

Effective Field Theories & Scattering Amplitudes

Camila Sampaio Machado



About Me

Background, past activities

PhD

2013-2017

IFT-UNESP (Sao Paulo, Brazil)
(+ 1 yr @ CERN)

PostDoc

2017-2020

JGU (Mainz, Germany)

Joint position

PostDoc

2020 —

DESY (Hamburg, Germany)

— 2024

Weizmann (Rehovot, Israel)



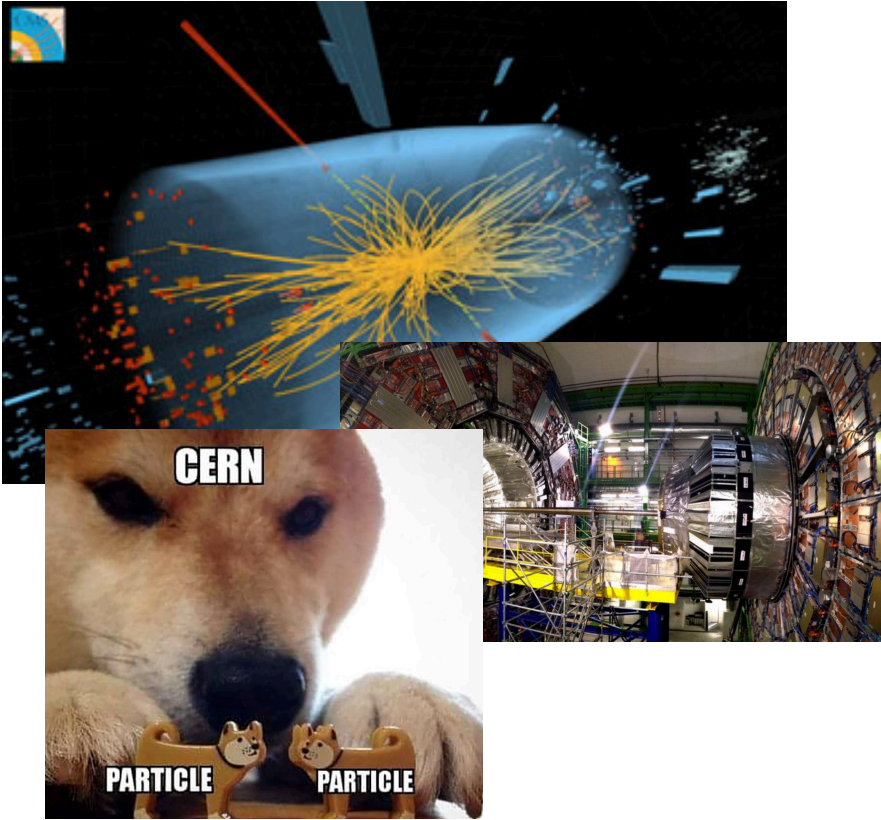
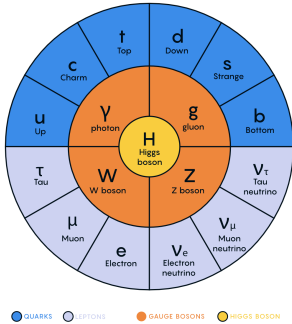
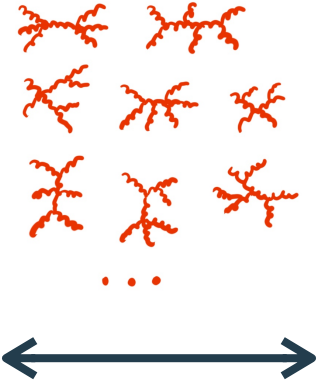
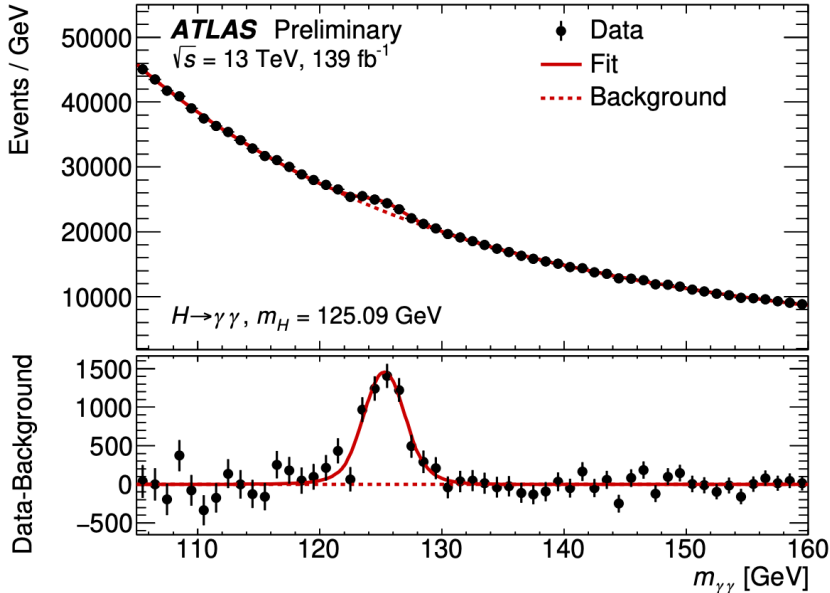
JOHANNES GUTENBERG
UNIVERSITÄT MAINZ



מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

My Current Work

Scattering Amplitudes



My Current Work

EFTs and amplitude methods

Effective Field Theories

Energy

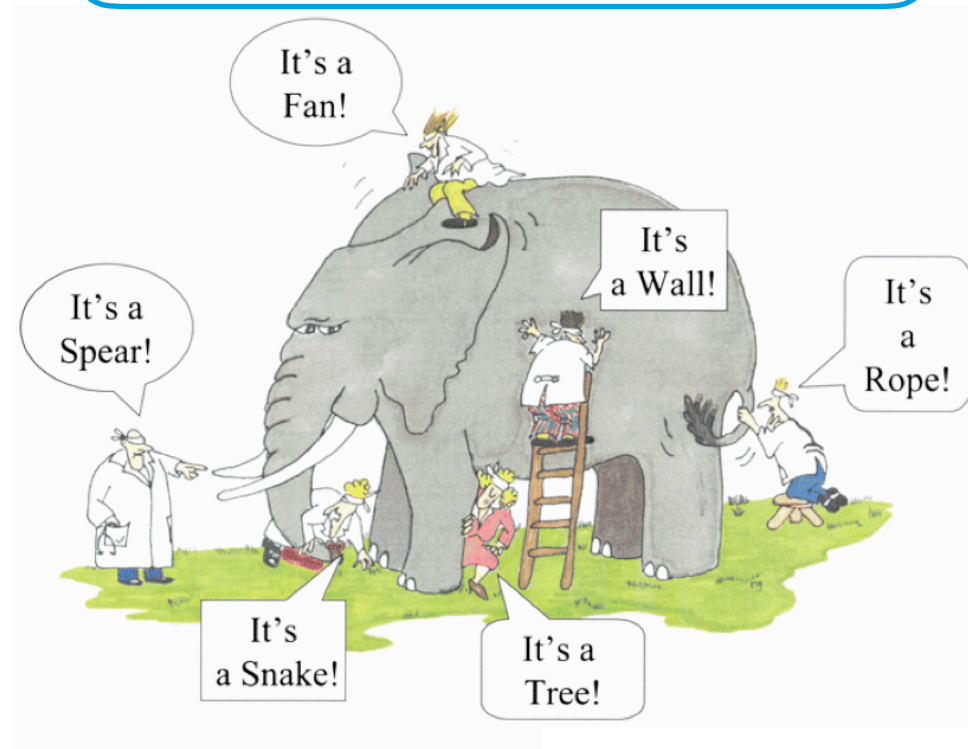


UV-theory (?)

SM-EFT

SM

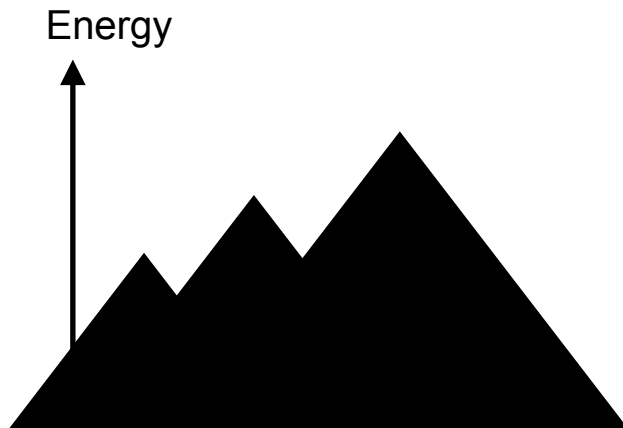
Beyond Standard Model Elephant



My Current Work

EFTs and amplitude methods

Effective Field Theories

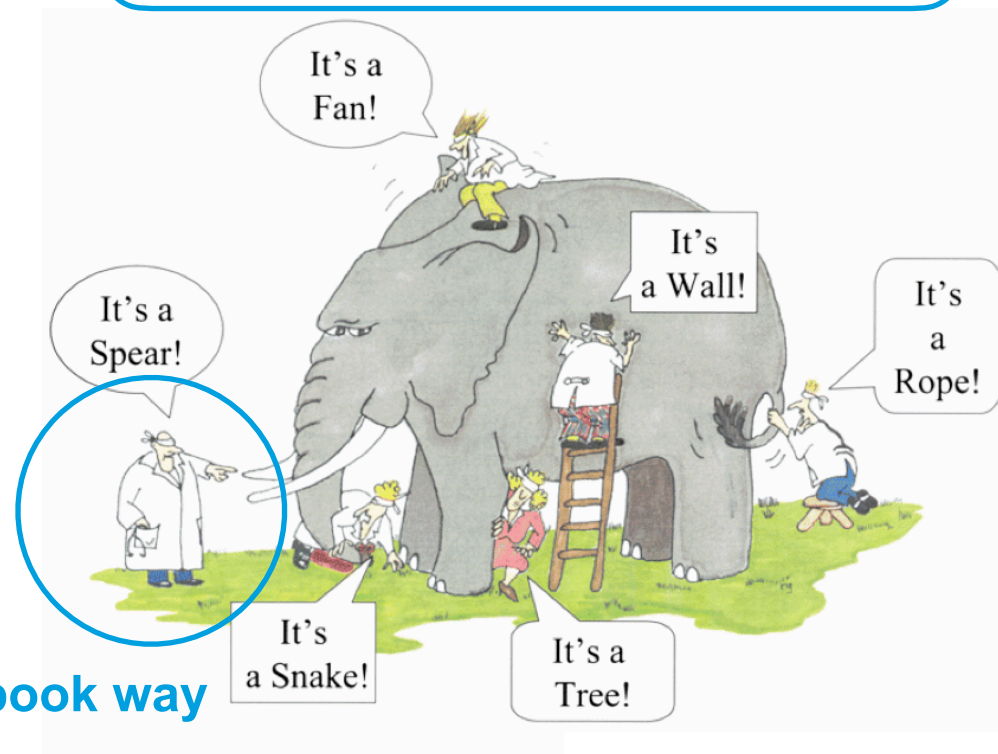


UV-theory (?)

SM-EFT

SM

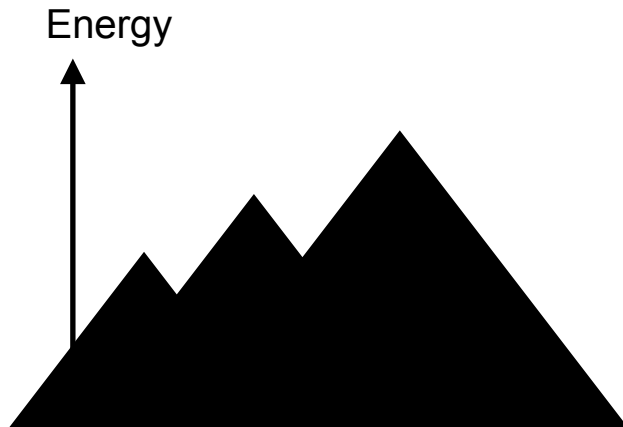
Beyond Standard Model Elephant



My Current Work

EFTs and amplitude methods

Effective Field Theories

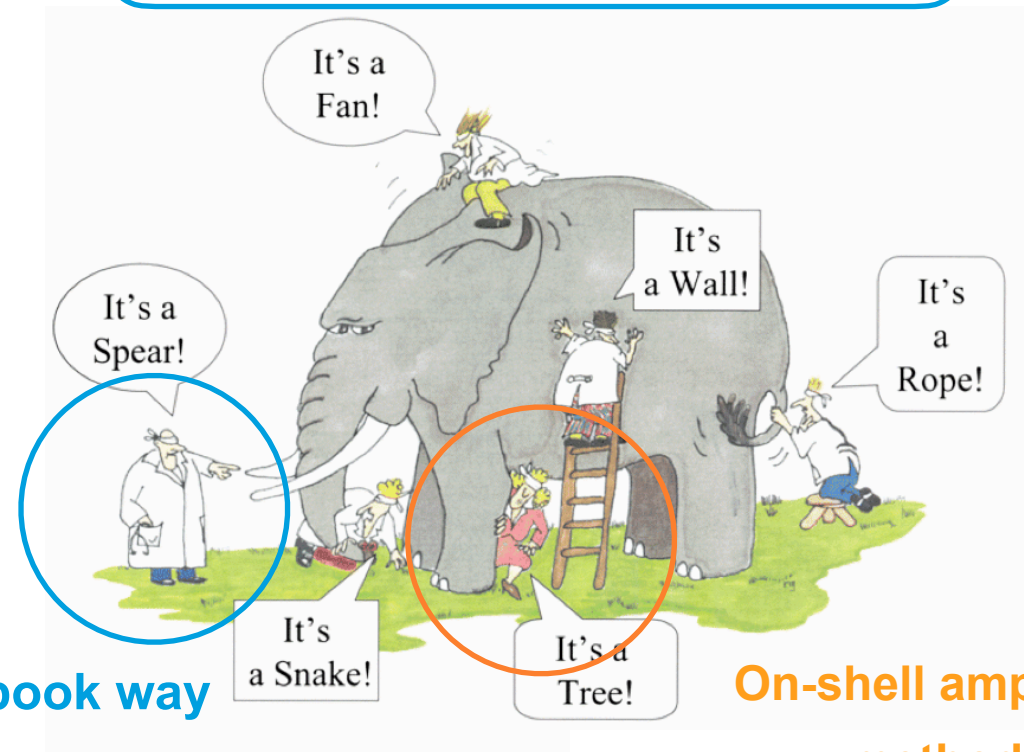


UV-theory (?)

SM-EFT

SM

Beyond Standard Model Elephant



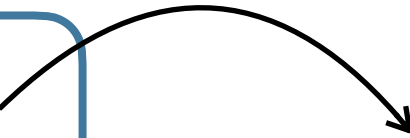
QFT textbook way

On-shell amplitude methods

Research Overview

Beyond Standard Model

- **Gravitational waves and axions**
w/ P. Schwaller, Ben A. Stefanex, W. Ratzinger
PRD 102 (2020) 7, 075033/ JHEP 01 (2019) 053
- **Relaxion models**
w/ N. Fonseca, B. Von Harling, L. De Lima, R. D. Matheus
PRD 94 (2016) 1, 015010/ JHEP 07 (2018) 033/ PRD 100 (2019) 10, 105019
- **Neutrinos in extra dimensions**
w/ M. Carena, Ying-Ying Li, Pedro A.N. Machado, Carlos E.M. Wagner
PRD 96 (2017) 9, 095014
- **Flavour violation in SM-EFT**
w/ L. De Lima, R. D. Matheus, L.A.F Prado
JHEP 11 (2015) 074



Getting a broad view of SM problems
and BSM probes

Research Overview

Beyond Standard Model

- Gravitational waves and axions
- Relaxion models
- Neutrinos in extra dimensions
- Flavour violation in SM-EFT

Developing new (amplitude) tools for massive particles and EFTs



Amplitude methods

- Recursion relations for massive amplitudes (and soft theorems) w/ A. Falkowski
arXiv: 2005.08981 [hep-th]
- Operator basis for general EFTs (massless and massive) w/ G. Durieux, T. Kitahara, Y. Shadmi, Y. Weiss
PRD 102 (2020) 7, 075033/ JHEP 12 (2020) 175

Research Overview

Beyond Standard Model

- Gravitational waves and axions
- Relaxion models
- Neutrinos in extra dimensions
- Flavour violation in SM-EFT

Applying amplitude methods for EFTs of phenomenological interest

Amplitude methods

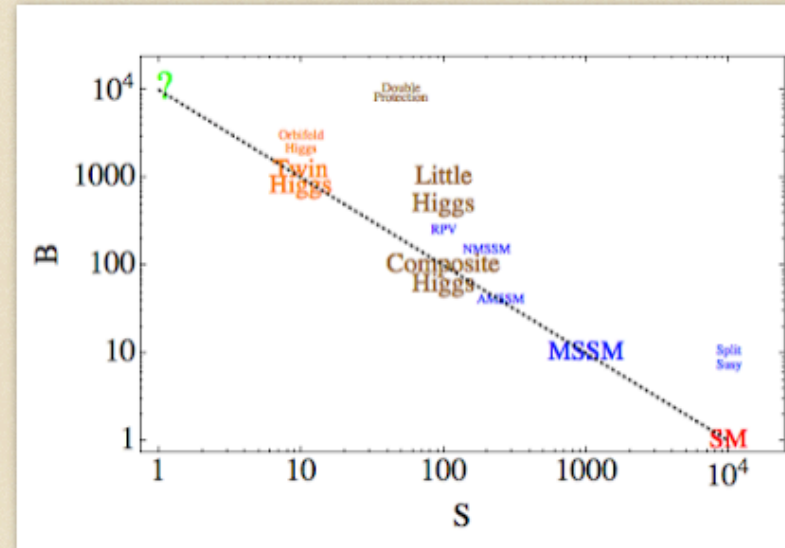
- Selection rules in SM-EFT w/ A. Azatov, R. Contino, F. Riva
PRD 95 (2017) 6, 065014
- Massive amplitudes in SM-EFT w/ R. Aoude
JHEP 12 (2019) 058
- Higher-spin dark matter w/ A. Falkowski, G. Isabella
arXiv: 2011. 05339 [hep-ph]
- Amplitudes for black holes w/ Aoude, Chung, Huang, Tam
PRL 125 (2020) 18, 181602

- Recursion relations for massive amplitudes (and soft theorems)
- Operator basis for general EFTs (massless and massive)

An Interesting Plot

Weekend plot: minimum BS conjecture

This weekend plot completes my last week's [post](#):



It shows the phase diagram for models of natural electroweak symmetry breaking. These models can be characterized by 2 quantum numbers:

- **B** [Baroqueness], describing how complicated is the model relative to the standard model;
- **S** [Specialness], describing the fine-tuning needed to achieve electroweak symmetry breaking with the observed Higgs boson mass.

(A. Falkowski - <http://resonaances.blogspot.com/>)