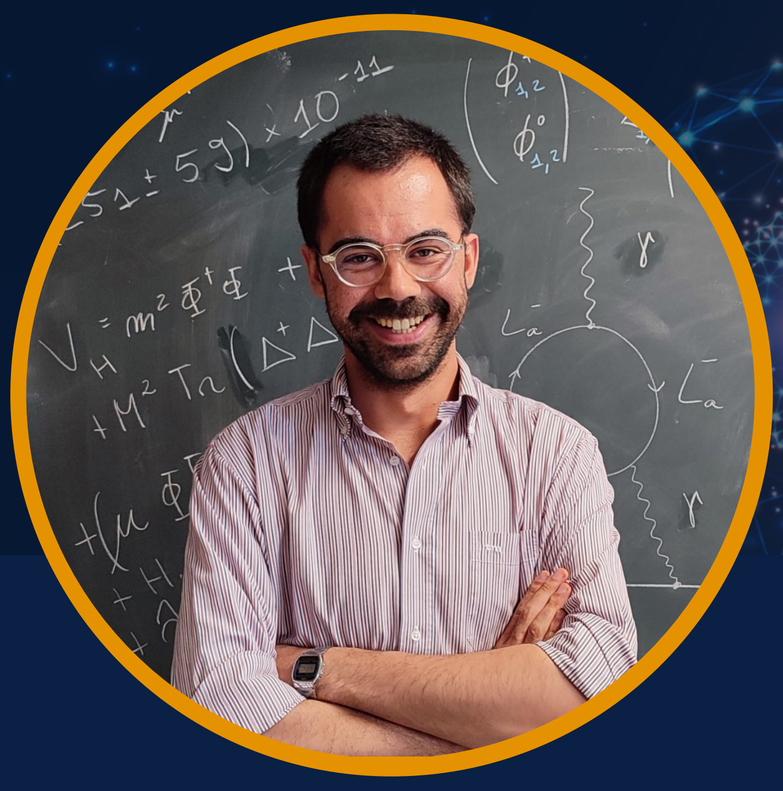
The $(g-2)_\mu$ in the two-Higgs Doublet (2HDM) model

P.M. Ferreira, B.L. Gonçalves, F.R. Joaquim, Marc Sher



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Supervisors:
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MSc Thesis:
High-scale neutrino mass degeneracy in the two-Higgs doublet model

Supervisor:
Filipe Joaquim

Project MEFT video

MSc Thesis (MEFT)

Highlighted Publications:

- **$(g-2)_\mu$ in the 2HDM and slightly beyond: An updated view**
  P.M. Ferreira, B.L. Gonçalves, F.R. Joaquim, Marc Sher
  Published in: Phys.Rev.D 104 (2021) 5, 053008
- **The hidden side of scalar-triplet models with spontaneous CP violation**
  P.M. Ferreira, B.L. Gonçalves, F.R. Joaquim
  Published in: JHEP 05 (2022) 105
- **A closer look at the $U(1)_{B-L}$ explanation of the ATOMKI nuclear anomalies**
  P.M. Ferreira, B.L. Gonçalves, F.R. Joaquim
  e-Print: 2311.18004 [hep-ph]

Some Talks at International Conferences

- **Workshop on the Standard Model and Beyond @ CORFU 2021**
- **FLASY'22** (IST, Lisbon)
- **Scalars 2023** (Warsaw)

Check this work @ SLAC Summer Institute 2021

Full Publication List

PHYSICAL REVIEW D **104,** 053008 (2021)

$(g-2)_\mu$ in the 2HDM and slightly beyond: An updated view

P. M. Ferreira, [1,2] B. L. Gonçalves, [3,2] F. R. Joaquim, [3] and Marc Sher [4]

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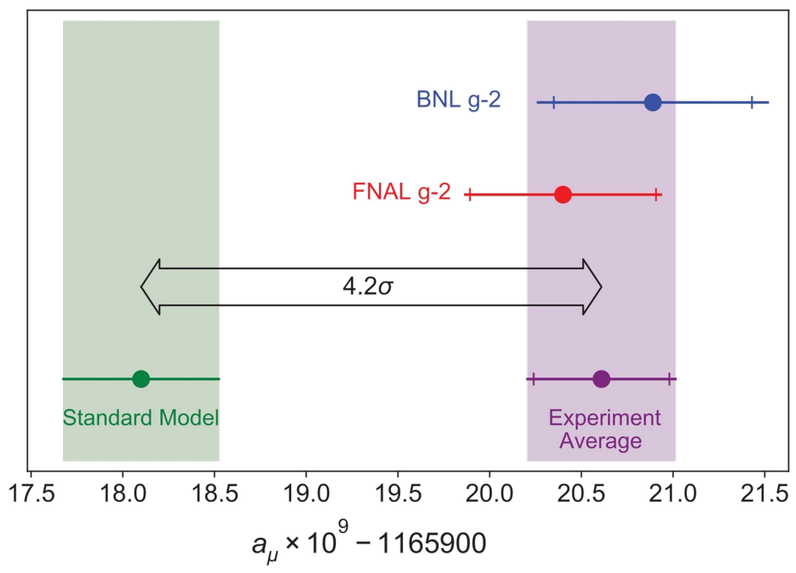
The problem

Discrepancy between the SM predicition and the measured value for the Muon anomalous magnetic moment

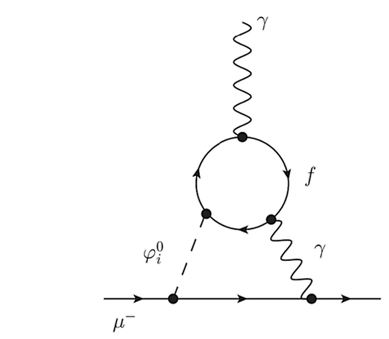
$$\Delta a_\mu^{\text{exp}} = a_\mu^{\text{exp}} - a_\mu^{\text{SM}}$$

NEW PHYSICS IS NEEDED!



The solution: the 2HDM and beyond

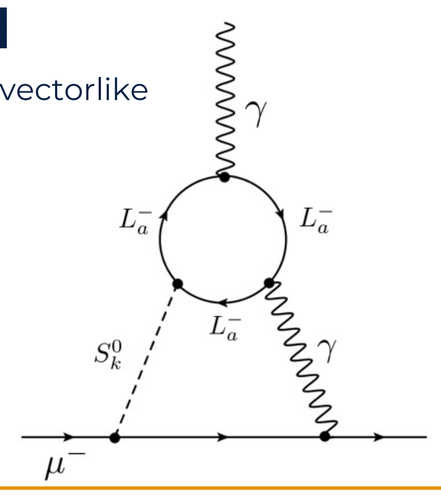
We compute Δa_μ in the two Higgs doublet model witout and with vectorlike leptons @ the 2-loop level.



New diagrams involving the new Higgs particles

Vector-Like Leptons (VLLs)

	$\chi_{L,R}$	$E_{L,R}$
$SU(2)$	**2**	**1**
$U(1)$	$-1/2$	-1



New diagrams involving the new heavy leptons

The results...

In the 2HDM, the discrepancy can be accommodated with **light pseudoscalars** and **large values of $\tan\beta$**.

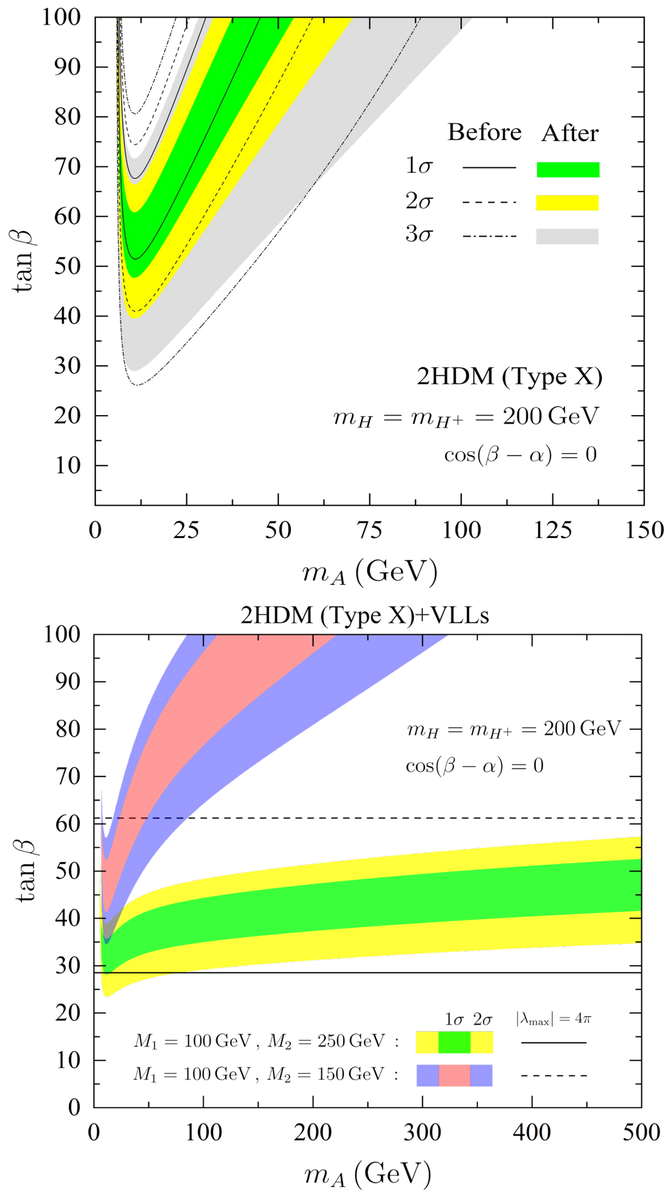
TENSION WITH EXPERIMENTAL CONSTRAINTS

ADDING VLLs

Parameter space is widened

COUPLINGS ABOVE PERTURBATIVITY LIMIT

This can be alleviated by considering N families of vectorlike leptons instead of only one (very roughly, this would reduce the maximum values of these couplings by a factor of 1/N). Alternatively, one can include VLL-muon mixing.



UIDB/00777/2020, UIDP/00777/2020, CERN/FIS-PAR/0019/2021