Christoph Englert

UK Theory & Phenomenology overview

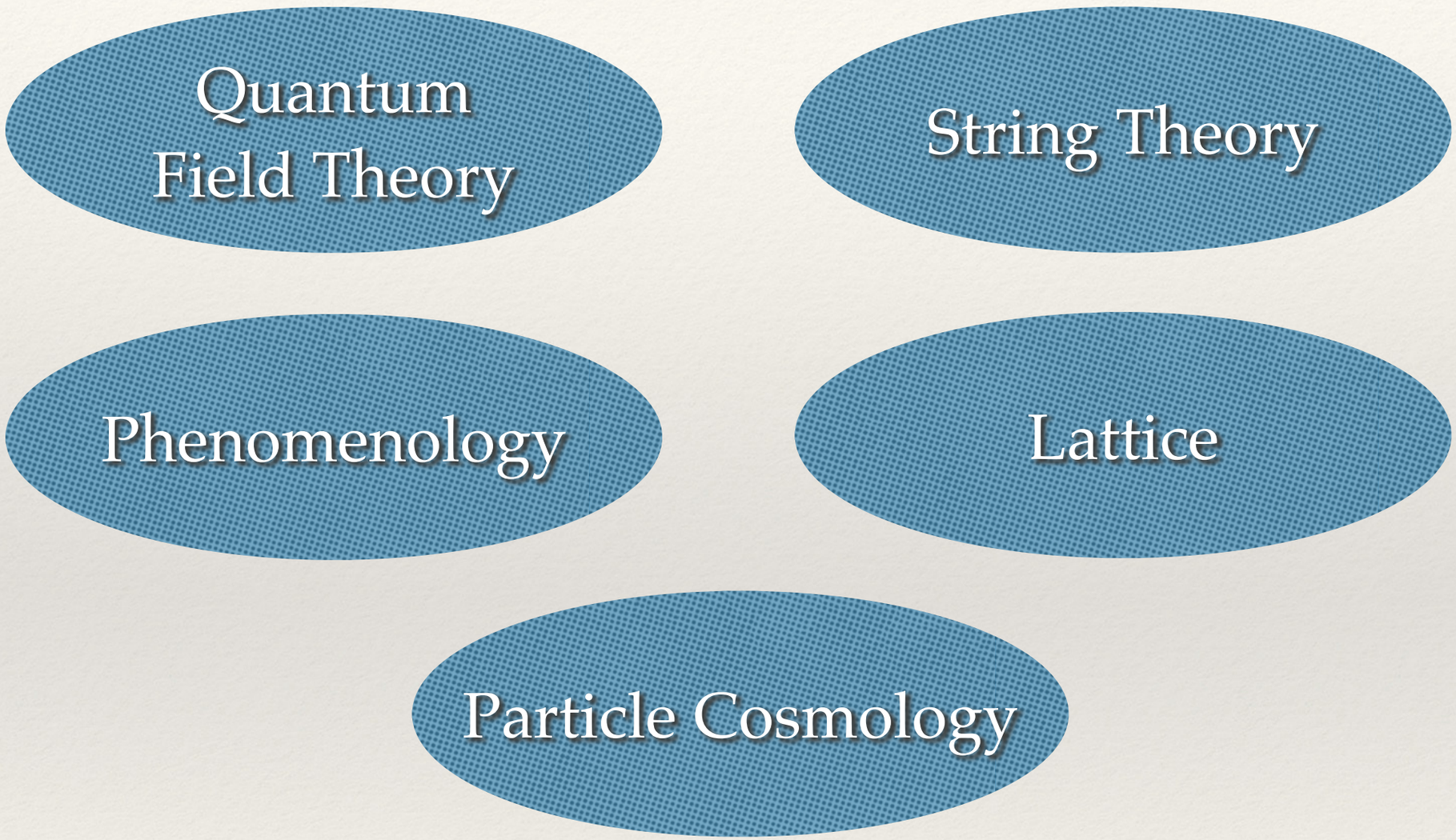
PPAP Community Meeting

Birmingham

16/07/26

MANCHESTER 1824
The University of Manchester

The UK Particle Theory Landscape - PPGP[T]



PPGP[T] programme categories

The UK Particle Theory Landscape - PPGP[T]

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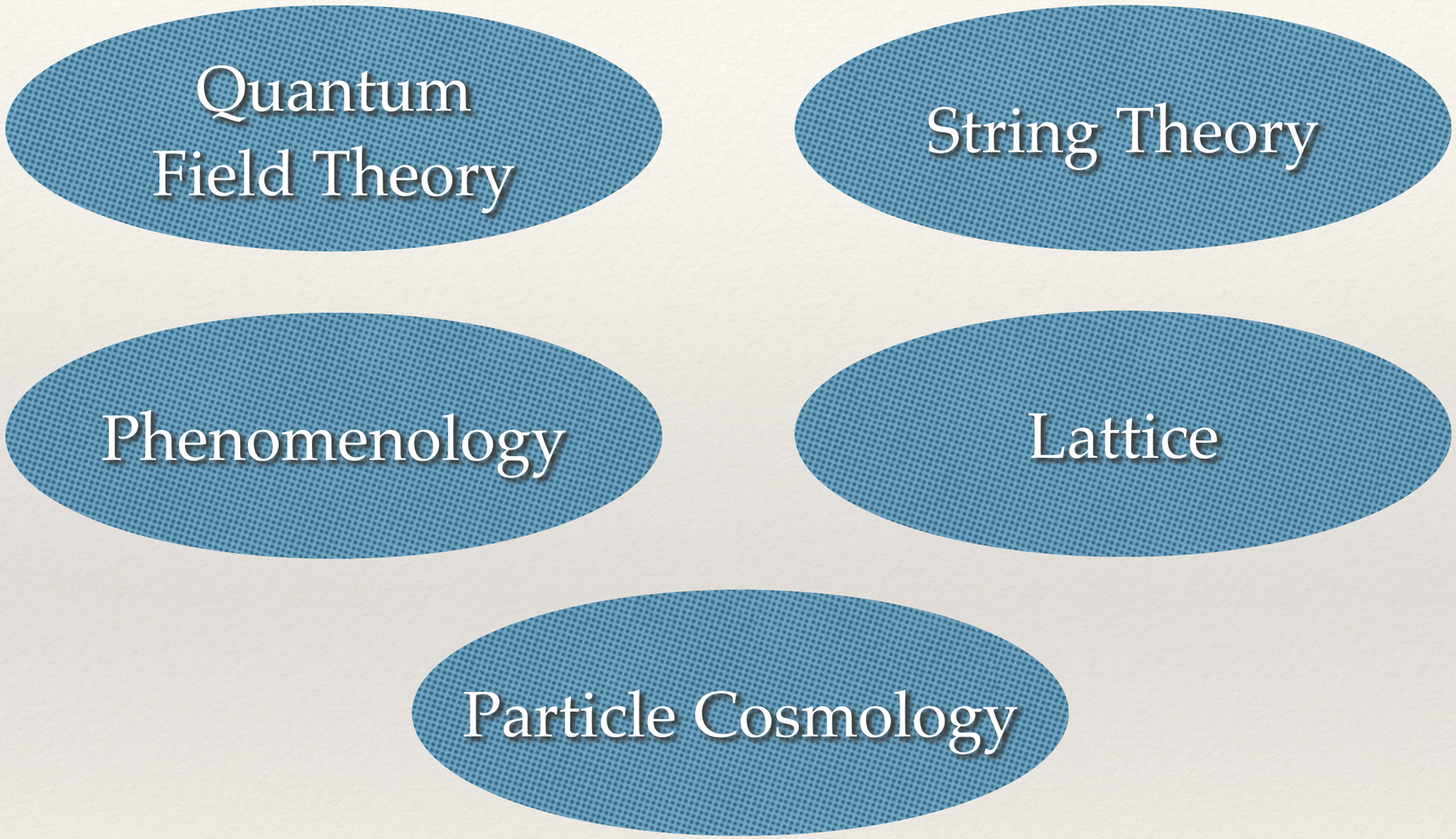

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Quantum Field Theory

String Theory

Phenomenology

Lattice

Particle Cosmology

O(40) studentships / yr

- consortia
- virtual institutes
- Summer Schools & Conferences

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new structures

new techniques

...

- **interconnecting different subdisciplines = physics case innovation**

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- flagship activities with, e.g., direct ECFA relevance

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LHCHWG, FCC-ee…
mandated recommendations
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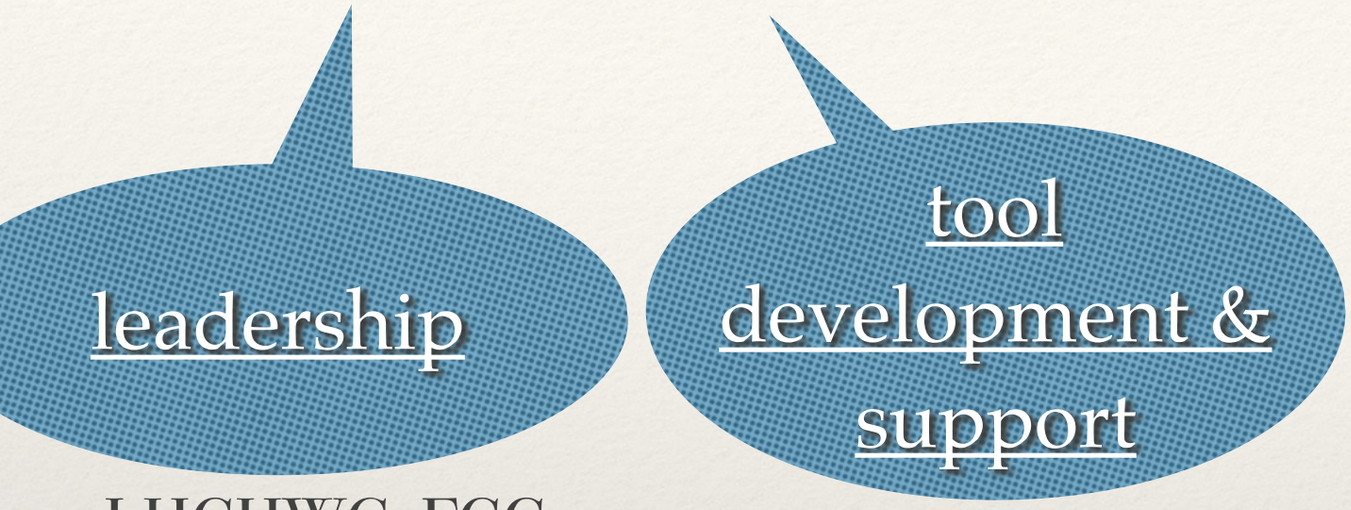

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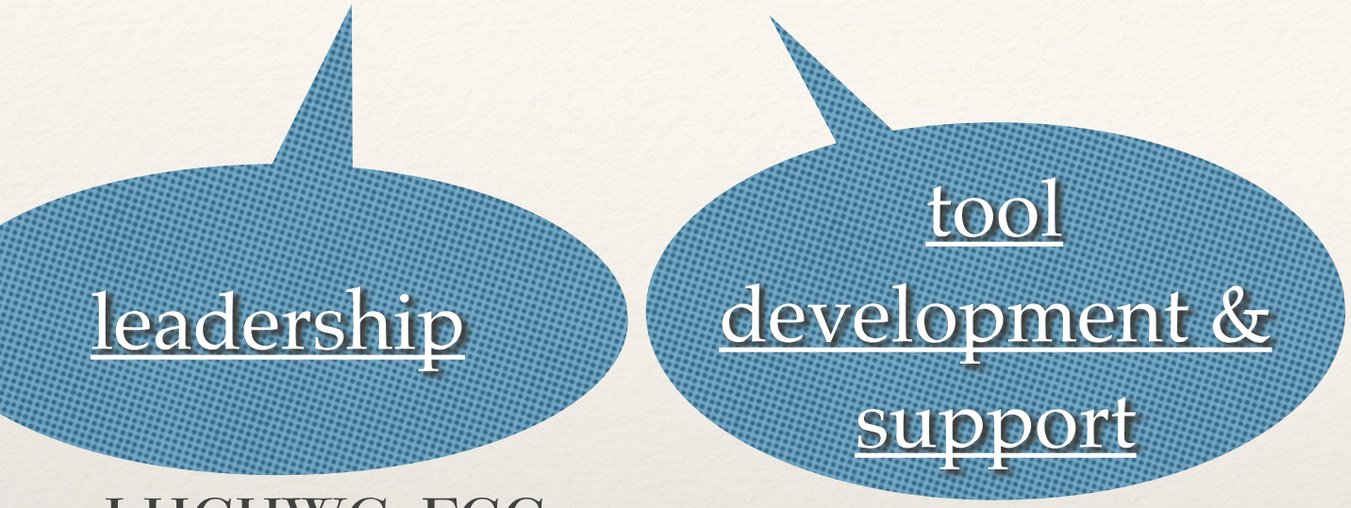

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Research Support

- support for all HEP across experiment and theory

Science Exchange

- workshops, schools,…
- exchange programmes

Computing/Data

- HEPData: store/preserve
- HEPForge: development

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- ‘flat cash’ funding for many years

flat cash since ~2011

- inflation adjustments
- +20 RA uplift 2022

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overheads rising = recoup from FTE & <u>now</u> RAs

2019: staggered <20% …. 2022: 5% 2026: <5%

190 bidding academics 243 academics 269 academics

very subjective physics highlights

[Bordone, Gubernari, Huber, Jung, van Dyk `20]

longstanding tension in non-leptonic B decays within QCDf

	Channel	Experiment	SM	Pull
R_K	$\bar{B}^0 \to D^+ K^-$	$0.058^{+0.004}_{-0.004}$	$0.082^{+0.002}_{-0.001}$	$\approx 5.6\,\sigma$
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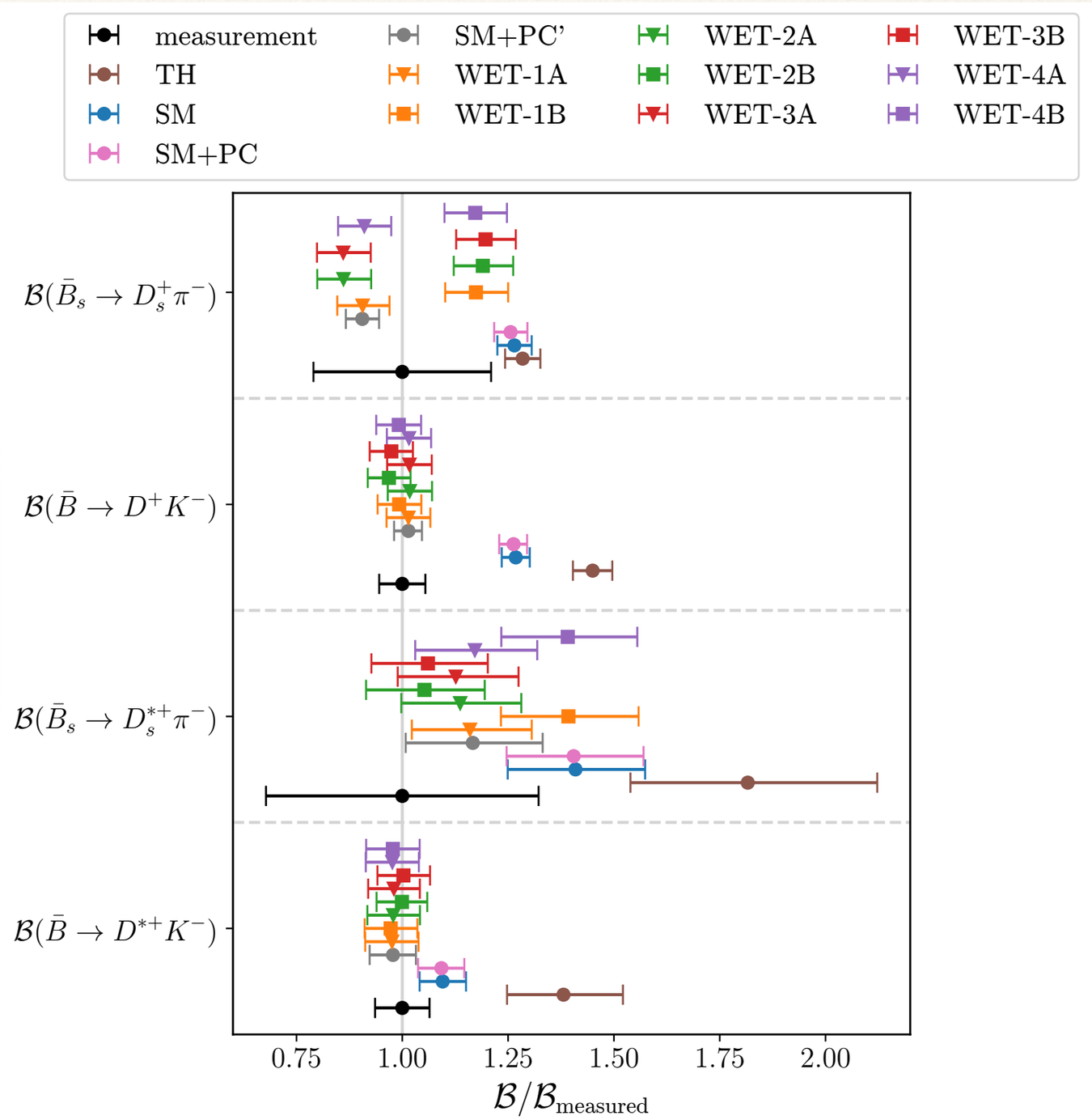

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e.g. [Piscopo, Rusov `23]

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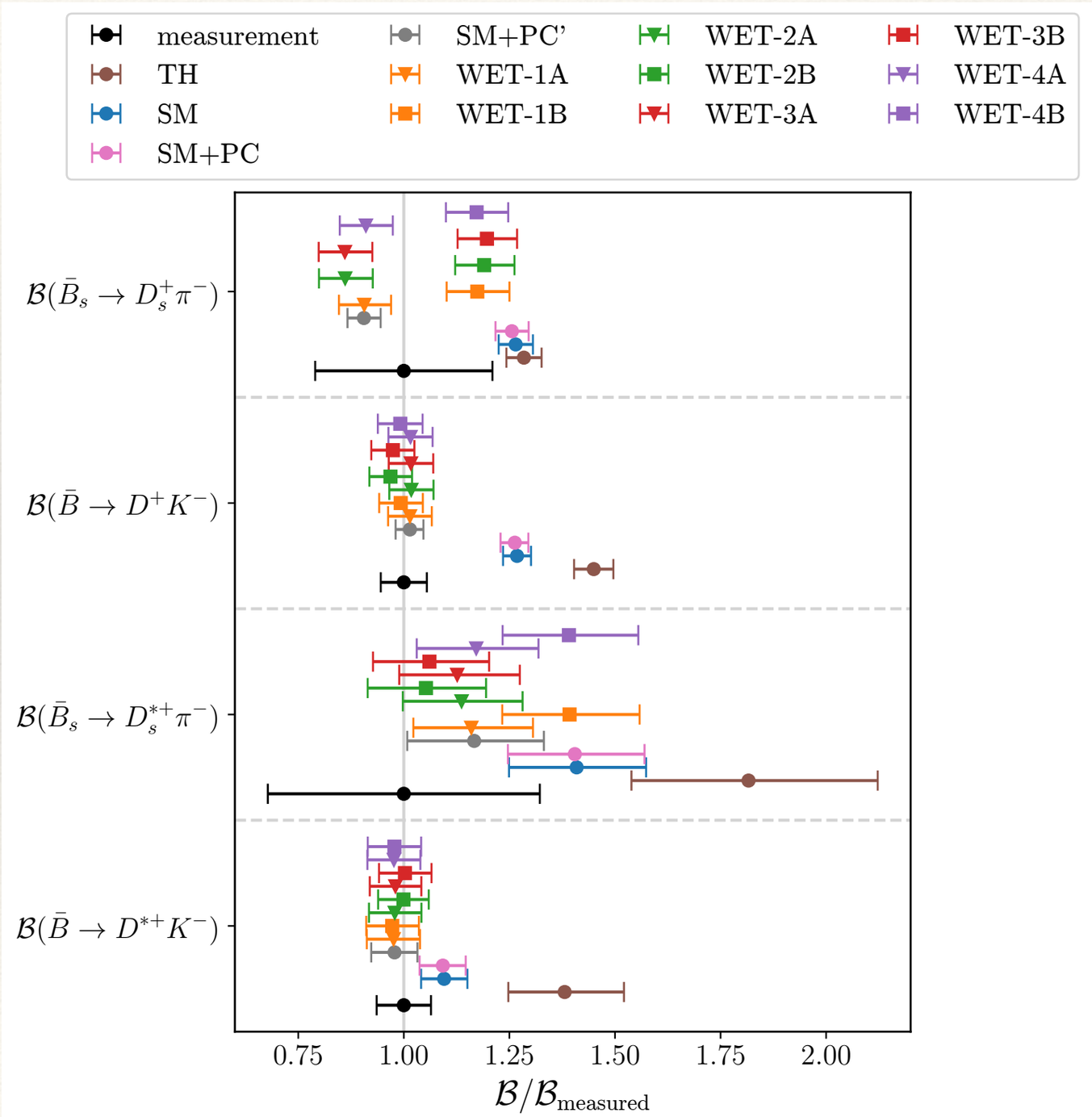

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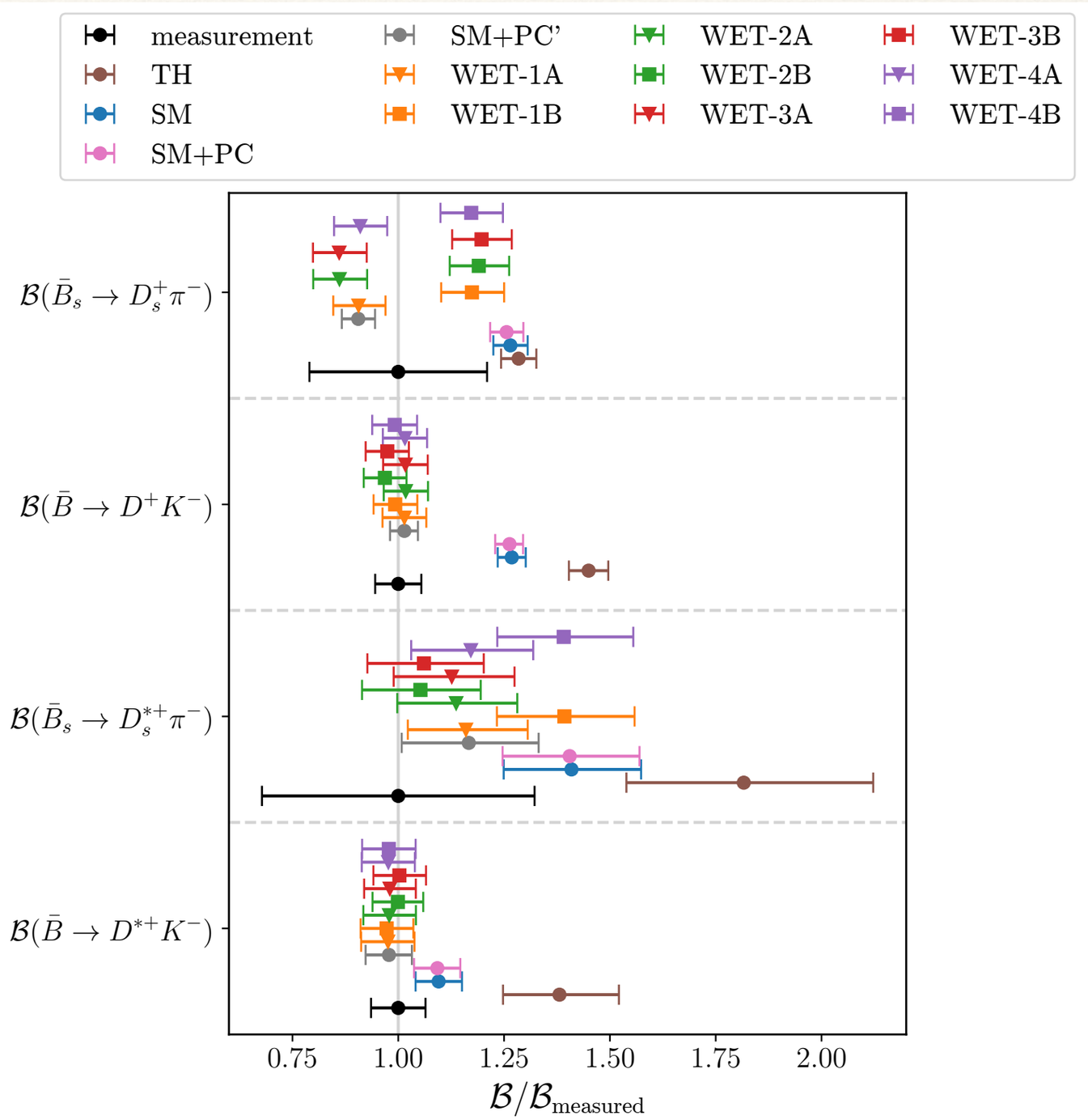

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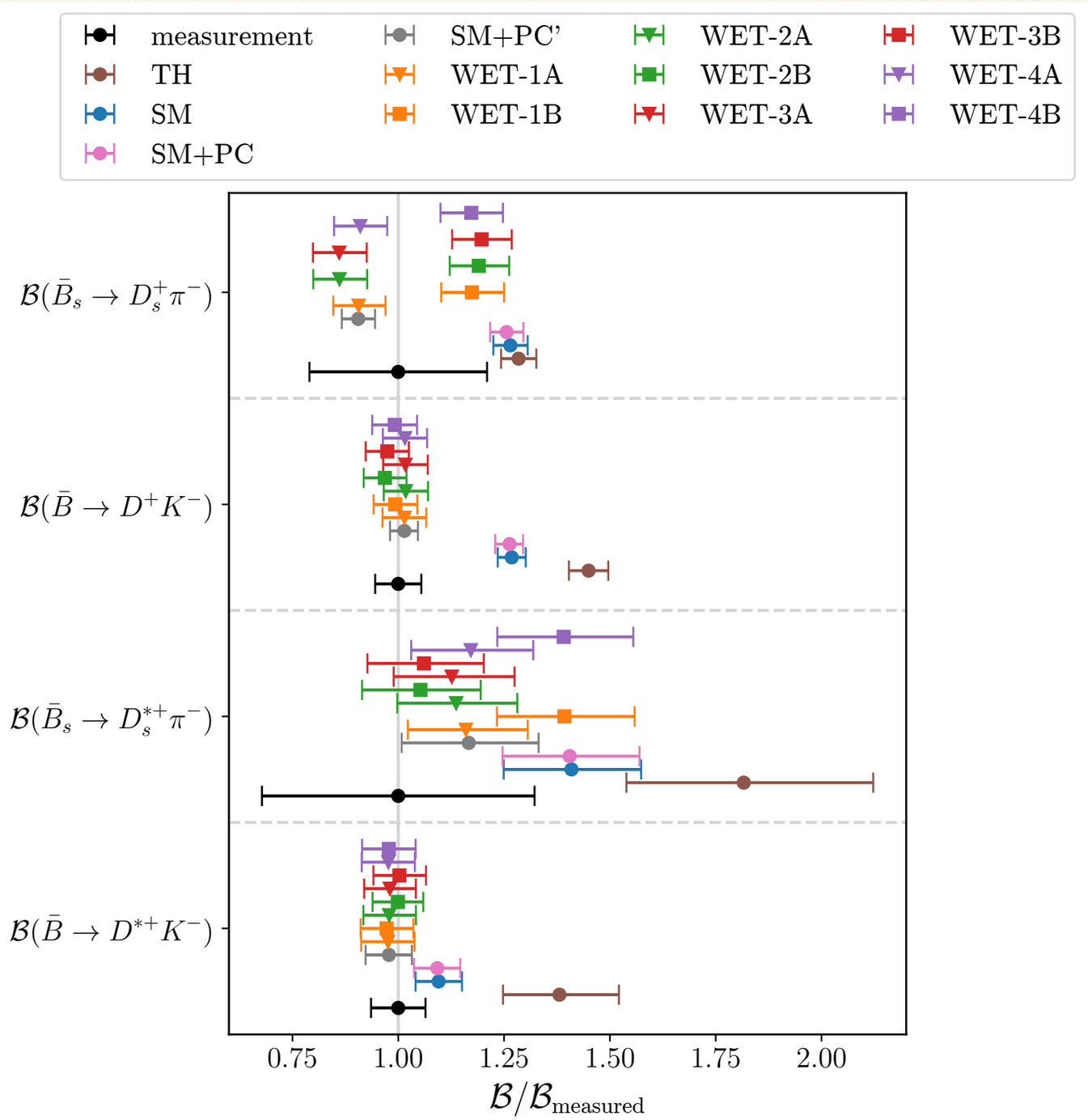

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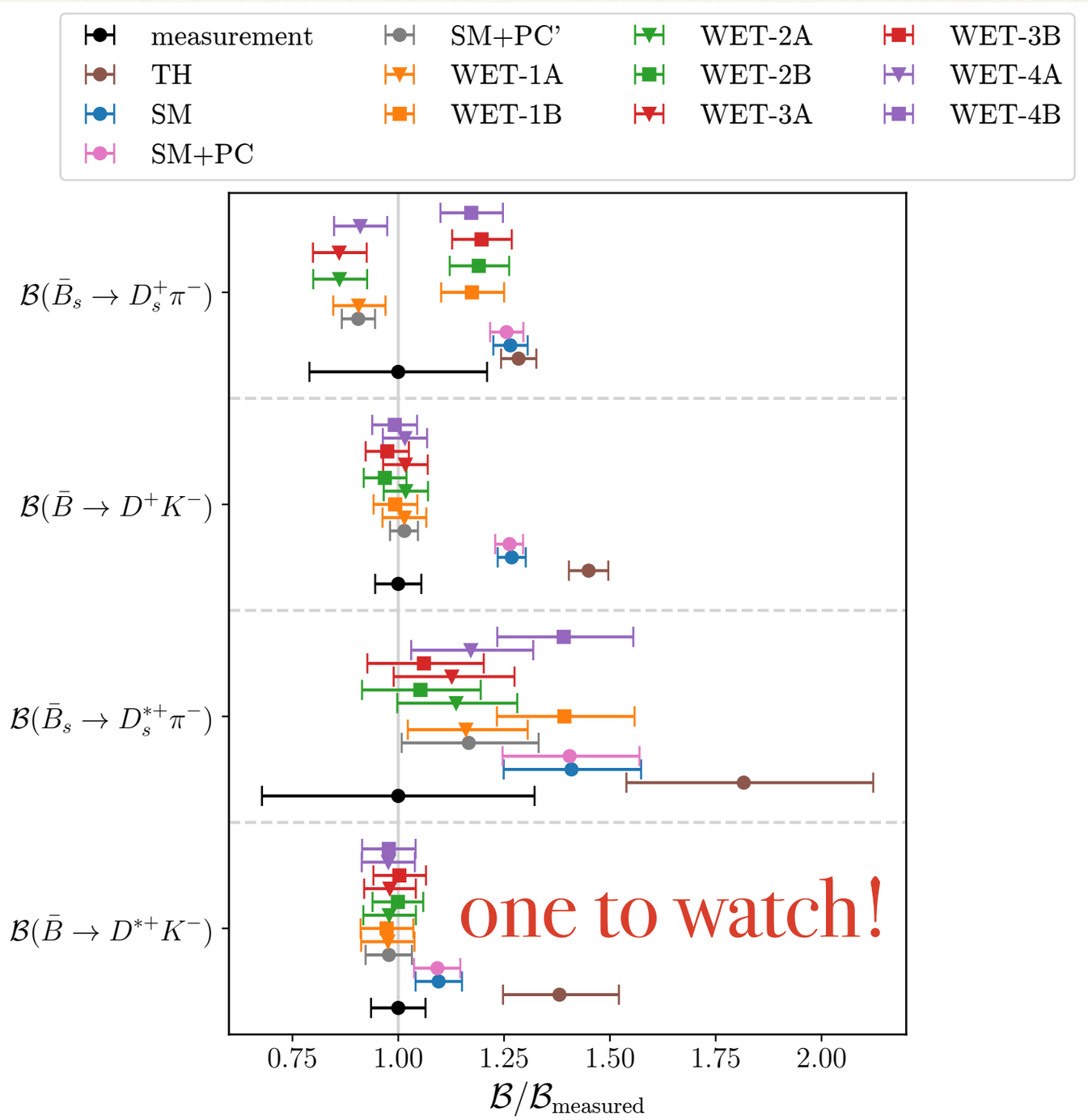

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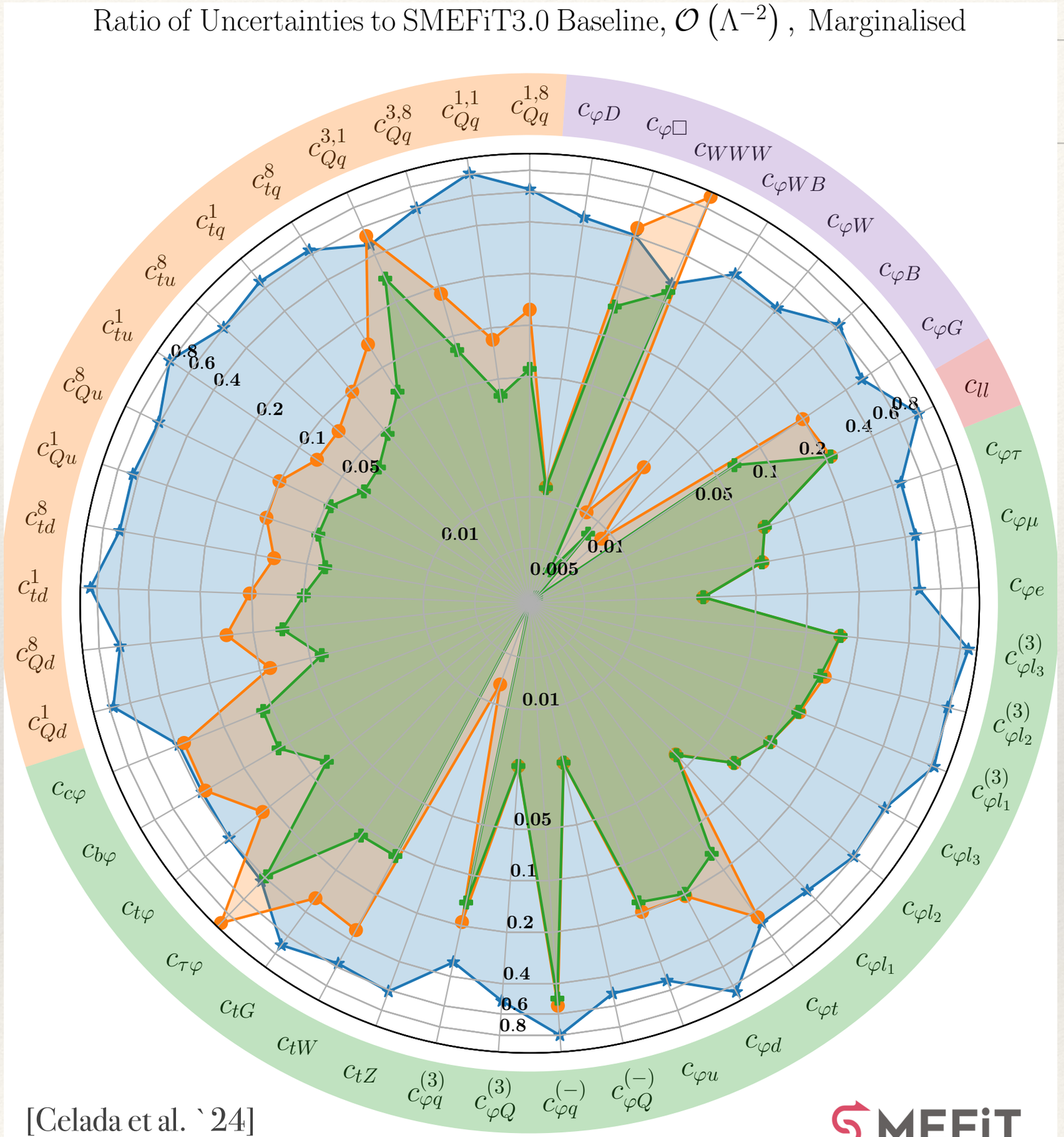
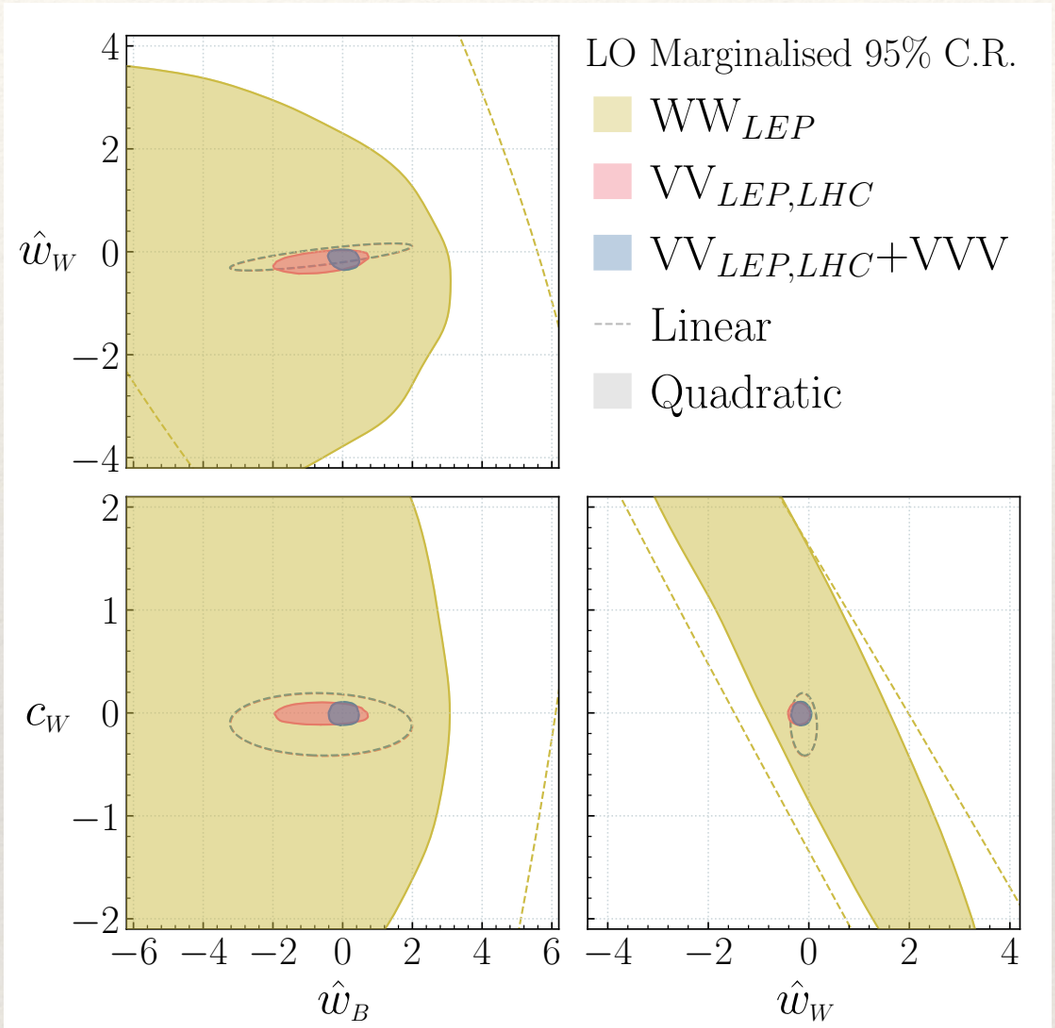
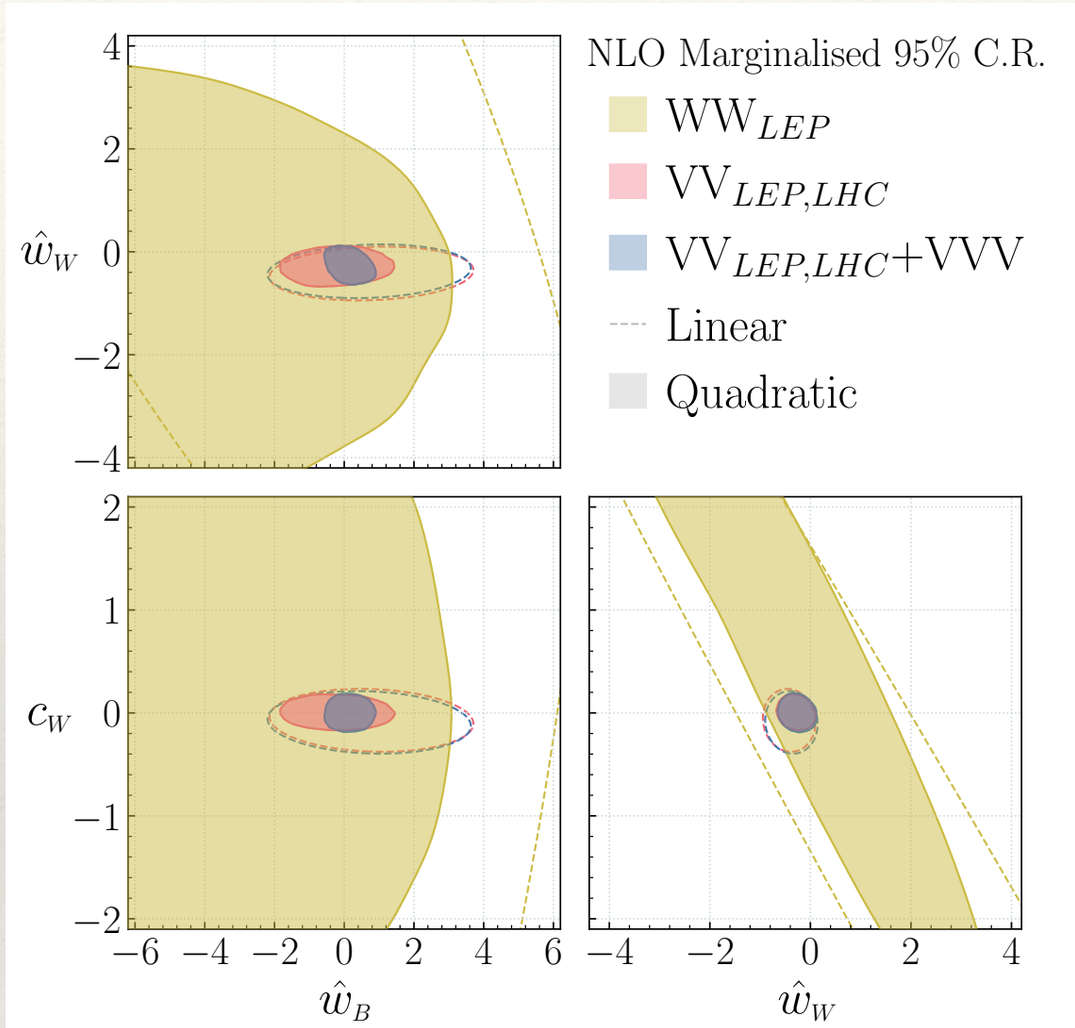


SMEFT analyses

- ...well underway...
- ...with exp. buy-in
- plethora of parameters
- <u>flavour-blind</u> results: 0.1-1/TeV² sensitivity
- improvements towards HL-LHC possible via data...

- continuously improved with data and fit methodology, e.g. tribosons





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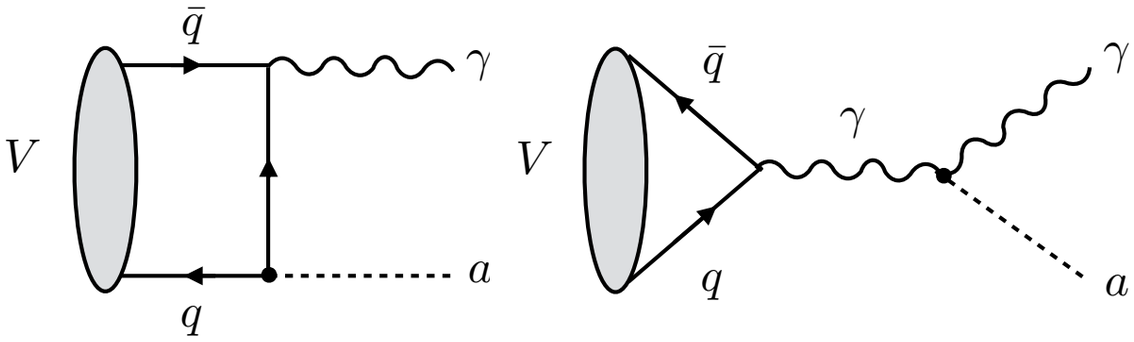

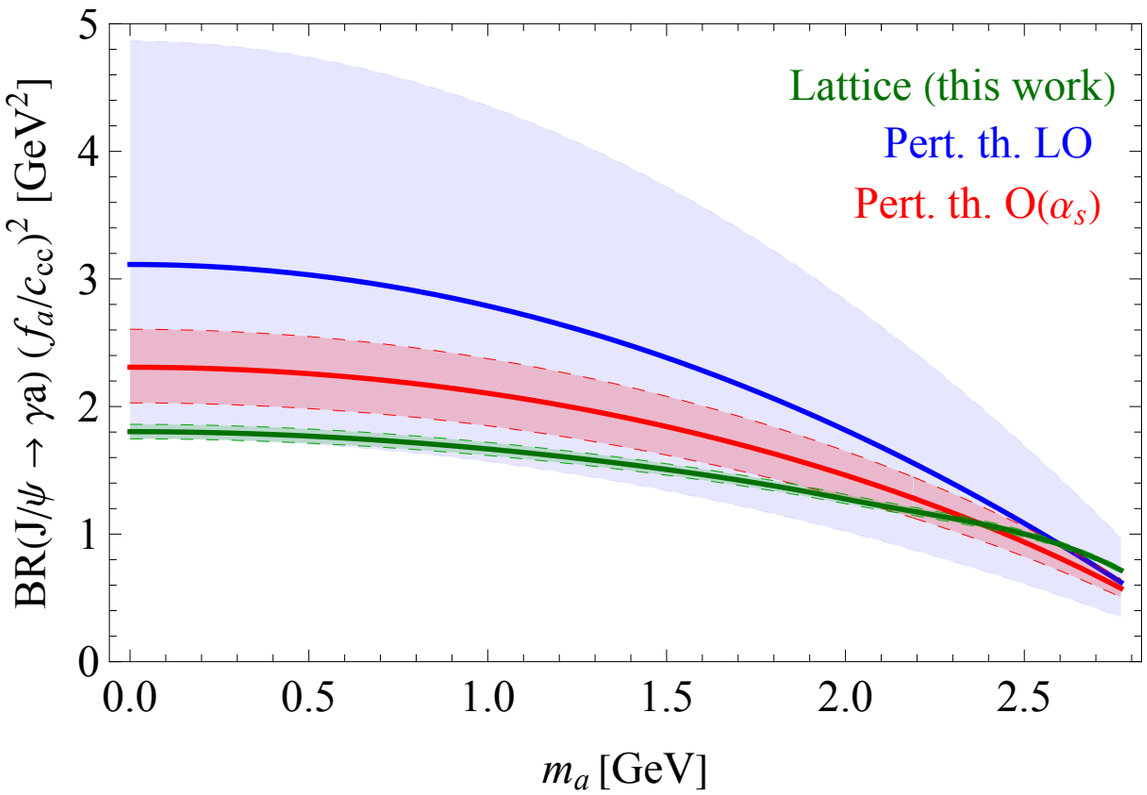

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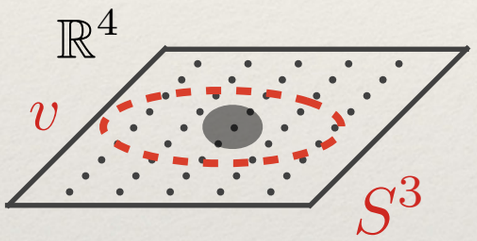

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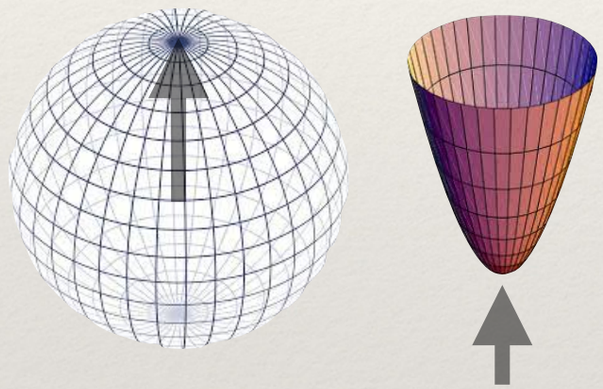

composite Higgs theories

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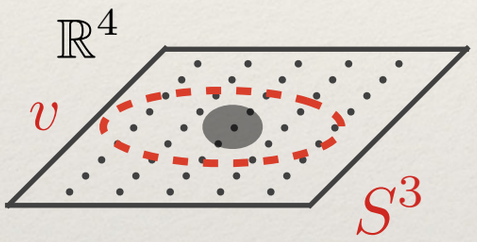

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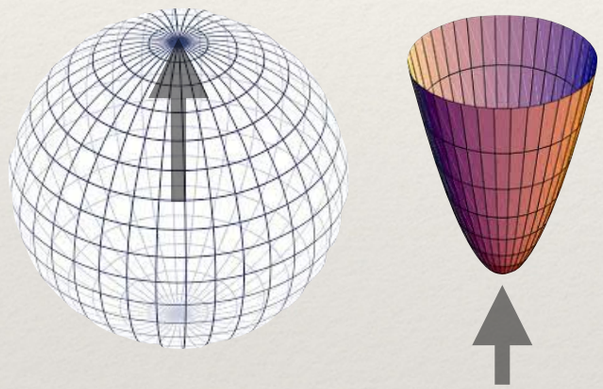

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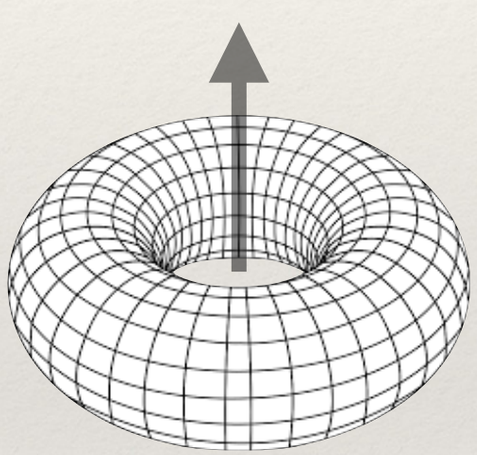

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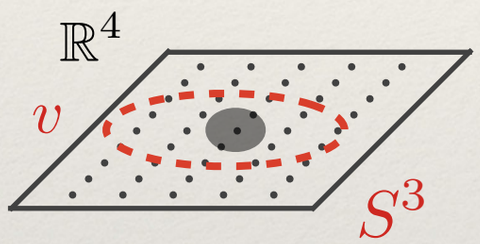

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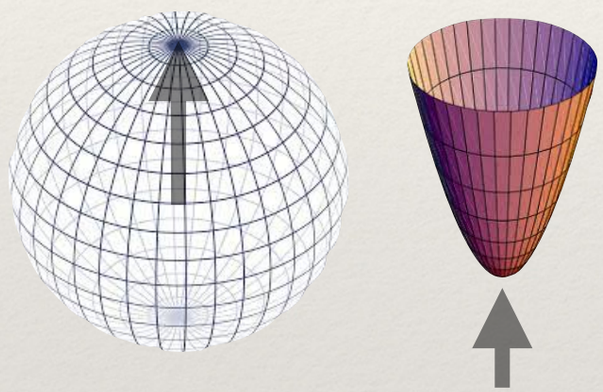

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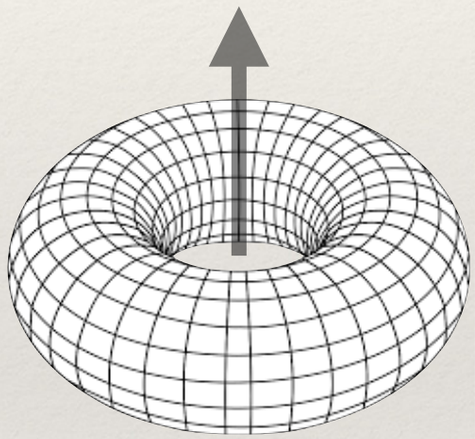
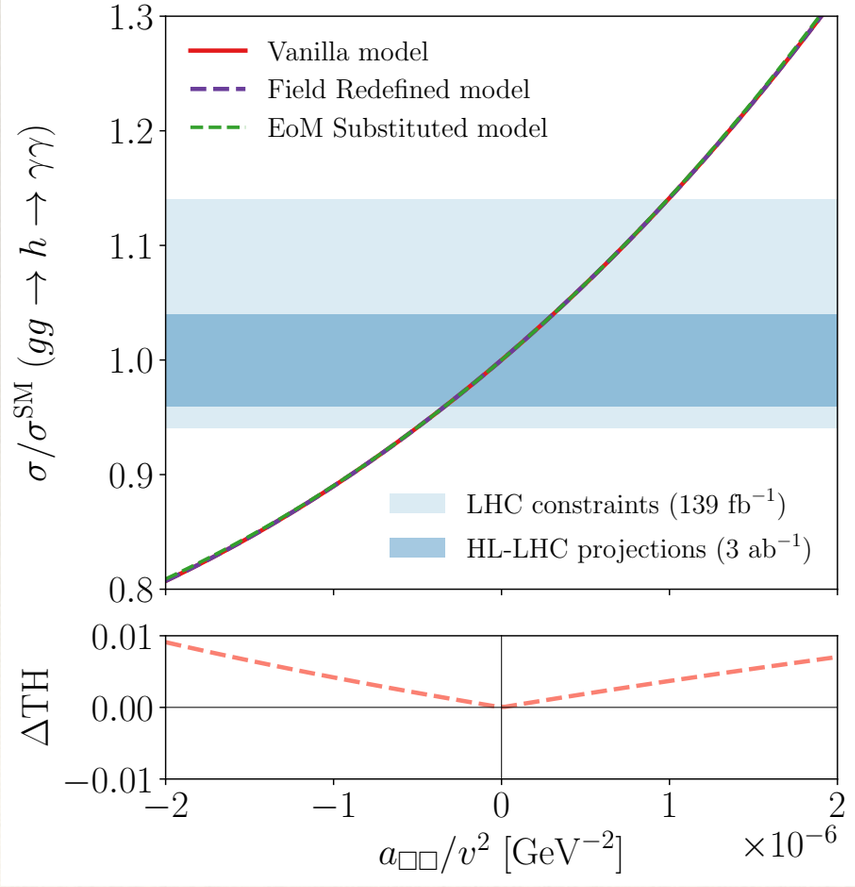


non-SMEFT

- new insights into the robustness of EFT interpretations of LHC data *EFT uncertainties*

[Alonso, CE, Naskar, Rahaman `25]



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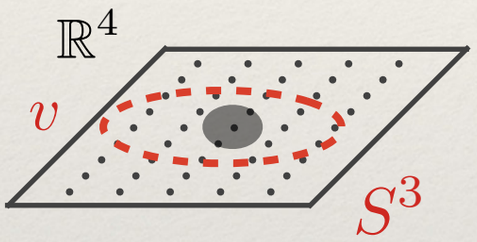

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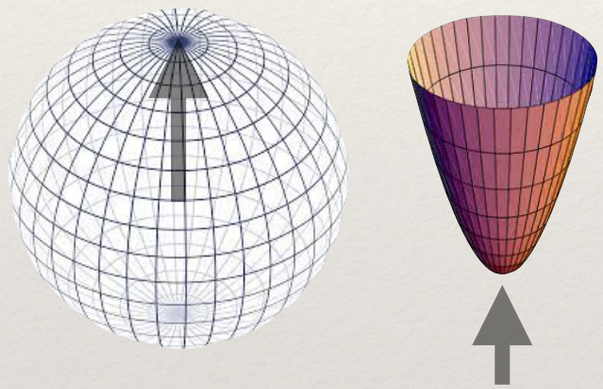

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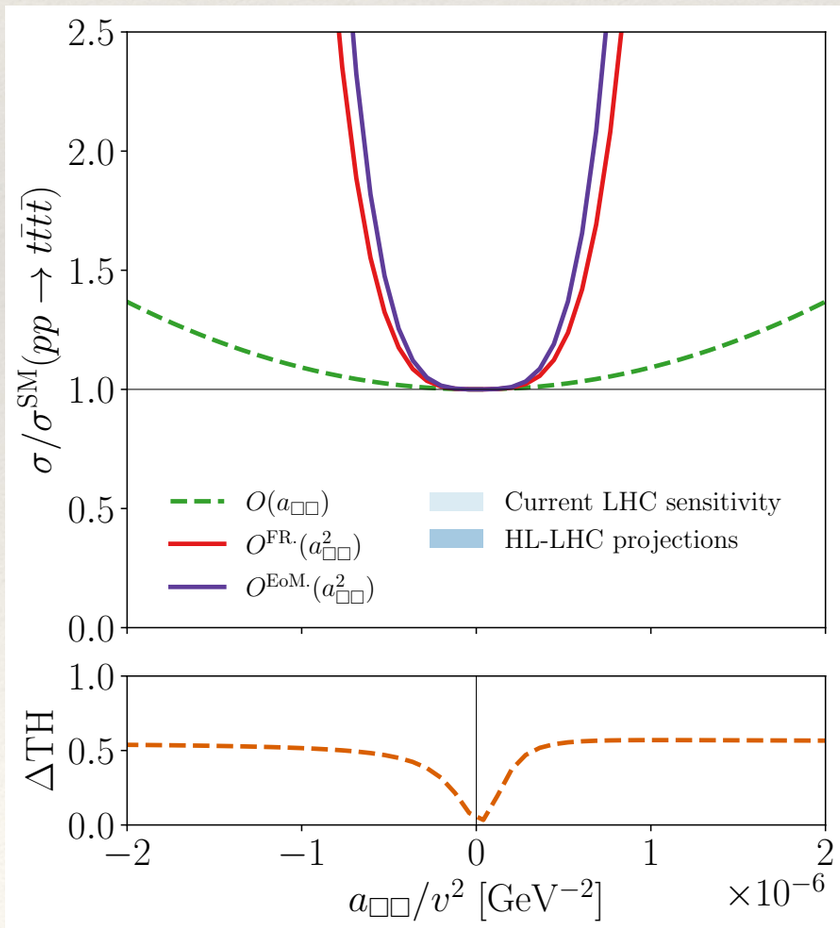

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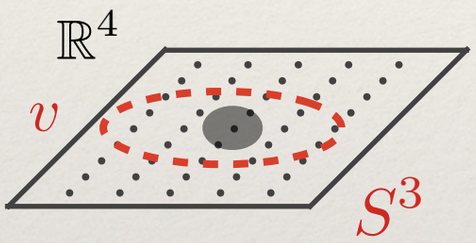
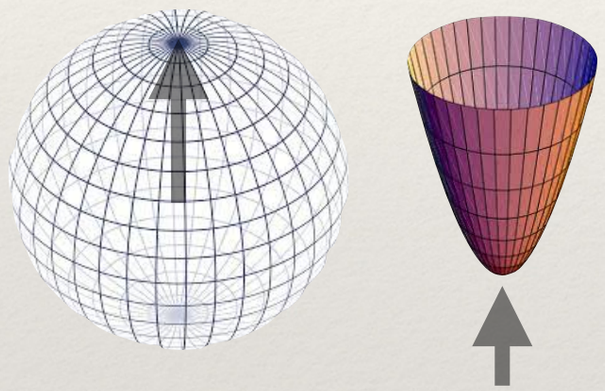
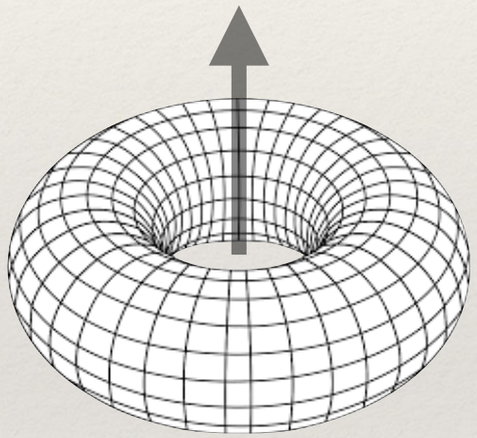


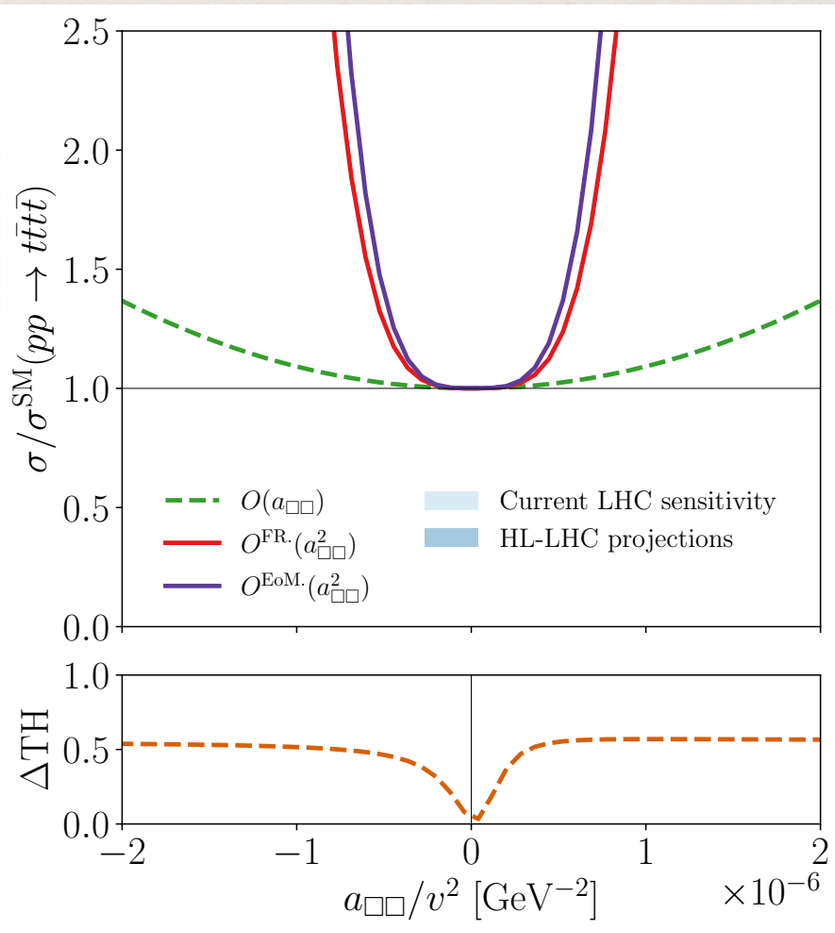
SM



composite Higgs theories



non-SMEFT



SMEFT@LHC

- continuously improved with data and fit methodology, e.g. tribosons

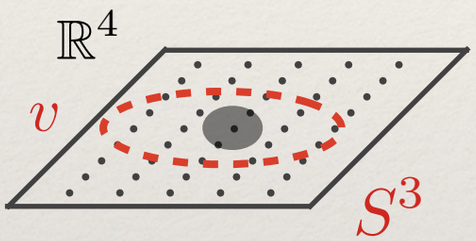
e.g. [Celada, Durieux, Mimasu, Vryonidou `24]

- EFT cross talk with precision methods/calculations (*e.g. ALPs)*

e.g. [Colquhoun, Davies, Lepage, Renner `25]

- improved theoretical & geometric understanding of EFT structures

[Alonso et al. `16]
[Alonso, West `21]
[Alminawi, Brivio, Davighi `23, `26]



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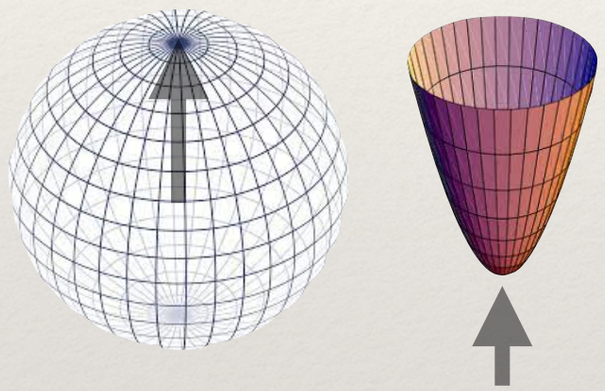

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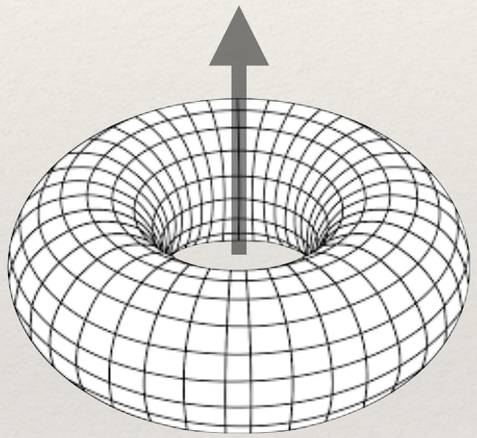

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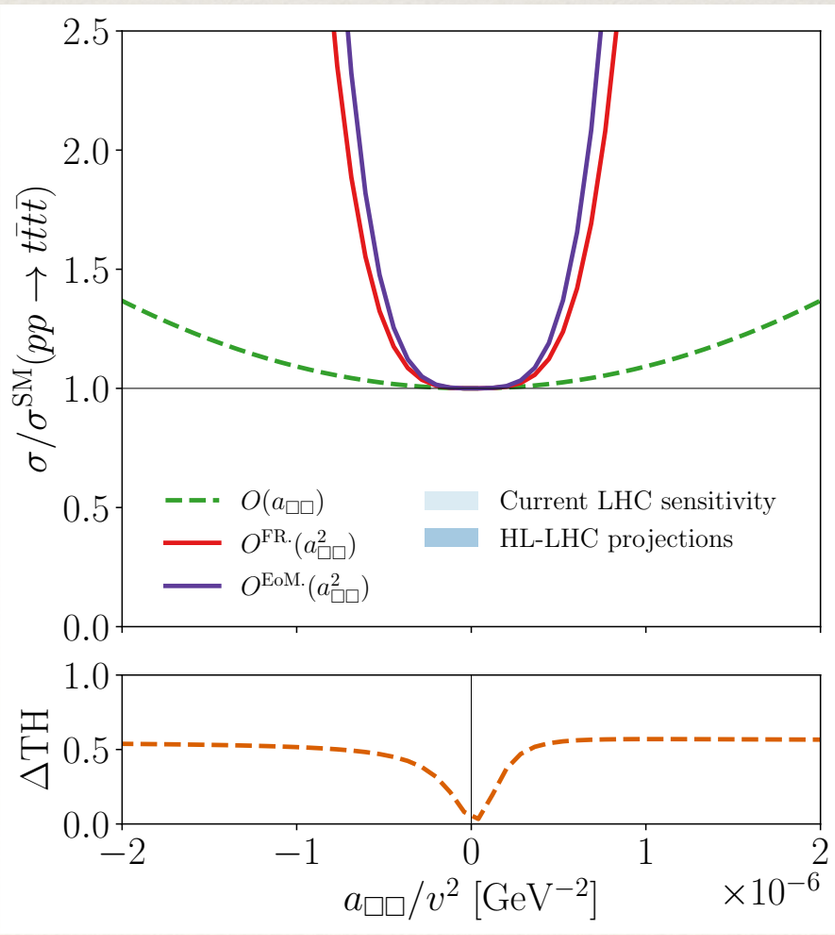
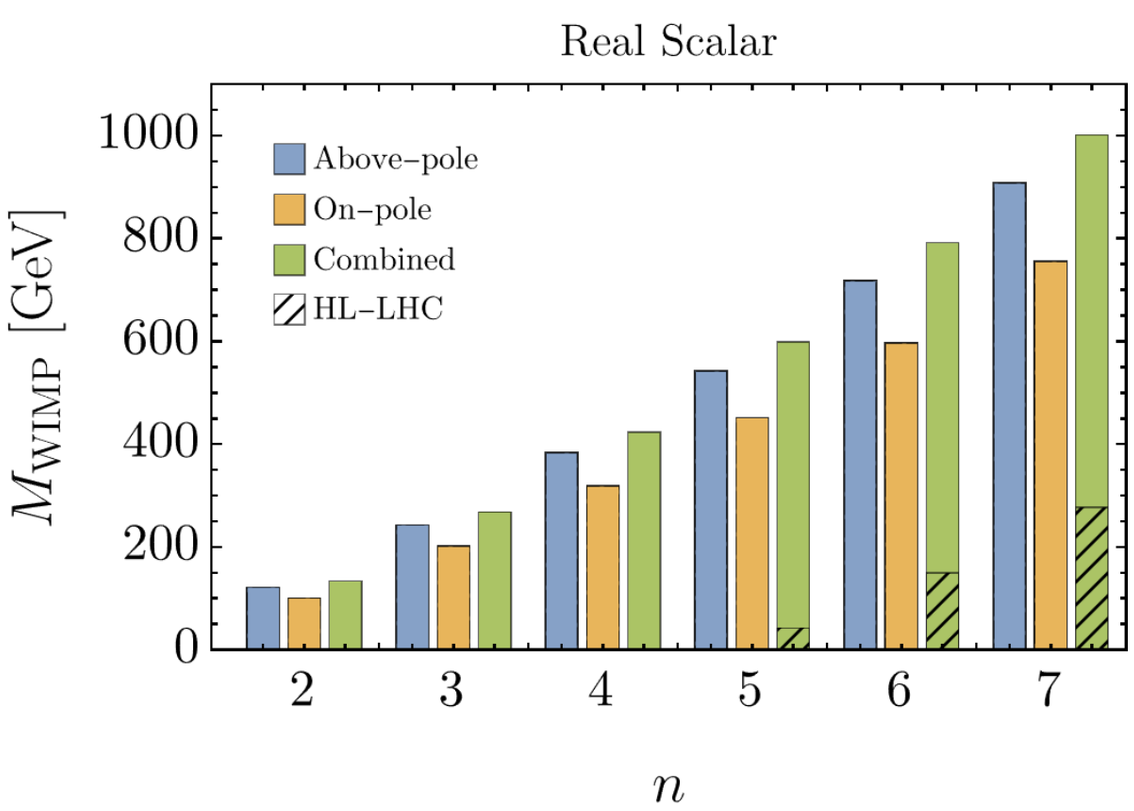


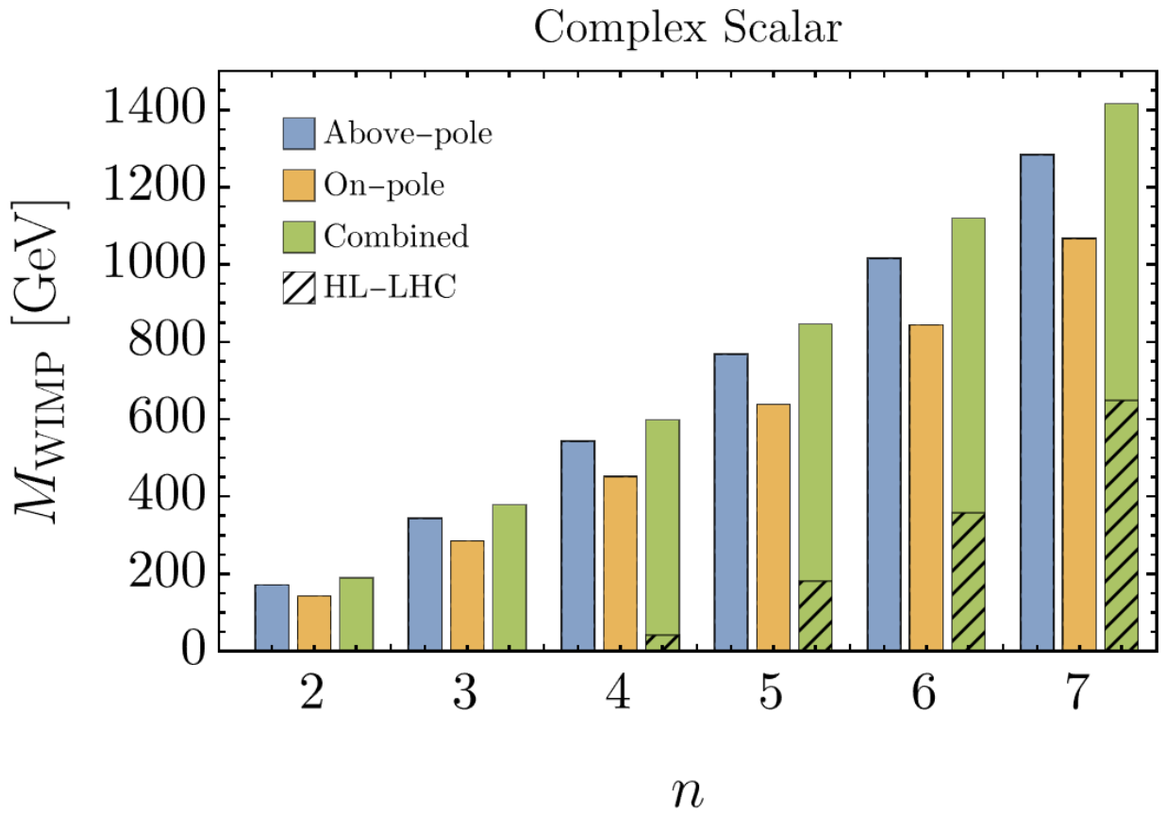
- new insights into the robustness of EFT interpretations of LHC data *EFT uncertainties*

[Alonso, CE, Naskar, Rahaman `25]

looking beyond the LHC

- FCC-ee will gain unprecedented precision in a limited array of observables
  - *'Tera-Z'* e.g. [Maura, Stefanek, You `24]





looking beyond the LHC

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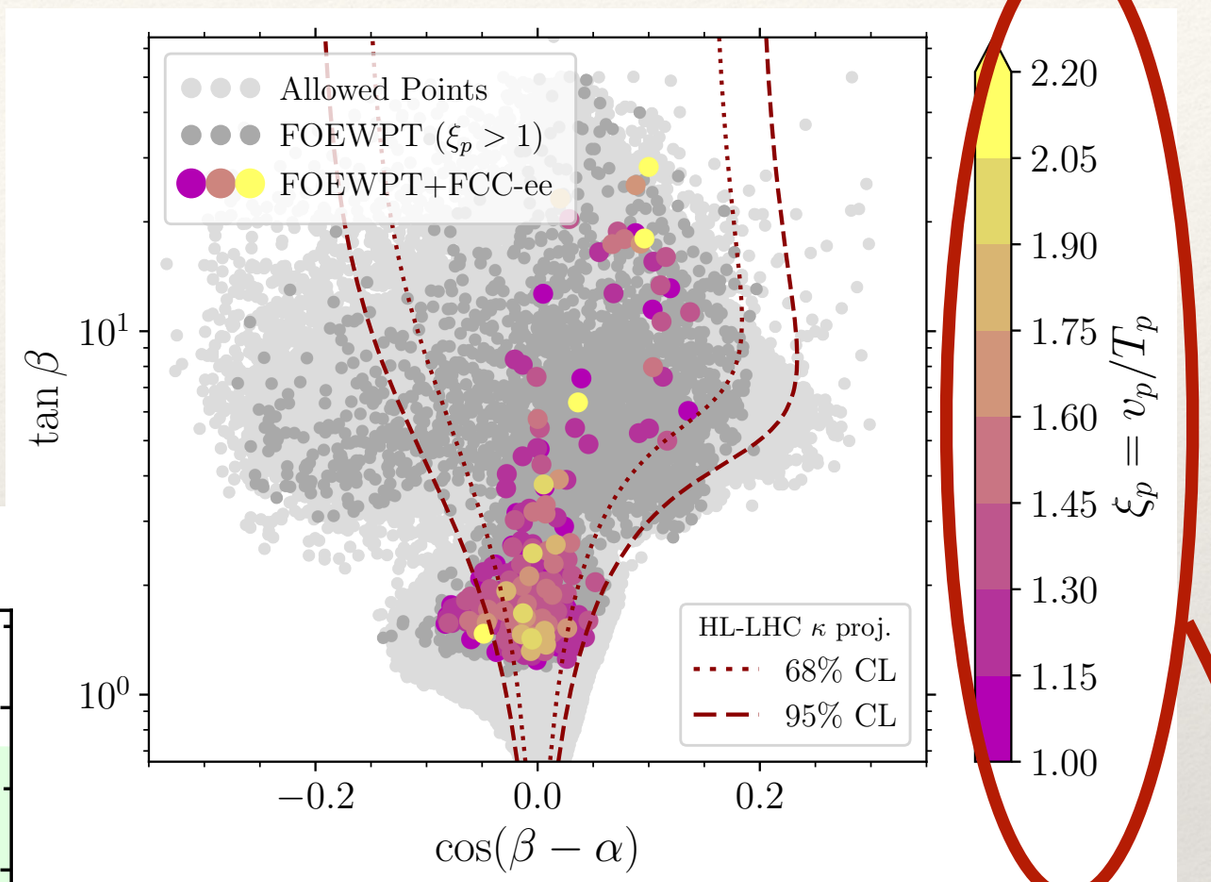
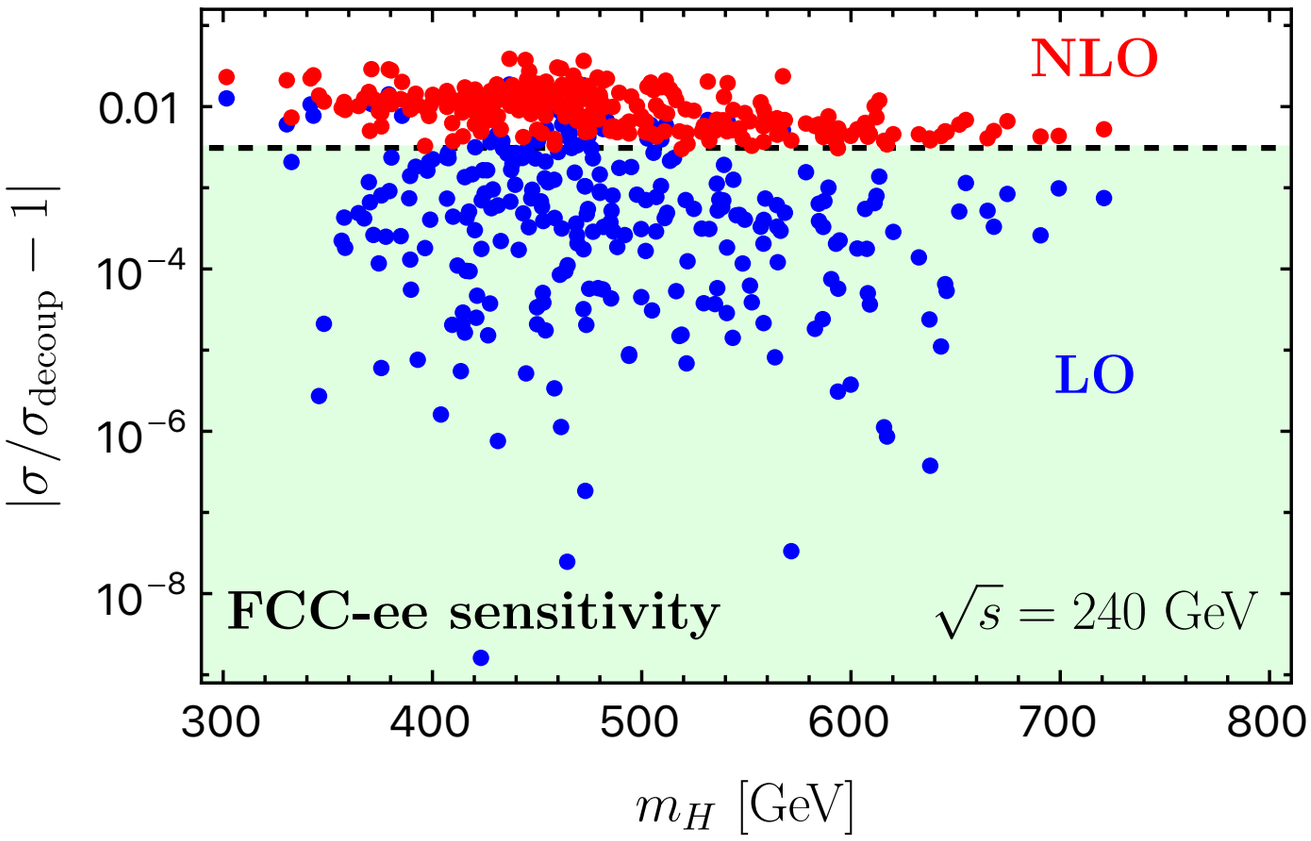
  - *'Tera-Z'* e.g. [Maura, Stefanek, You `24]
  - *Higgs + Z*

    e.g. [Anisha, Biermann, et. al `25]





new physics through
alignment w/o decoupling
[Gent et al. `25]

concrete (UV-complete) scenarios
capitalise FCC-ee sensitivity

UK Particle Theory & Pheno

- **Particle theory is fundamental to particle physics strategy**

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building case for future accelerator(s)