

STEALTH physics at LHCb: unleashing the full power of LHCb to probe new physics

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Book of Abstracts

Contents

Novel B -decay signatures of light scalars at high energy facilities	1
Soft displaced objects from dark matter at the LHC	1
Probing dark sectors with long-lived particles at BELLE II	1
Collider Consequences of Baryogenesis and Dark Matter from B Mesons	2
Registration	2
Welcome and introduction	2
LHCb reconstruction and PID	2
LHCb trigger in Run 3	2
LHCb results in Stealth Physics	2
Simulation tools	3
Discussion (ask an experimentalist)	3
The future of LHCb	3
Codex-b experiment status	3
Searching for Confining Hidden Valleys at LHCb	3
Z portal to a confining hidden sector	3
Long Lived Particles Searches in Heavy Ion Collisions at the LHC	3
Search for the true muonium at LHCb	4
Dark photons theory	4
LHC probes of co-scattering dark matter	4
Baryogenesis and Dark Matter from Mesons	4
Collider Implications of Baryogenesis and Dark Matter from B Mesons	4
Discussion (ask a theorist)	4
Probing dark sectors with long-lived particles at BELLE II	4

Who are LHCb's main rivals?	4
Novel χ -decay signatures of light scalars at high energy facilities	5
ALPs from composite Higgs models	5
Identifying Exclusive Displaced Hadronic Signatures at LHCb	5
Discussion and work in common	5

2

Novel B -decay signatures of light scalars at high energy facilities

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In this talk, we will discuss the phenomenology of light scalars of masses m_1 and m_2 coupling to heavy flavour-violating vector bosons of mass $m_V \sim \text{TeV}$. This scenario is particularly motivated, as the scalar-vector coupling arises naturally in non-minimal composite Higgs models and the vector boson is a prime candidate to solve the apparent anomalies observed in tests of lepton flavour universality.

For $m_{1,2} \sim \text{few GeV}$, the model triggers rare B -meson decays such as $B_s^0 \rightarrow 3\mu^+3\mu^-$, $B^0 \rightarrow 3\mu^+3\mu^-$, $B^+ \rightarrow K^+3\mu^+3\mu^-$ and $B_s^0 \rightarrow K^{0*}3\mu^+3\mu^-$. None of these signals has been studied experimentally. Therefore, we will discuss dedicated analyses to test these channels at the LHCb, obtaining current and future limits on the corresponding branching ratios.

For $m_{1,2} \gg \mathcal{O}(1) \text{ GeV}$, the scalars arise instead in the decay of the vector mediator, which can be produced in pp collisions at the LHC. In this regime, we will show that modified versions of current multiplepton and multitau searches can probe a wide region of the parameter space of this scenario.

Altogether, the potential of the searches we propose outperform other constraints such as those from meson mixing.

3

Soft displaced objects from dark matter at the LHC

Author: Susanne Westhoff¹

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Feebly interacting dark sectors with a compressed spectrum should leave characteristic signatures with soft displaced particles in the LHC detectors. I will discuss how we can directly predict such signatures from co-scattering dark matter in the early universe. At ATLAS and CMS searches for soft displaced objects are underway, but limited by large hadronic background. Can LHCb do better?

4

Probing dark sectors with long-lived particles at BELLE II

Authors: Anastasiia Filimonova^{None}; Ruth Schäfer^{None}; Susanne Westhoff^{None}

I will present a new search for light scalar singlets in rare meson decays. For tiny interactions, the scalar is long-lived at detector scales and decays into displaced pairs of leptons or light mesons. I will show that Belle II has a remarkable potential to probe scalars in the GeV range with couplings as small as 10^{-5} . The predicted sensitivity is higher than at the long-baseline experiments FASER and NA62.

5

Collider Consequences of Baryogenesis and Dark Matter from B Mesons

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In this talk based on ArXiv:1810.00880, I will detail what are the different approaches by which current collider experiments can test whether Baryogenesis and Dark Matter arise from CP violating B meson oscillations and their subsequent decays in the early Universe. These are:

- 1) Searches for heavy colored scalars (ATLAS, CMS).
- 2) Measurements of direct CPV in the B meson system (LHCb, Belle-II, ATLAS, CMS).
- 3) Searches for indirect CPV in the neutral B meson system (LHCb, Belle-II, ATLAS, CMS).
- 4) Searches for a new decay mode of B mesons into Missing energy and a visible Baryon (LHCb, Belle-II).
- 5) Searches for a new decay mode of b-flavored baryons into missing energy and mesons (LHCb).

I will of course focus on those relevant for the LHCb experiment, (2-5).

6

Registration

7

Welcome and introduction

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8

LHCb reconstruction and PID

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10

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11

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13

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14

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15

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16

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17

Long Lived Particles Searches in Heavy Ion Collisions at the LHC

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18

Search for the true muonium at LHCb

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19

Dark photons theory

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20

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21

Baryogenesis and Dark Matter from Mesons

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22

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24

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25

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26

Novel χ -decay signatures of light scalars at high energy facilities

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27

ALPs from composite Higgs models

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28

Identifying Exclusive Displaced Hadronic Signatures at LHCb

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29

Discussion and work in common