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Synergies between astroparticle, particle and nuclear physics

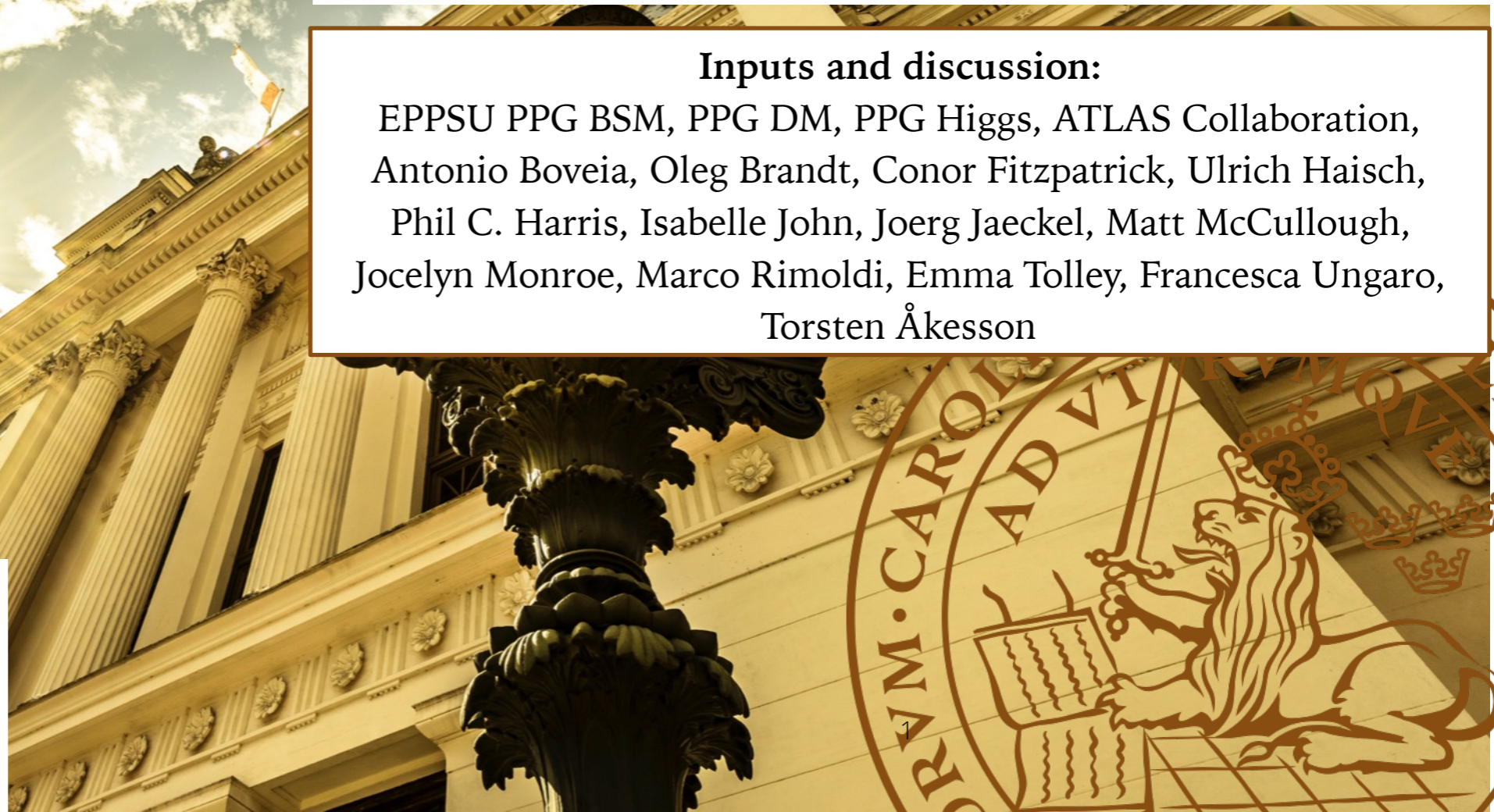
CATERINA DOGLIONI - LUND UNIVERSITY

Inputs and discussion:

EPPSU PPG BSM, PPG DM, PPG Higgs, ATLAS Collaboration,
Antonio Boveia, Oleg Brandt, Conor Fitzpatrick, Ulrich Haisch,
Phil C. Harris, Isabelle John, Joerg Jaeckel, Matt McCullough,
Jocelyn Monroe, Marco Rimoldi, Emma Tolley, Francesca Ungaro,
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Visions: APPEC, ECFA, NuPECC

Astroparticle (APPEC)



Particle (ECFA)


CERN Council Open Symposium on the Update of
European Strategy for Particle Physics
13-16 May 2019 - Granada, Spain



Physics Preparatory Group		Local Organizing Committee	
Halina Abramowicz (Chair)	Beate Heinemann	Francisco del Águila	Juan José Hernández
Shoji Asai	Xinchou Lou	Antonio Bueno (Chair)	Mario Martínez
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Keith Ellis	Marco Zito	María José García Borge	
Belen Gavela	Antonio Zoccoli	Igor García Irastorza	
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Sponsored by:



Nuclear physics (NuPECC)



NuPECC
NuPECC
Long Range Plan 2017
Perspectives
in Nuclear Physics



Astroparticle, particle and nuclear physics in Europe have **strategies and plans** that **recognize the importance of synergies** between the different fields



Visions: APPEC, ECFA, NuPECC

Some of the **common scientific goals** in the strategy documents:



**Nature of dark matter
and dark energy**

Fundamental forces & symmetries

Properties of neutrinos at all energy scales

Origin of elements

Extreme states of matter

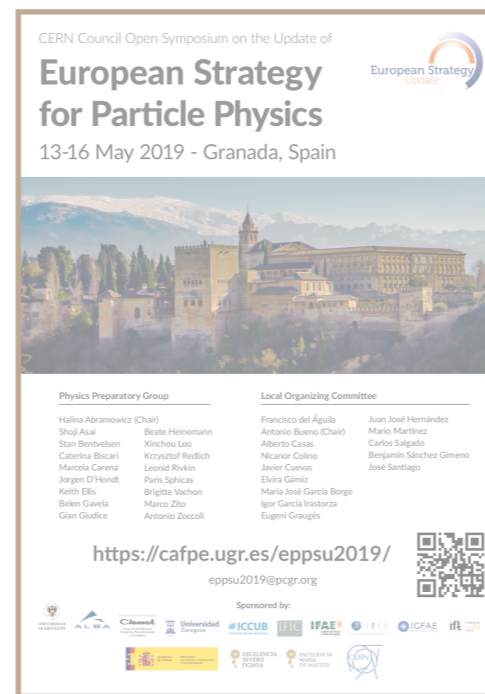


More synergies: "foundations" for common challenges

Astroparticle



Particle



Nuclear



Common theory ground

instrumentation
(accelerators, beams, detectors,
vacuum & cryogenics,
control & automation...)

data acquisition,
computing,
data sharing
& open science



A constellation of activities and initiatives

Astroparticle

Particle

Nuclear

APPEC input to EPPSU:
taking off in 2019 with CERN
as first 5-year host



European Center for Astroparticle Theory (EuCAPT)

Common theory ground

instrumentation
(accelerators, beams, detectors,
vacuum & cryogenics,
control & automation...)

data acquisition,
computing,
data sharing
& open science



APPEC news,
after Granada '19:
wish to enhance collaboration
and discussion between
LHC DMWG and DD/ID

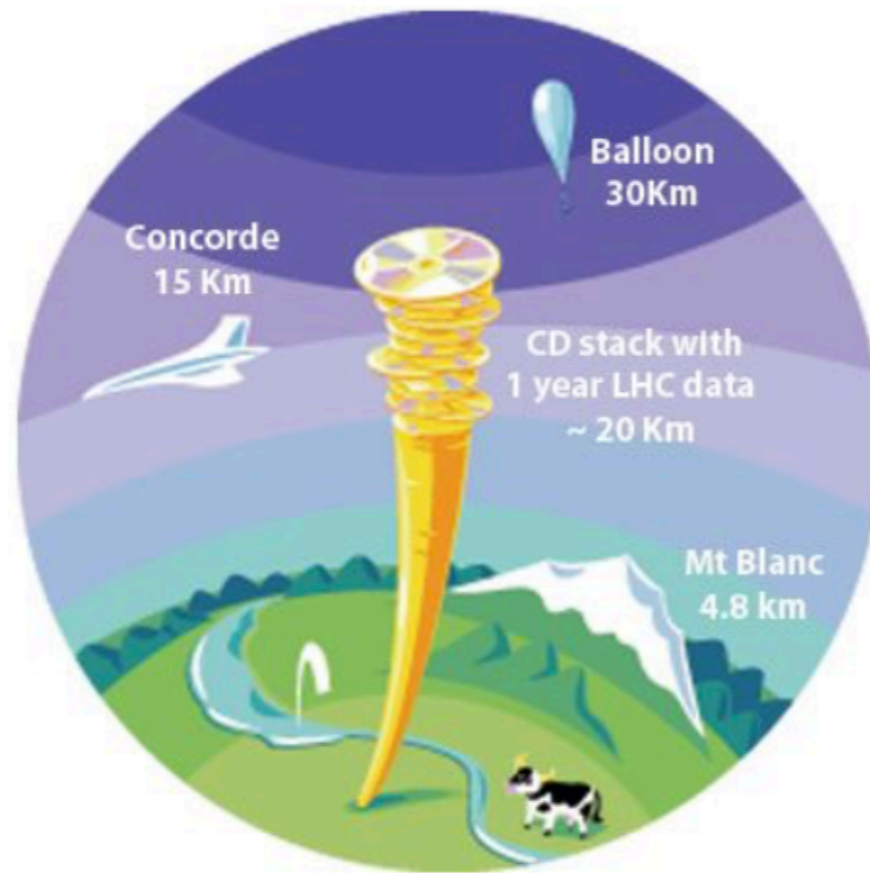
Direct Detection
collaborations
input to EPPSU:
strengthen
common
efforts



Enabling discoveries in particle physics

- **Many different theories** can explain **particle physics** shortcomings
 - None of these theories is yet favored by data
 - Very different signatures in the detector

A key challenge: within millions p-p collisions/second, select/analyze the interesting ones **in real time**



LHC data volumes
after selection
of "interesting" data



Extremely large datasets, in different contexts

C. Fitzpatrick, **LHCb**

E. Bellm, **Large Synoptic Survey Telescope**

The trigger




...or how to drink from a firehose



The slide contains a table of contents with the following items: Flavour, Introduction, LHCb, γ tests the SM, β_s with $D_s D_s$, The trigger (highlighted), and Conclusions. At the bottom, it lists the author C. Fitzpatrick, the date March 30, 2017, and the EPFL logo (Ecole Polytechnique Fédérale de Lausanne).

REAL-TIME DECISION MAKING • BERKELEY, CA • FEB. 26, 2018 47

Are we building a *firehose*?



The LHC and modern astrophysics surveys are **data firehoses**



Can benefit from **common techniques and tools for data taking & data reduction**
(e.g. on-detector / **real-time data analysis**, machine learning)
with applications beyond physics research



Conclusions and outlook

- Answering fundamental physics questions requires **concerted work** from **particle, astroparticle and nuclear physics**
 - Examples: dark matter, neutrino physics...
 - Common challenges in terms of foundations (detector, computing...)
- A number of **synergistic initiatives** exist, many **hosted by CERN**
 - What is the best way forward? Discussion started at Granada meeting
- More discussion at the **APPEC-ECFA-NuPECC meeting** in Orsay this October



ECFA
NuPECC
ApPEC

JENAS-2019
Joint ECFA-NuPECC-ApPEC Seminar
October 14-16, 2019 - LAL Orsay, France

COMMITTEES LOCAL ORGANIZING COMMITTEE ApPEC-NuPECC-ECFA ORGANIZING BOARD	Home This first Joint ECFA-NuPECC-ApPEC Seminar (JENAS) jointly organized by LAL, IPNO, IRFU and LPNHE will be held from October 14 to October 16, 2019 in Orsay.	CONTACT US
		POSTER JENAS-2019

- As input to that, come and put a **post-it** on my **poster**!



Thank you for your attention!

Caterina Doglioni - 2019/10/02 - Partikeldagarna