

HIGH-ENERGY PHYSICS
RESEARCH CENTRE

High-Energy Physics

May 3, 2022, Brussels (online)

Coordinator:

Jorgen D'Hondt

in total 8 promotor

Group leaders of VUB research groups :

Stijn Buitink

Astrophysics (AARG)

Ben Craps

Theoretical Physics (TENA)

Jorgen D'Hondt

Experimental High-Energy Physics (ELEM)

Alberto Mariotti

Phenomenology (AARG+TENA+ELEM)

Other promotor:

Krijn de Vries, Steven Lowette, Alexandre Sevrin, Nick van Eijndhoven

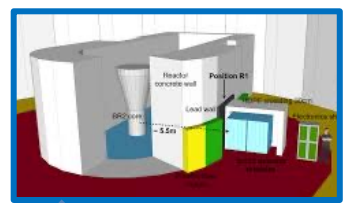
LIGO/VIRGO/KAGRA
Gravitational Wave
Interferometers



Radio Neutrino Observatory
Greenland



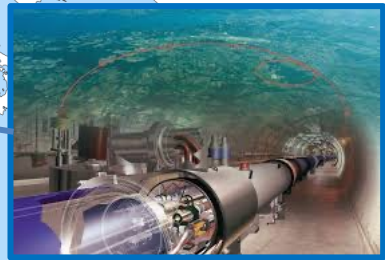
SoLid @ BR2



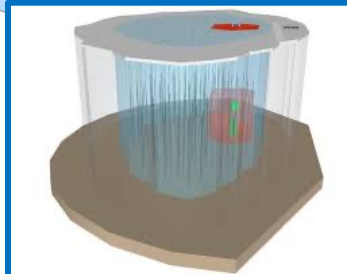
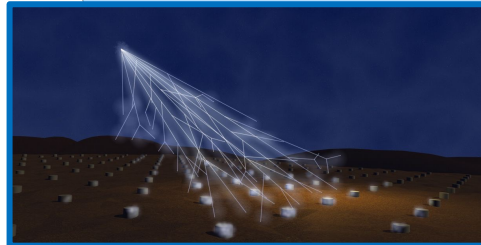
LOFAR Radio Telescope



CMS @ LHC



Pierre Auger
Cosmic Ray
Observatory



IceCube
Neutrino
Observatory



Askaryan
Radio
Array

We are involved in a vast
portfolio of running
research facilities



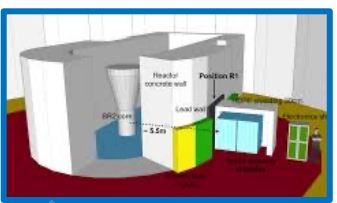
LIGO/VIRGO/KAGRA
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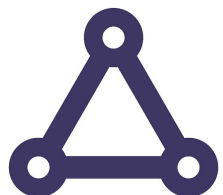
SoLid @ BR2



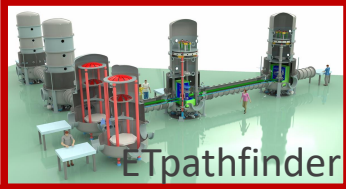
LOFAR Radio Telescope



CMS @ LHC

**Einstein
Telescope**



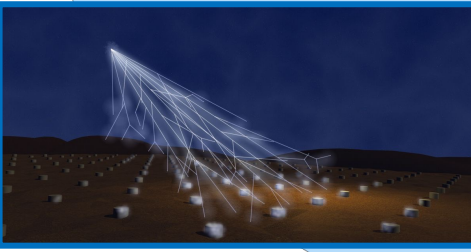
... and we prepare for new ones



**FUTURE
CIRCULAR
COLLIDER**

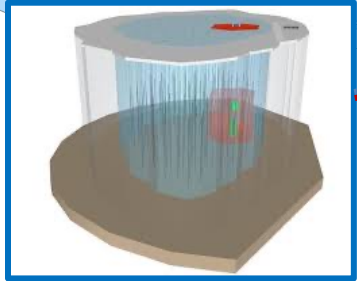


GRAND



Pierre Auger
Cosmic Ray
Observatory

RADAR ECHO TELESCOPE

IceCube
Neutrino
Observatory



SKA
SQUARE KILOMETRE ARRAY



Askaryan
Radio
Array





Theoretical physics

- string theory

Prof. B. Craps
Prof. A. Sevrin

Particle physics experiments

- high-energy colliders

Prof. J. D'Hondt

Ending FWO positions:
Prof. R. Roosen
Prof. W. Van Doninck

Active emeriti:
Prof. S. Tavernier

Astro-particle physics

- neutrino telescope

Prof. De Clercq



Coordinator: Prof. J. D'Hondt

Secretariat: N. Hindrikx and S. Van den Bussche

Theoretical physics

- string theory
- holography
- cosmology
- gravitational waves

Prof. B. Craps
Prof. A. Sevrin

Part-time:

Prof. V. Balasubramanian
Prof. C. Blair
Prof. M. Sakellariadou
Prof. D. Thompson

Guest professor:

Prof. O. Evnin
Prof. L. Lopez Honorez

TENA

Particle physics experiments

- high-energy colliders
- neutrino physics

Prof. F. Blekman
(previous Odysseus 2)

Prof. J. D'Hondt
Prof. S. Lowette
(previous Odysseus 2)

Active emeriti:

Prof. S. Tavernier

ELEM

Astro-particle physics

- cosmic neutrinos
- dark matter
- multi-messenger observations

Prof. K. de Vries
(ERC Starting Grant)
Prof. N. van Eijndhoven
(previous Odysseus 1)

Part-time:

Prof. K. Kotera

Active emeriti:

Prof. O. Scholten

ELEM

High-energy astrophysics

- radio astronomy
- cosmic rays
- lightning
- binary evolution

Prof. S. Buitink
(previous ERC Starting Grant)

Part-time:

Prof. J. Blommaert
Prof. T. Huege
Prof. K. Kolenberg

Guest professor:

Prof. D. Vanbeveren
Prof. J. Horandel
(ERC Advanced Grant)

AARG

Phenomenology

Prof. A. Mariotti

AARG – ELEM – TENA



High-Energy Physics – TODAY

Coordinator: Prof. J. D'Hondt

Secretariat: N. Hindriks and S. Van den Bussche

Theoretical physics

- string theory
- holography
- cosmology
- gravity

Particle physics experiments

- high-energy colliders
- neutrino physics

Astro-particle physics

- cosmic neutrinos
- dark matter

High-energy astrophysics

- radio astronomy
- cosmic rays

News: two new vacancies for professors
Experimental high-energy physics
Theoretical high-energy physics

In total 24 professors in high-energy physics
 to connect the large and small scales,
 and experiment and theory

We are highly dependent on the SRP program
 to provide a unique seed budget

Prof.
Prof.

Part-
Prof.
Prof.
Prof.
Prof.

Guest
Prof.
Prof.

(grant)

(grant)

P



HIGH-ENERGY PHYSICS
RESEARCH CENTRE

VUB-scale in Flanders

As a university, the VUB represents about 10% in the Flemish academic landscape, hence “covers” about 0.6M inhabitants

Strategic research choices are to be made in order
to excel on the international level

HEP@VUB aims to create a prolific and inclusive environment for novel research to emerge and for the best researchers to thrive in seeking answers to these open questions in high-energy physics.

Such a consortium is unique in the Belgian context
and rare in the European context.



10 professors
14 part-time professors
or emeriti
17 postdocs
28 PhD students

Gender:
18% professors female
(after one left for another high-level position)
21% postdocs female
15% PhD students female

Since 2012:
>1330 publications*
>145k citations
h-index 176
>42 PhD thesis

** many with 1000+ authors*

1 Odysseus-I (2 x 750k EUR)
2 Odysseus-II (2M EUR)
(more selected but declined)
2 ERC Starting Grant (2 x 1.5M EUR)

Through FWO in Flanders:
>1/3 of the resources in physics committee
(while VUB is only 1/10 fair share in Flanders)

Running & awarded since 2018:
>25M Euro external funds
11 FWO projects
13 FWO PhD grants
16 FWO postdoc grants

1.3M EUR from SRP program (~30k EUR/year/prof)
General leverage x20-25

Many of our postdocs have obtained a permanent academic position

International:
All (but two) our postdocs obtained their PhD elsewhere
Most of our PhD students obtained their Master abroad



- **Typically, leading research on the national level**
- **Long list of invited Opening and Plenary talks at all major conferences in the field**
- **Leadership at the international level, e.g.**
 - J. D'Hondt: chair of the European Committee for Future Accelerators
 - S. Lowette: convenorship Exotica research team in CMS
 - N. van Eijndhoven: PI and chair Executive Board of RNO-Greenland
 - K. de Vries: scientific PI of the Radar Echo Telescope for Cosmic Rays
 - S. Buitink: PI of the LOFAR Cosmic Ray Key Science Program
 - Others to highlight...
- **Several national and international awards and prizes, e.g.**

World Economic Forum, valorisation prize, science communication, guest professors, Distinguished Researcher Fermilab LPC, thesis awards, etc.



- **Instrumental and unique as seed budget**
 - supporting initial explorations of unknown territories
 - external resources leverage on this initial investment
 - e.g. young researchers apply for individual FWO grants and promoters apply for FWO research projects based on the outcomes of the pilot investigations
 - our engagement in new projects would not have been possible without the initial exploration supported by the HEP@VUB budget
 - e.g. SoLid (2x FWO project), VIRGO/LIGO (1x iBOF), FCC (1x FWO project)
- **Strengthening our capacity to explore inter-disciplinary aspects**
 - between the extremes in our high-energy physics research field
 - allows the promoters to enhance their horizon beyond the mono-disciplinary research
 - often results in opportunities for collaborations with external partners
 - e.g. over the last 5 years we have 19 joint-PhD students and 4 externally funded projects jointly with other institutions and involving mainly joint-PhD
- **Flexibility to act and react fast on novel scientific insights**



Investment to connect

One-day **workshops** with invited international experts focusing on contemporary topics on the interplay between our groups.

Bi-weekly invited **seminars** both topical as well as on the interplay between our groups.

Short term **visitors** that help us making the bridge between groups.

Guido Tonelli (Pisa)
Dieter Lust (Munich)
Francis Halzen (Madison)

Seminars (20)
Crosstalk Workshops (3)
Visitor program (10)
Logistics, Outreach & Coordination
Advisory Board
Allocation per staff member (8)

Professors need to work on **joint projects** to hire a PhD student or postdoc. Salary and bench-fee of PD or student is around 55k euro.

Annual Budget (kEuro)	
Seminars (20)	15
Crosstalk Workshops (3)	15
Visitor program (10)	15
Logistics, Outreach & Coordination	30
Advisory Board	2,7
Allocation per staff member (8)	27.5 (x 8) = 220
297.7	



- ① Elaborate more on the risk evaluation and measures**
Several key risks were identified, and our measures described.
- ② Enhance diversity in the research team**
We have confirmed that we do not observe a passive role, but actively promote diversity in our organisation (incl. gender).
- ③ Provide more concrete work packages**
We argued that HEP@VUB is a broad research programme and provided several mono- and interdisciplinary examples.



HEP@VUB: *investment to connect*

- ① Strong international recognition of our groups
- ② Research groups are successful in funding requests
- ③ Need to explore the interplay of our research towards potential breakthroughs connecting the large and the small scales in our universe
- ④ Successful strategic hiring choices make us unique in Belgium and internationally very competitive to reach these objectives