Stealth physics workshop: **Introduction**

X. Cid Vidal (IGFAE) for the organizers

17th February 2020

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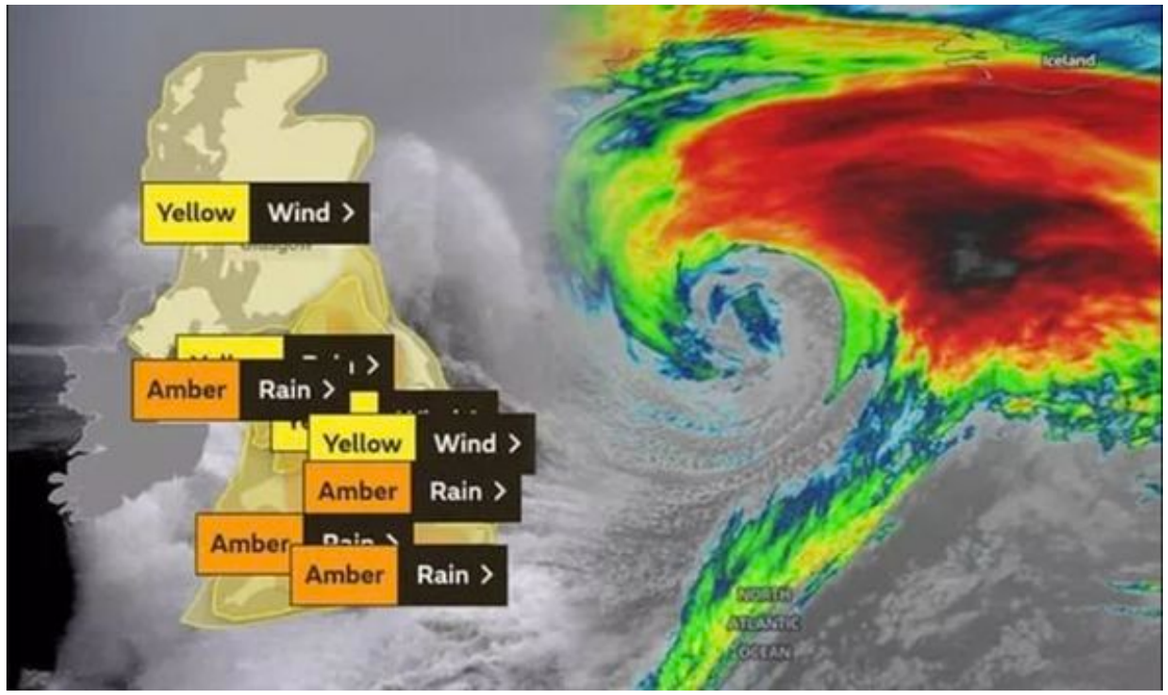
Thanks for being here...



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...and welcome!

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The workshop

- Workshop to **bring together theorists and experimentalist** to foster an area with **great potential** at LHCb, but completely under explored (more later)
- We want to promote **discussion** and exchange of ideas! If you have bold, blue-sky proposals, don't be shy to **share**!
- First of many workshop editions?
- Final goal: we would like to write a **white paper** that could serve as a guide/source of ideas for future analysis, to help this effort growing, both from the experimental and theoretical perspectives

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Discussing...

- Relatively short sessions planned, with a lot of discussion time between talks

*__wifi__: use either eduroam or the one at the back of your badge

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...and eating

- Coffee breaks in “Casa de Europa” (right in front)

- Workshop dinner in “O Dezaseis” (Tue at 21:00)
  - Register here if haven’t done yet

*The menu is here

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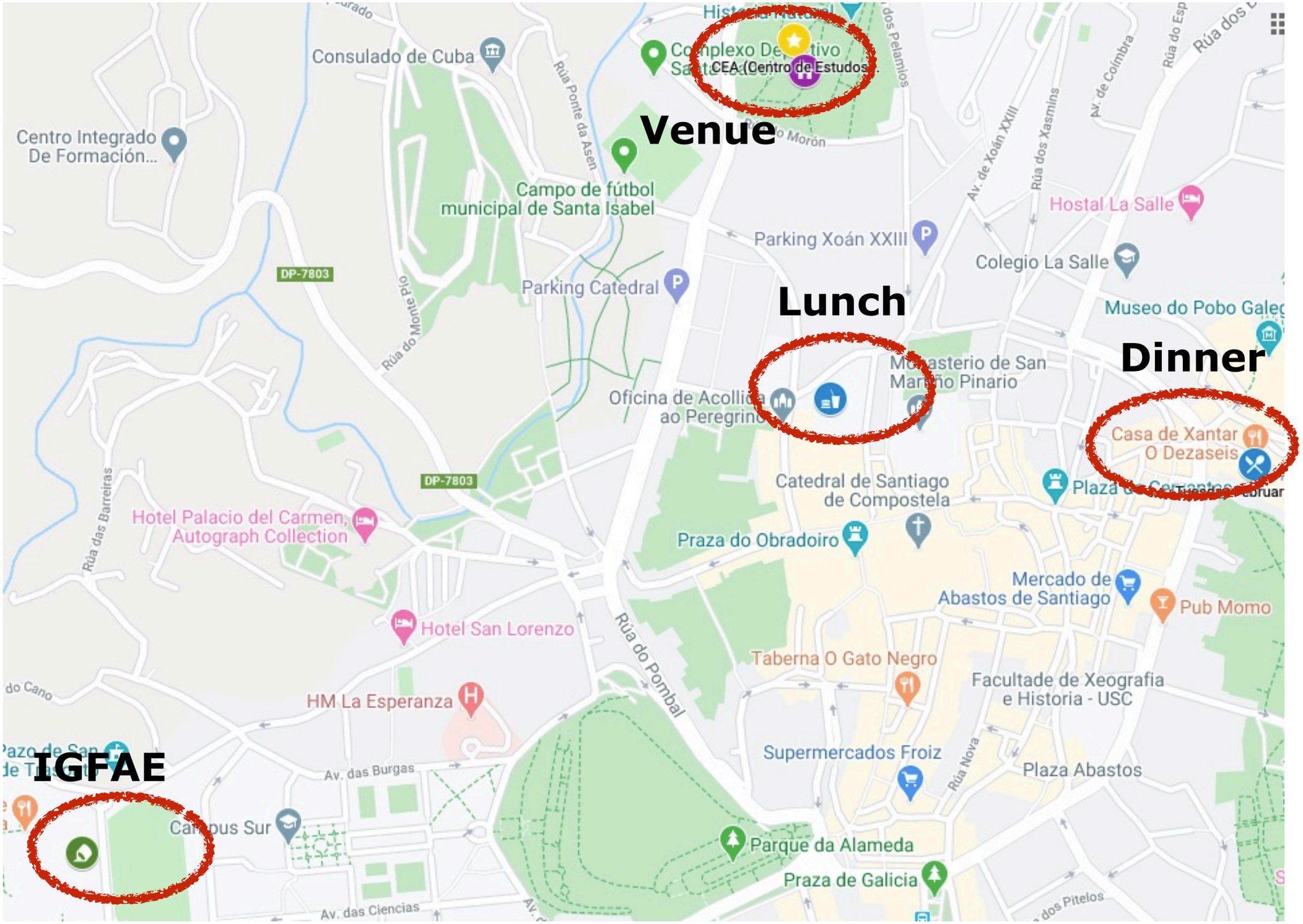
General view



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What is Stealth? (I)

- AFAIK Stealth first appears in HEP in this paper, introducing “Stealth SUSY”
  - This is a type of SUSY with almost degenerate fermion/boson pairs, providing small mass splittings and small phase space for MET
- This is ~aligned with the kind of signatures that we want to promote

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What is Stealth? (II)

J. Zurita

- Electroweak naturalness (hierarchy) problem solved by New Physics (NP) at the TeV scale.
- Other fundamental questions (dark matter, CP asymmetry, neutrino masses, flavor, etc) can also be solved if the NP scale, Λ_{NP} is around the TeV scale.
- No New Physics at the LHC yet! (modulo flavour anomalies…)
  - 1) *collider-phobic* (axions, dark photons, sub-GeV dark matter, sterile neutrinos, …): "we'll need <another kind of experiment>" (e.g: FASER, MATHUSLA, ADMX, DUNE)
  - 2) Λ_{NP} higher than expected: → "let's build a new collider!" [BSM-doer, energy]
    → "let's compute more loops!" [QCD-doer, precision]
  - 3) Λ_{NP} ~ 0.1-1 TeV, but it operates in *stealth mode:* heavy mediators, tiny couplings, compressed spectra, sequestered sectors, large backgrounds, …)

*Very long-lived, tiny couplings and/or ultra light new particles

Ideal territory for LHCb to explore!

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What is Stealth? (III)

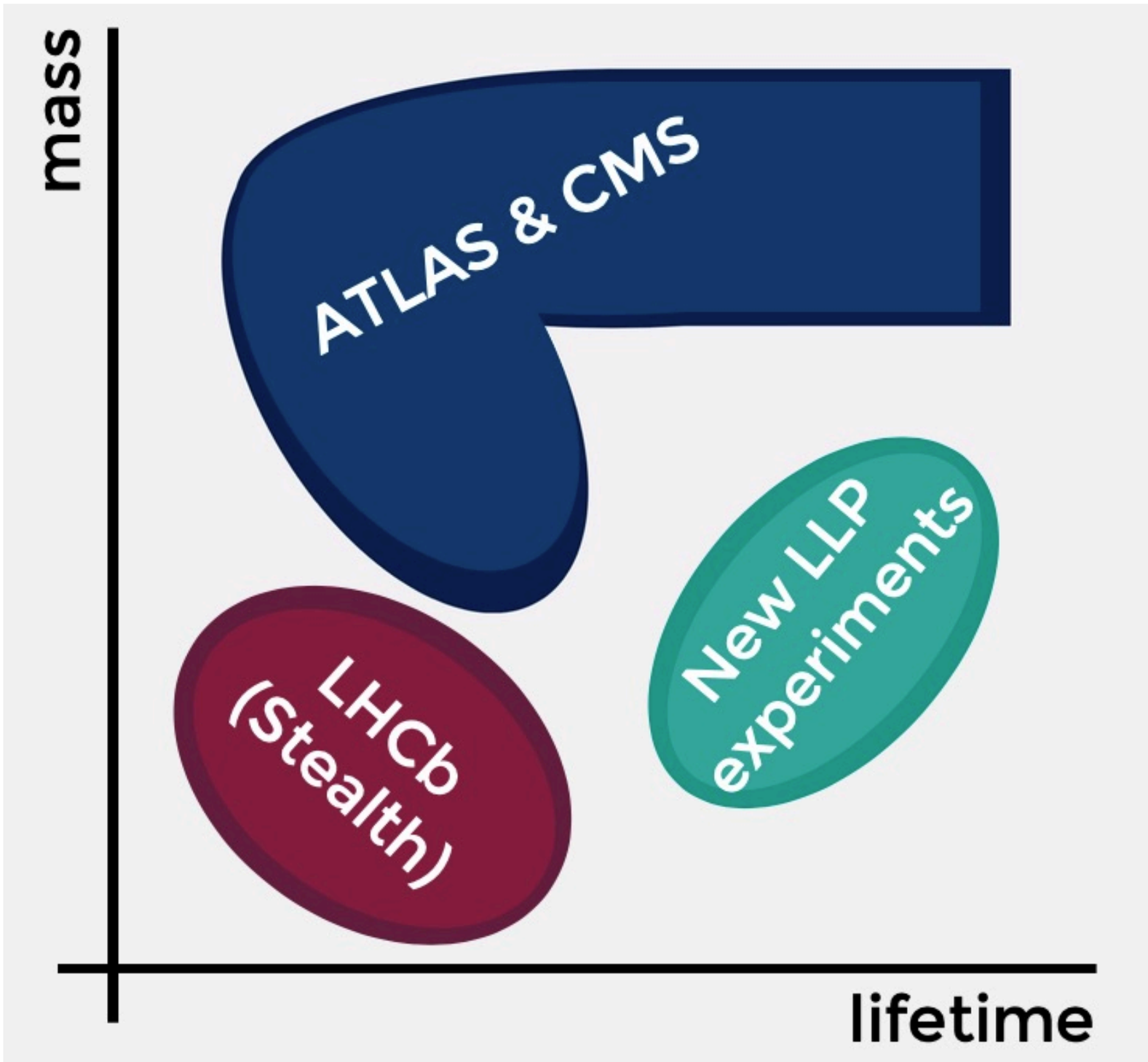
J. Zurita

- LHCb is usually considered *only good for flavour physics*. ATLAS&CMS have more luminosity and larger geometrical acceptance (central), so that's the ideal playground to hunt for new heavy degrees of freedom.

- But LHCb has several other advantages compared to ATLAS&CMS!!! e.g: trigger on soft objects, accurate vertex reconstruction, hadronic ID, precise mass resolution ($\Delta m \sim 0.5\%$ for $m \lesssim 10$ GeV), charged track reconstruction…

Can LHCb probe New Physics (besides flavor)?

The parameter space



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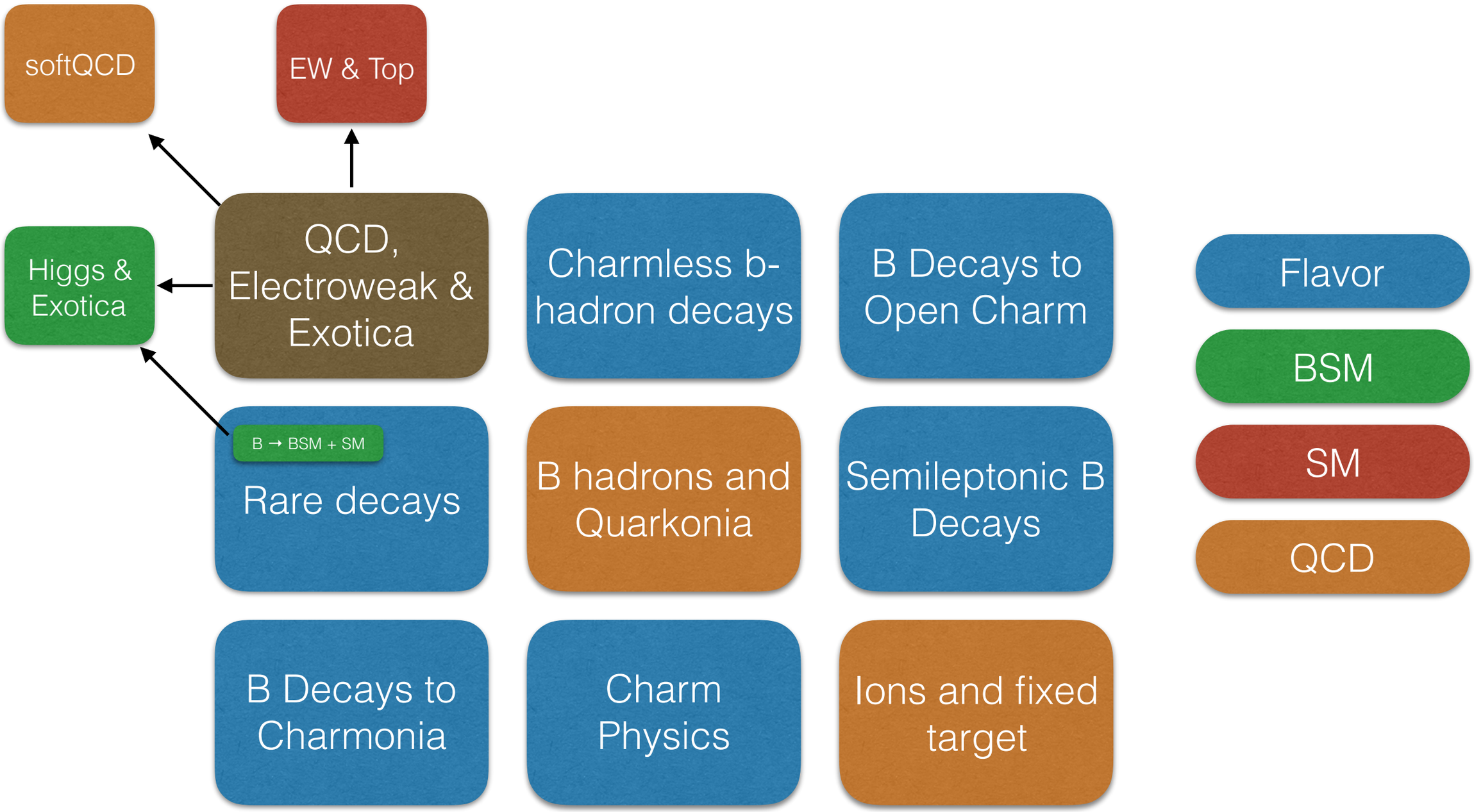
How does Stealth fit at LHCb?



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Workshop structure

Monday, 17 February

14:30 → 15:00 **Registration**

15:00 → 15:30 **Welcome and introduction**
Speaker: Xabier Cid Vidal (Instituto Galego de Física de Altas Enerxías)

15:30 → 16:00 **LHCb reconstruction and PID**
Speaker: Murilo Santana Rangel (Federal University of of Rio de Janeiro (BR))

16:00 → 16:30 **LHCb trigger in Run 3**
Speaker: Miguel Ramos Pernas (Universidade de Santiago de Compostela (ES))

16:30 → 17:00 Coffee break

17:00 → 17:30 **LHCb results in Stealth Physics**
Speaker: Philip Ilten (University of Birmingham (GB))

17:30 → 18:00 **Simulation tools**
Speaker: Diego Martinez Santos (Universidade de Santiago de Compostela (ES))

18:00 → 18:30 **Discussion (ask an experimentalist)**
Speakers: Carlos Vazquez Sierra (Nikhef National Institute for subatomic physics (NL)), José Francisco Zurita (KIT)

Tuesday, 18 February

10:00 → 10:30 **The future of LHCb**
Speaker: Federico Leo Redi (EPFL - Ecole Polytechnique Federale Lausanne (CH))

10:30 → 11:00 **Codex-b experiment status**
Speaker: Xabier Cid Vidal (Instituto Galego de Física de Altas Enerxías)

11:00 → 11:30 Coffee break

11:30 → 12:00 **Hidden Valleys 1**
Speaker: Yuhsin Tsai (University of Maryland)

12:00 → 12:30 **Hidden Valleys 2**
Speaker: Ennio Salvioni (CERN)

12:30 → 13:00 **Long Lived Particles Searches in Heavy Ion Collisions at the LHC**
Speaker: Dr Jan Hajer (Université catholique de Louvain)

15:00 → 15:30 **Dark photons theory**
Speaker: Patrick Foldenauer

15:30 → 16:00 **Soft displaced objects from dark matter at the LHC**
Speaker: Susanne Westhoff (Heidelberg University)

16:00 → 16:30 Coffee break

16:30 → 17:00 **Baryogenesis and Dark Matter from Mesons**
Speaker: Gilly Elor

17:00 → 17:30 **Collider Implications of Baryogenesis and Dark Matter from B Mesons**
Speaker: Miguel Escudero (King's College London)

17:30 → 18:00 **Discussion (ask a theorist)**
Speakers: Martino Borsato (Ruprecht-Karls Universitaet Heidelberg (DE)), Yuhsin Tsai (University of Maryland)

Wednesday, 19 February

10:00 → 10:30 **Who are LHCb's main rivals?**
Speaker: Albert De Roeck (CERN)

10:30 → 11:00 **Probing dark sectors with long-lived particles at BELLE II**
Speaker: Ruth Schäfer (Universität Heidelberg)

11:00 → 11:30 **Novel B-decay signatures of light scalars at high energy facilities**
Speaker: Maria Ramos (LIP)

11:30 → 12:00 Coffee break

12:00 → 12:30 **ALPs from composite Higgs models**
Speaker: Diogo Buarque Franzosi (Chalmers University of Technology)

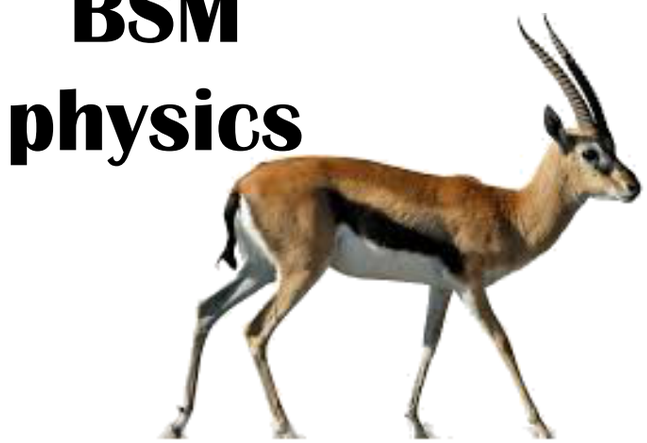
12:30 → 13:00 **Identifying Exclusive Displaced Hadronic Signatures at LHCb**
Speaker: José Francisco Zurita (KIT)

13:00 → 15:00 Lunch

15:00 → 18:00 **Discussion and work in common**

*please upload your slides in Indico or send them to us before the beginning of each session

The LHC jungle



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The LHC jungle

BSM physics

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The LHC jungle

ATLAS

BSM physics

CMS

LHCb

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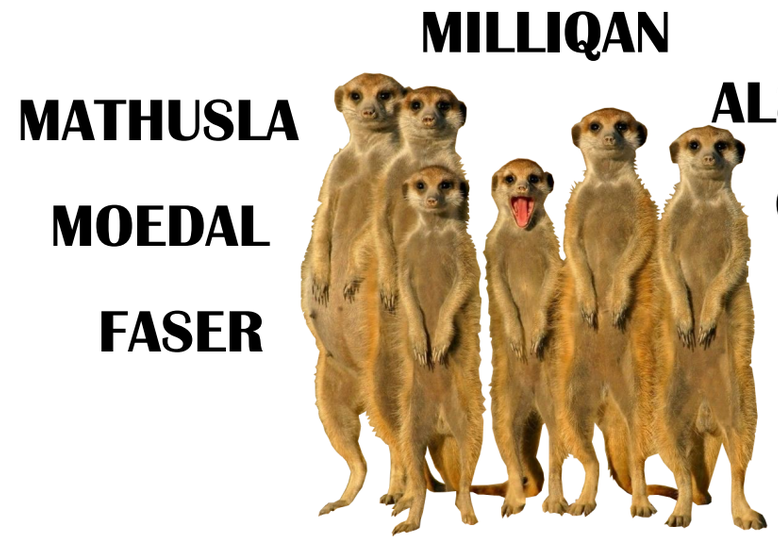
The LHC jungle



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The LHC jungle

MILLIQAN

MATHUSLA

AL3X

MOEDAL

CODEX-b

FASER

ATLAS

BSM physics

CMS

THEORY

LHCb

Let’s make the most of this workshop!