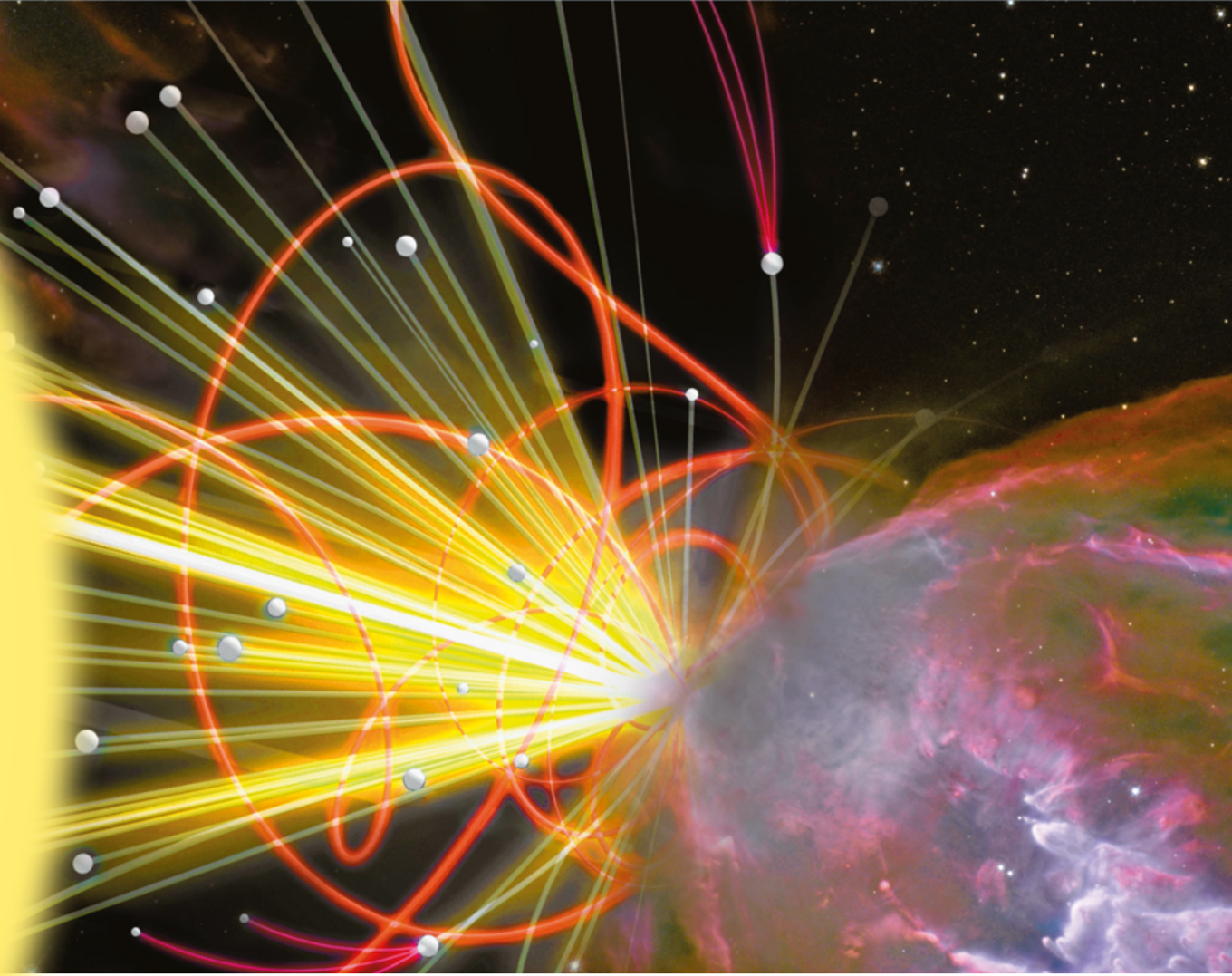
Welcome to LPCA & Clermont!



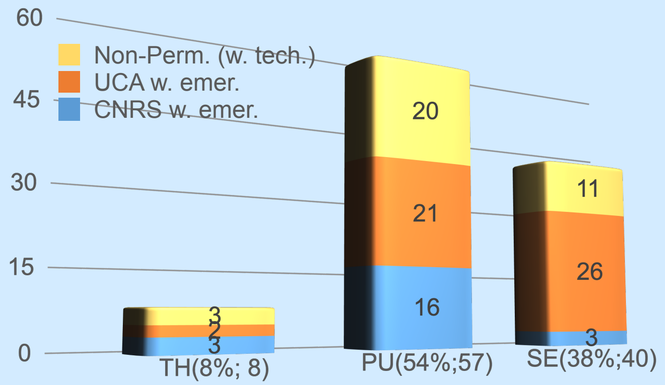
Laboratoire de Physique Clermont Auvergne
Jean ORLOFF

Newcomer’s Welcome Day, October 16 2025

LPCA: what do we do?

- **3 research departments:**
  - **TH (Theory):**
    Analyses BSM in Flavour Physics and Dark Matter;
    Percolation model of pandemics
  - **PU (Particles and Universe):**
    Instrumental and physics contributions to ATLAS, LHCb, ALICE
    CKMfitter, COMET, Future Colliders,
    Observational cosmology through SuperNovae with LSST/ZTF,
    Development of Fink broker for transient objects with LSST/ZTF (beyond SN) & others
  - **SE (Health & Environment)**: effects of radiation on living organisms and environment:
    Conception et efficiency of biomaterials
    Dosimetry and modeling of life
    Radiobiology & Biophysics of single molecule
    Mitochondrial DNA reparation
    Radioactivity in environment (e.g. radon…)
    Developing innovative connected captors (IoT)
    Developing data clouds for environment studies

LPCA: research staff (105)



- 4 support & technical **services**: Administration, Informatics, Electronics, Mechanics
- 4 technical **platforms**:
  - MICA: micro-electronics developments (ALTIROC for HGTD in ATLAS, SPIDER for LHCb, EIC… IoT devices)
  - E2CA: electronics complex cabling and characterization of components (eg. from MICA)
  - PAVIRMA: controlled X-irradiation of biological samples, small animals or electronic components
  - LCG: Tier2 node of the **L**HC **C**omputing **G**rid
- 1 double bachelor (Maths-Physics), 2 masters: Physics with **IMAPP Erasmus Mundus**, & Nucl. Engineering, with Health
- NB: U**M**R = Mixte : **2 supervising bodies**, both **CNRS** (IN2P3) and University Clermont Auvergne (**UCA**)

Conseil Scientifique
Président : Pascal PERRET

Conseil d'Unité
Vice-Président : ? (en cours)

Commission Locale Santé et Sécurité au Travail

Commission Paritaire Locale

Chargés de mission

QVCT Emmanuel GANGLER
Valorisation Emmanuel BERGERET
Isite-Instruments Laurent ROYER

Communication Aurélie TERRISSE, ndreas GOUDELIS, Vincent TISSERAND

Eco-Responsabilité Samuel CALVET
RPS Eric COGNERAS - Géraldine FETTAHI
Parité Eric COGNERAS - Laurine PERROT

DIRECTION

Directeur Jean ORLOFF

Adjoints au Directeur
David CALVET – Vincent BRETON

Directeur Technique Nicolas PILLET

Assistante de Direction Géraldine FETTAHI

Responsable Administratif
Cyril GALPIER

Agents de Prévention Christine GASQ, Thierry PILLEYRE, Adèle PORCAN
CRP et radioprotection Thierry PILLEYRE, Guillaume RIVRAIS
Séminaires Andreas GOUDELIS, Corentin RAVOUX

Correspondants
Formation Continue, RH Géraldine FETTAHI
Web Alexandre CLAUDE
Information Sc et Tech Olivier DESCHAMPS
GED Dominique BONNET
CSSI Jean Claude CHEVALEYRE, Thierry MALLETx@

SERVICES SUPPORTS & TECHNIQUES

Administration
Cyril GALPIER

Informatique
Support Info ASR Dominique BONNET
Calcul et données Bogdan VULPESCU

Électronique
Nicolas PILLET

Mécanique
Nicolas PILLET

PÔLES DE RECHERCHE		ÉQUIPES
Particules et Univers	**Correspondants** Éric COGNERAS, Philippe CROCHET	**ATLAS** Djamel BOUMÉDIENE; **ALICE** Xavier LOPEZ; **LHCb** Stéphane MONTEIL; **COMET** Cristina CÂRLOGANU
		LSST/ZTF Philippe GRIS; **FINK** Emille ISHIDA
Théorie	**Correspondante** Ana M. TEIXEIRA	**THÉORIE** Ana M. TEIXEIRA
Santé Environnement Énergie	**Correspondante** Lydia MAIGNE	**ENVIRONNEMENT / ÉNERGIE** Vincent BRETON **SANTÉ** Patrick VERNET

PLATEFORMES & PLATEAUX

MiCA	Frédéric JOUVE – Laurent ROYER, Romain MADAR
E2CA	Frédéric JOUVE, Emmanuel BERGERET
PAVIRMA	Guillaume RIVRAIS, Patrick CHARDON
TIER 2 – LCG	Jean-Claude CHEVALEYRE, Eric COGNERAS

LPCA: who are we?

- 158 people (28% women, 17% non-French)
- 120 permanent (80%, average age: 50.3 yr)
  - 67 researchers (3/4 are university teachers)
  - 53 technicians & engineers (3/4 are CNRS)

- **~500k€**/yr (CNRS+UCA fundings, + salaries)
- **~400k€**/yr (projects)
- 3000 m² at Cézeaux
  + extension in Montluçon



Recent highlight: NODSSUM

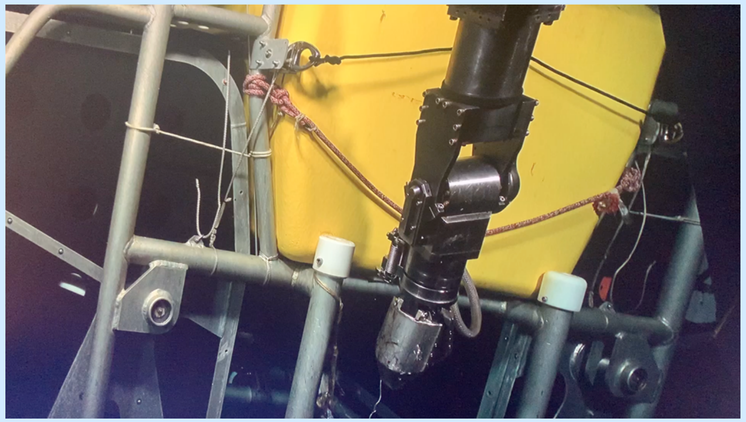




- On June 15- July 12, 4 lab members are on board the ATALANTE in the Atlantic, 1000km West of Brittany
- The mission Nuclear Ocean Dump Site Survey Monitoring was co-planned with Ecole Normale Supérieure by Patrick Chardon (médaille de cristal du CNRS 2025) to
- investigate the fate and effects of the 200.000 barrels with low activity nuclear waste (97% < 40y lifetime) dumped by **4000m depth** between 1950 and 1990:
  - Identify and map the barrels with the pilotless submarine Ulyx with sonar & ultra high res. cameras
  - Evaluate the state of barrels selected by Ulyx using the Remote Operated Vehicle Victor 6000 by sampling water, sediments and animals at different distances from 10km to next to the barrels
  - Evaluate the impacts on ecosystems, e.g. deep sea fish collected by intelligent targeted traps

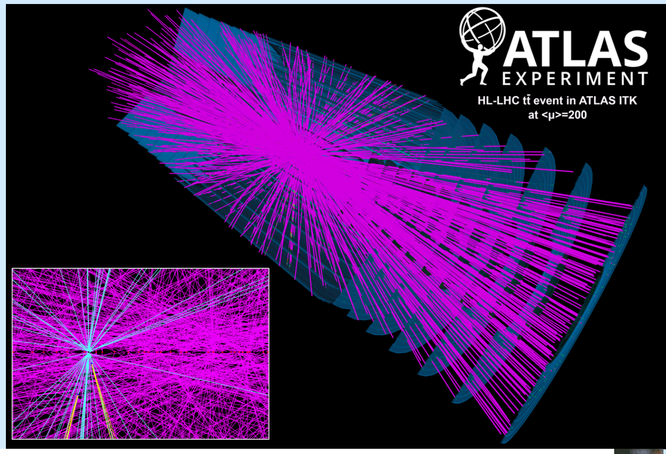


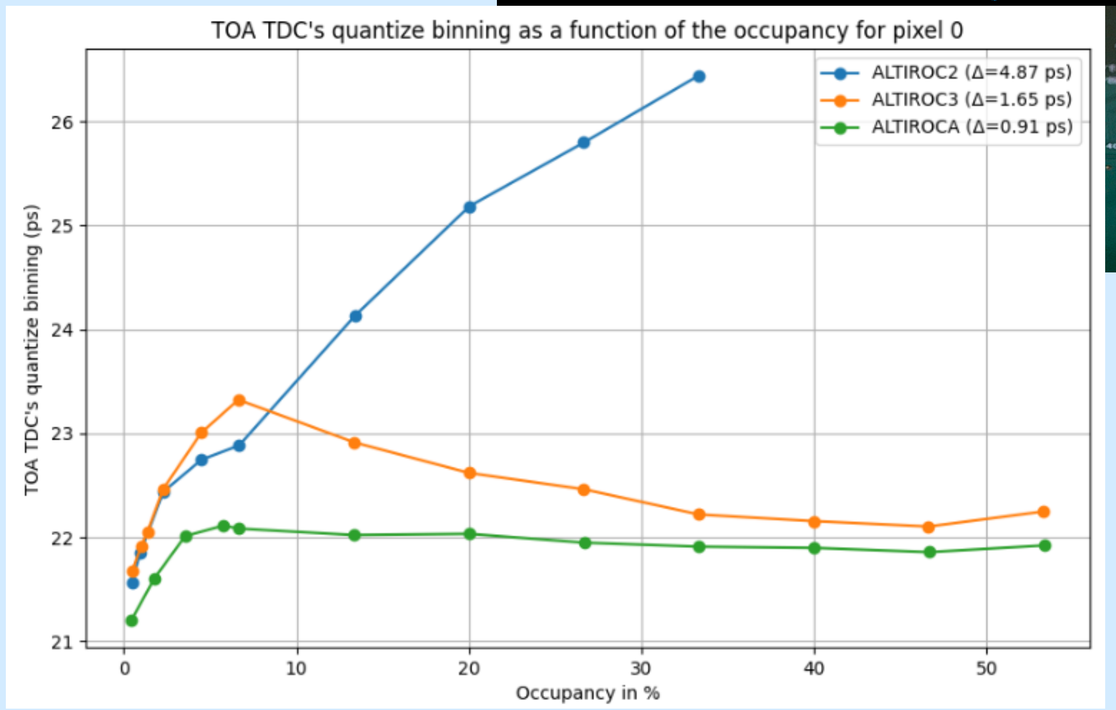




Recent highlight: HGTD/ATLAS@LPCA

- Clermont welcomed in July'25 the collaboration meeting of the ATLAS **H**igh **G**ranularity **T**ime **D**etector week 2025
- HGTD is absolutely crucial to fight pile-up and take full advantage of HL-LHC, eg. for extracting the coupling of H with itself.
- Delivering a 30-50 ps time resolution for each track is a real **technical challenge**: never been done at this scale!
- LPCA plays its role in HGTD:
  - Responsible for grounding and shielding
  - Responsible for Timing calibration and clock
  - MICA designed the ASIC ALTIROC-A
  - Its time resolution was greatly improved





Why Clermont?
A bit of LPCA (pre)history…

LPCA, 12 years ago

- **12 novembre 2013:** François Englert receives a Honoris Causa Doctorate in Clermont, shortly before receiving his Nobel in Stockhom after the discovery by ATLAS and CMS of the (Brout-Englert-)Higgs boson imagined in 1964.
- LPCA activities in ATLAS at CERN, and personal connections with Theory made this possible.
- But upon closer look, activities of the Theory, Particles et Universe at LPCA do have a longer history in Clermont…



1648: Pascal's experiment and the nature of vacuum

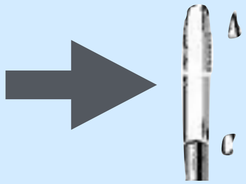
- before: *"Nature abhors vacuum"* is supposed to explain the rising of mercury in a Torricelli barometer…?!?
  Not for Pascal *(born next to Clermont cathedral, living in Paris)*

- **1648** F. Perier, asked by Pascal, carries a barometer to the top of Puy de Dôme:

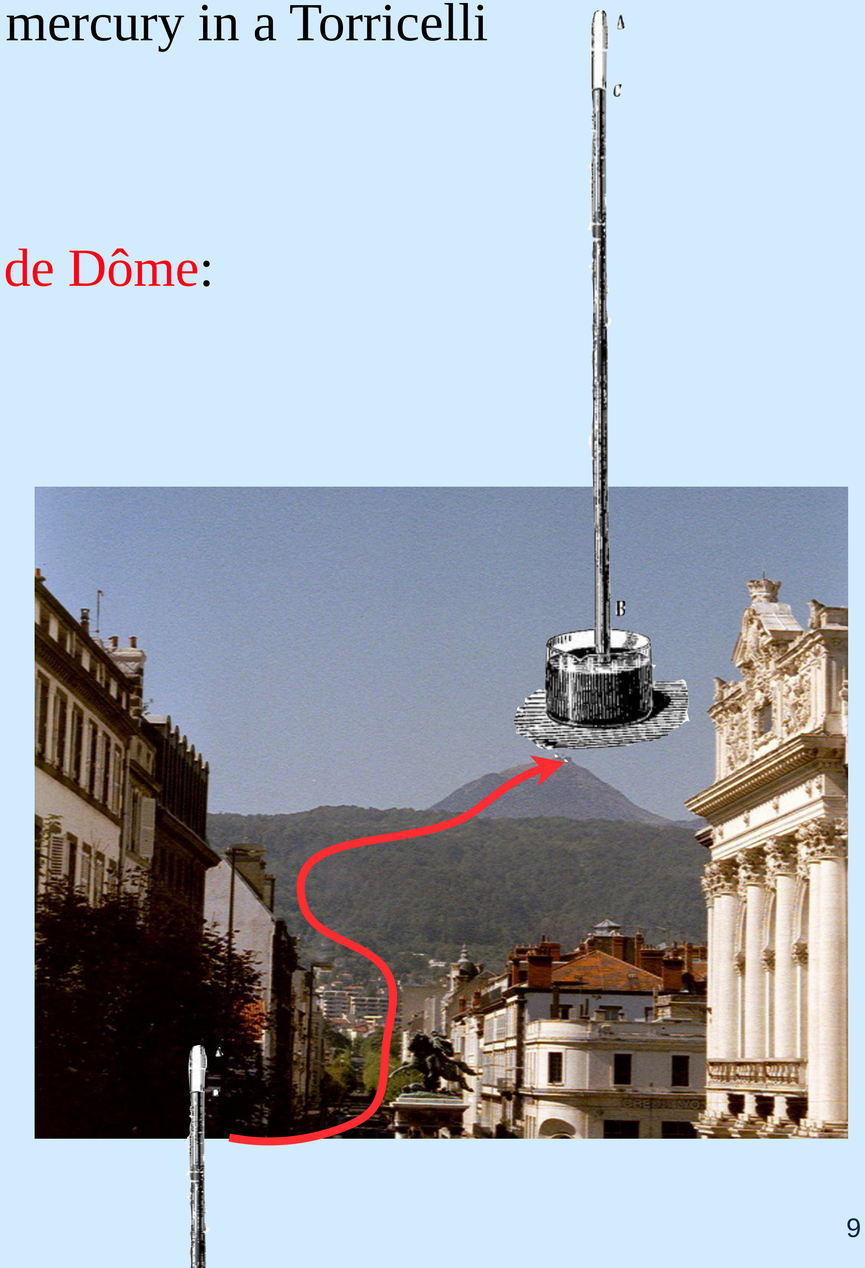
  - mercury there rises not as high as in Place de Jaude…
    Nature would abhor vacuum less up there???

  - Major founding experiment, for pressure and atmospheric science, but not only:
    - extremely modern experimental protocol, and
    - geographic separation (Paris-Clermont), but most of all:

- **What is vacuum: absence of matter?…**



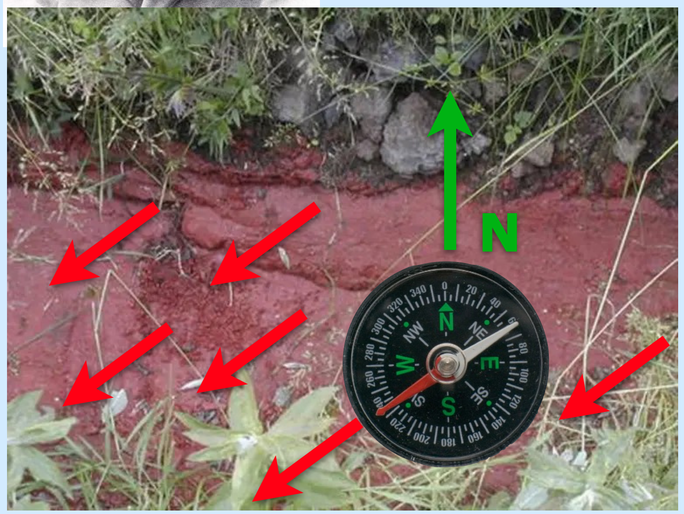
- Today LPCA researchers approach this question with experiments in Geneva and Chile, …



1905: variation of earth magnetism and symmetry breaking

- **B. Brunhes** (Clermont Observatory director)
- **1905**: in Cantal, he discovers volcanic *"porcelanites"* which are magnetised *"upside down"*
- **Hypothesis:** when they cooled down 6 My ago, the (weak) earth magnetic field was inverted (verified 50 years later in the Atlantic rift)
- **Spontaneous symmetry breaking**: while cooling down, a magnetic material *chooses* for its magnetisation the direction of an external magnetic field, however small.
  (Of course, this is not in vacuum: need magnetic dipoles or electric currents to create a magnetic field)
- **What is vacuum: absence of matter AND fields?…**





No!!! In vacuum,
a field of **Brout-Englert-Higgs** (1964) (verified in 2012) is needed to understand the mass of particles, and another field, **dark energy,** seems necessary (1998) to account for cosmological expansion.

The study of both is today the main goal of the LPCA **Particles and Universe** department

Health & environment applications

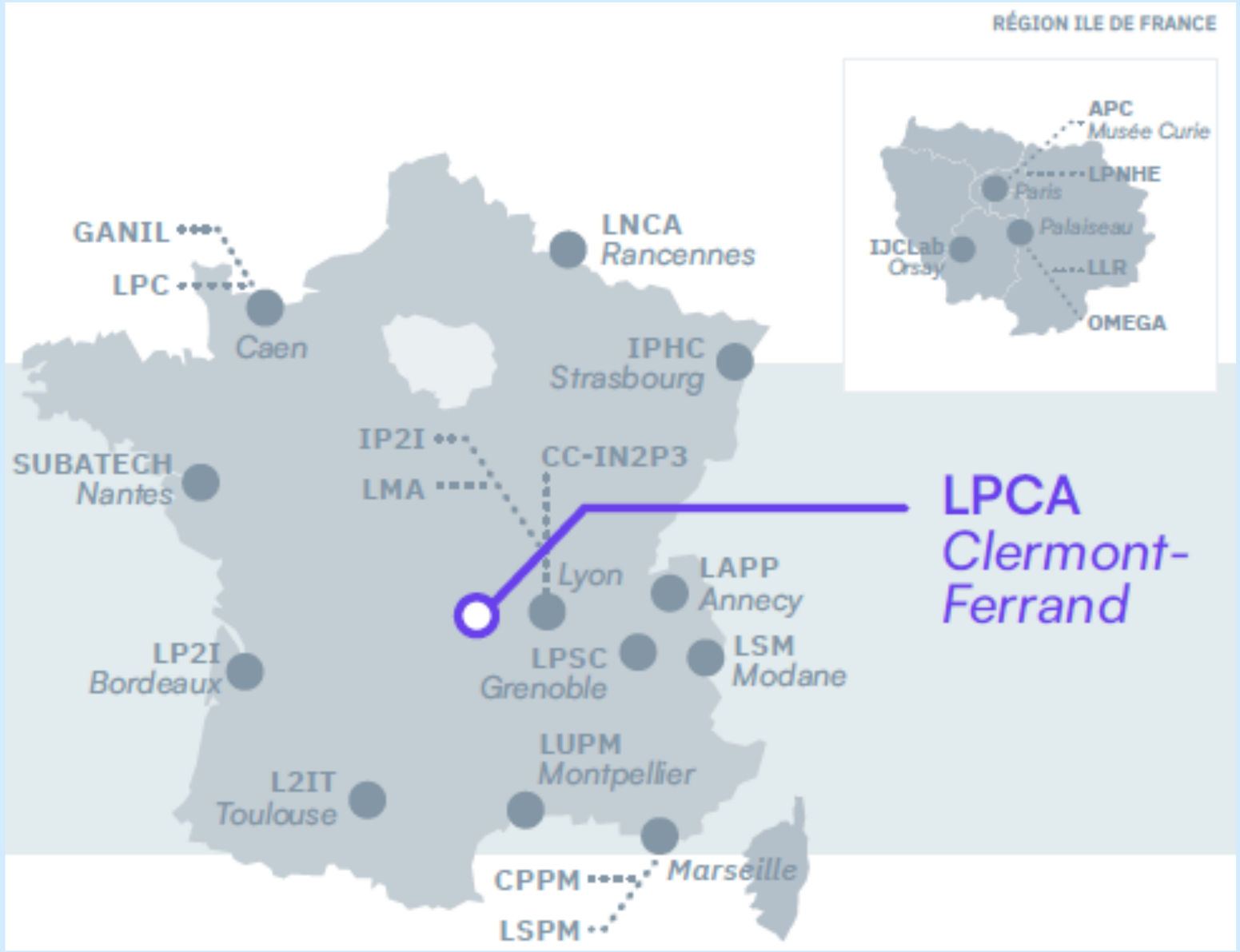
- From its beginning in 1959, LPCA developed **instruments** (e.g. gamma spectrometer) and applications for studying the effects of radiation on cells (e.g. weak doses) or environment (e.g. datation by thermoluminescence).
- 60 years later, this component had been reinforced in 2017 with the addition a team of biologists





National positioning: IN2P3

- IN2P3: National Institute for Nuclear Physics & Particle Physics
- 25 laboratories
  (7 in Auvergne-Rhone-Alpes)
- 1050 researchers (2/3 CNRS)
- 1600 ITA (600 research ing.)
- 800 non-permanent



Position dans le paysage local et régional

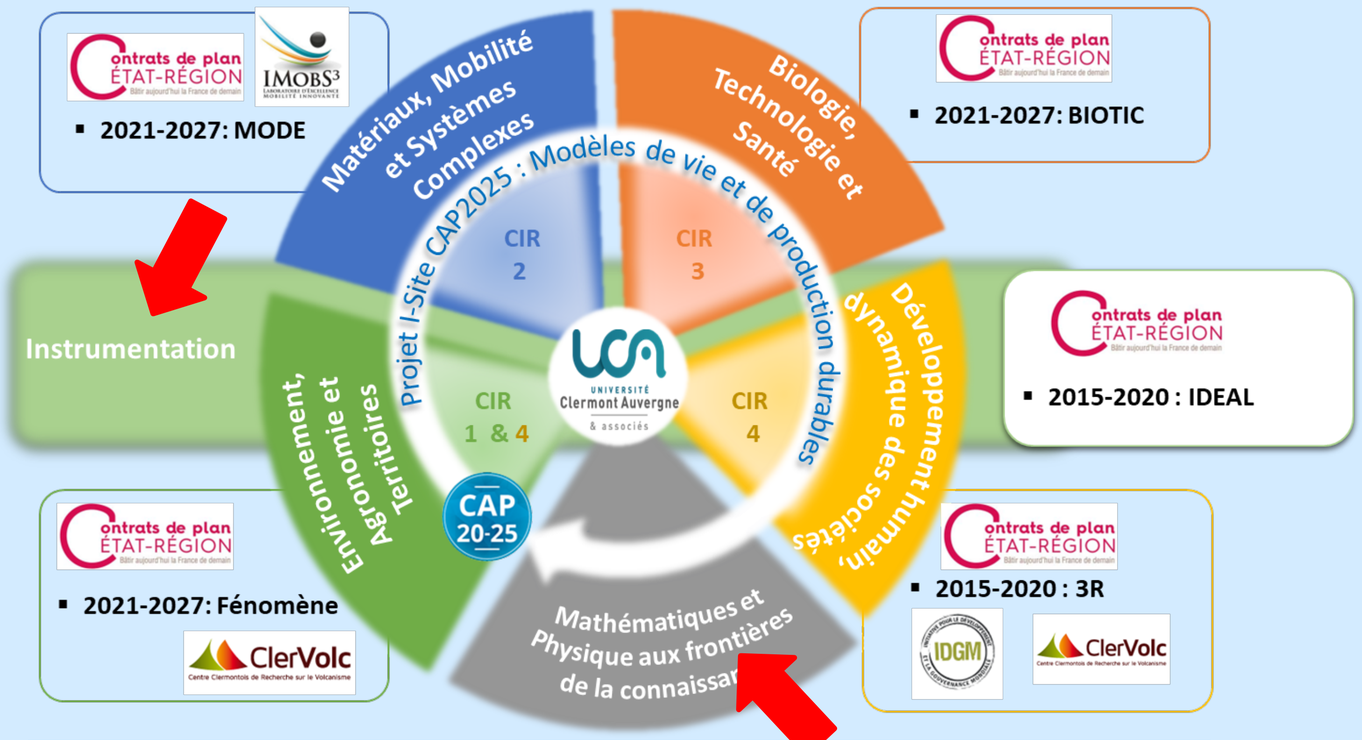
Instances et resp. pédagogiques

Master Physique Fondamentale et Applications

Master Ingénierie Nucléaire (PTR-IPM)

International (Erasmus Mundus)

DU Data Scientist



Contrats de plan ÉTAT-RÉGION

BIOTIC : Santé & Innovation thérapeutique
FENOMENES : Agriculture et environnement
MODE : Mobilité durable
3R : Risques, ruptures, résiliences SHS
IDEAL : Big data & Numérique

CAP 20-25

CIR 1 : Les agrosystèmes durables dans un contexte de changement global
CIR 2 : Systèmes et services innovants pour les transports et la production
CIR 3 : La mobilité personnalisée comme facteur-clé de la santé
CIR 4 : Risques naturels catastrophiques et vulnérabilité socio-économique
AXE transverse : Ressourcements scientifiques et instrumentaux

Copil DD UCA

Projet ILE Médiation scientifique en milieu scolaire

Le LPCA et les Observatoires de l'Eau

Soutiens institutionnels

Cadre collaboratif

Partenaires non-académiques

SAGE Allier Aval

EAU Grand Sud-Ouest

Collecte-Transmission-Gestion des données









L'Observatoire de l'anthropocène

Lien

Gestion de la ressource Eau Dordogne - Allier



Lien

Zone Atelier des Territoires Uranifères Sources minérales



Lien

Observatoire du bassin versant de la Veyre (63)



Lien

Prolifération des cyanobactéries dans les lacs



Lien

Suivi des services écosystémiques de la rivière



Lien

Summary: Welcome & Enjoy!





I wish you to enjoy the pleasure of doing science:

- in a vibrant international crew (even locally!)
- in a beautiful lab
- on a beautiful campus
- in a beautiful region

and hope these beauties will help your career taking off and shining bright!

National and local position