



# Research Institute in Mathematics and Physics - IRMP

## 1 Research scope

The Research Institute in Mathematics and Physics (IRMP) develops frontier, fundamental research in several areas of Mathematics and Physics. The research pursued within the institute ranges from the exploration of various mathematical worlds to the systematic study and observation of our Universe at infinitely small and infinitely large space and time scales. Because some of the research topics require advanced technology in the field of particle accelerators, particle detectors, electronics, computing, and software, research and development projects in these areas as well as technical facilities are also managed in the Institute.

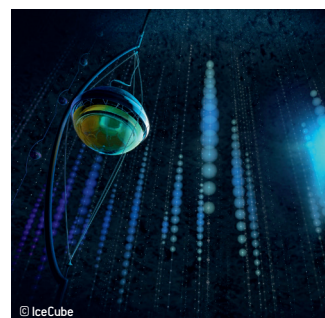
## 2 Research topics

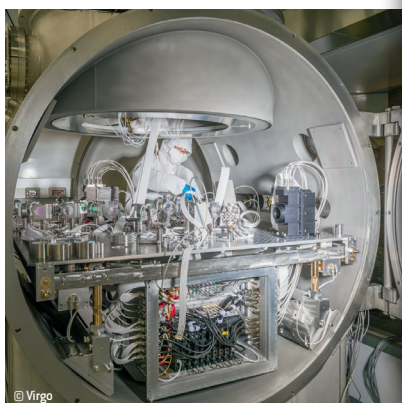
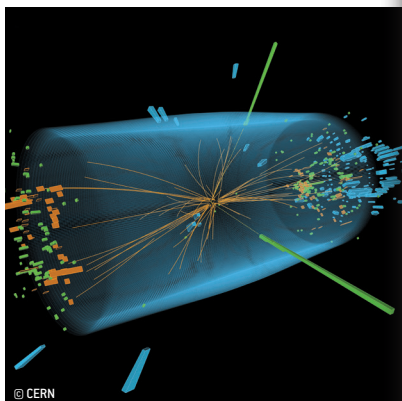
Researchers at the IRMP are organised within four groups that represent the major research domains of the institute:

- ▀ **Mathematics (MATH)**  
<https://uclouvain.be/en/research-institutes/irmp/mathem>
- ▀ **Centre for research in Geometry, Physics and Probability (GPP)**  
<https://uclouvain.be/en/research-institutes/irmp/gpp>
- ▀ **Centre for Cosmology, Particle Physics and Phenomenology (CP3)**  
<https://uclouvain.be/en/research-institutes/irmp/cp3>
- ▀ **Cosmology, Universe and Relativity at Louvain (CURL)**  
<https://curl.group/>

The IRMP main research topics are the following:

- Algebraic topology
- Category theory
- Differential equations and calculus of variations
- Group theory
- Integrable combinatorics and statistical field theory
- Noncommutative geometry
- Random matrix theory
- Mathematical education
- Theories of the fundamental interactions
- Cosmology and general relativity
- Phenomenology of elementary particles
- Data analysis in high-energy physics experiments, gravitational waves and neutrino detection (CMS, NA62 at the CERN international laboratory, Virgo, IceCube and Km3NET)
- Detector commissioning, operation and data processing in high-energy (astro)physics
- Research and development of new particle and gravitational wave detectors.





### 3 Technical facilities

The IRMP institute includes a number of technological facilities whose mission is to provide technical support to researchers of the IRMP or the UCL at large. One of these centers, the CRC described below, also offers services outside UCL.

- The **Cyclotron Resource Centre** (CRC - <https://uclouvain.be/fr/instituts-recherche/irmp/crc> ; with a staff of 14 full-time equivalent) is a technological platform for:
  - Research and development in the field of particle accelerators, ion sources and their applications.
  - Production of accelerated ion beams for applications like testing of irradiated electronics and production of track etched membranes.
- The **CP3 computing facility** provides storage and computing resources for several research projects. It consists of a computing cluster, which totals about 3000 cores and 3500 TB of disk storage, and a supercomputer capable of running 296 threads and with 25 TB of disk. The cluster is integrated in the UCL CISM technological platform (cf. CISM card) and contributes for about 50% of its resources
- **Technical workshops and laboratories: mechanics** (500 m<sup>2</sup>, co-managed by the IRMP and IMCN institutes), **electronics** (co-managed by IRMP and IMCN), a **design office**, and a number of laboratories with clean rooms and gas distribution systems.

### 4 Key numbers

As of November 2021 the IRMP comprises 25 faculty members, 4 research scientists, 28 technical and administrative staff members, 36 postdoctoral researchers, and 44 PhD students. About 10 PhD theses are defended yearly. Since 2013 members of the IRMP received, or participated in the following notable grants or recognitions:

- 3 European ERC Starting Grants,
- 3 European Innovative Training Network,
- 2 Belgian Excellence Of Science grants,
- 1 Belgian Francqui Research Chair,
- 1 Francqui Starting Grant

### 5 Contact



Website: <https://uclouvain.be/en/research-institutes/irmp>  
 President: Marino GRAN, [president-irmp@uclouvain.be](mailto:president-irmp@uclouvain.be)  
 Secretary: Martine FURNEMONT, [secretariat-irmp@uclouvain.be](mailto:secretariat-irmp@uclouvain.be)

*"The beauty of mathematics reveals itself in many ways, in particular in the physical laws governing our universe".*

Address: Boîte L7.01.02  
 Bâtiment Marc de Hemptinne (bureau B.001)  
 Chemin du Cyclotron, 2  
 B-1348 Louvain-la-Neuve

Tél. +32 (10) 47 31 74

