



LPSC  
Laboratoire de Physique  
Subatomique & Cosmologie

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# General Overview

## Tutelles du laboratoire

Unité mixte de recherche UMR 5821

CNRS : IN2P3 + INSU & INSIS

Grenoble-Alpes University: UJF & Grenoble INP

## Human resources

Total of 210 people + ~50 academic training students / year

66 permanent staff (38 CNRS, 28 EC : 19 UJF + 9 INP)

89 Engineers/Technicians/Administrative staff (84 CNRS + 5 UJF)

~33 PhD students, 13 postdoc's, 5 CDD ITA/BIATS

## Patrimoine et infrastructure

UJF site

20,000 m<sup>2</sup> (9 buildings)

Facility and research infrastructures

Mounting halls, installations for accélérateurs/ion sources production

Technological Plateformes (Laboratoire de basse activité, Tier-2 Grid,  
plateformes expérimentales subatomique et PEREN  
plateforme IA3P)

# LPSC : an overview



# Local and national synergies

## Institut National de Physique Nucléaire & Particules (IN2P3) -- CNRS

Research fields in nuclear physics, particle and astroparticle physics

Coordination by the CNRS, partenariat with CEA/IRFU

Coordination of 20 laboratories

Participation to large infrastructure program

Grands Equipements/Expériences/Collaborations

## Local and regional synergies

University Grenoble-Alpes (UGA) with CNRS &GI

Pôle IN2P3-INSU (OSUG, LPSC, LAPP, LSM, LAPTh)

Physique des Origines et des 2 infinis

Labex ENIGMASS (LAPP, LAPTh, LSM)

Labex FOCUS (IPAG, Neel, IRAM) + ANR (NIKA)

Interdisciplinary (théory, medical physics, energy)

Centre de Théorie en Physique de Grenoble (LAPTh, Lyon..)

Labex PRIMES (France, CHU), ANR AAP Cancer

Carnot Energie: sels fondus (GEN-IV, SIMAP), Matériaux (Neel, LETI..), Plasmas

Grid for computing (EGEI et CIMENT)

Equipex BEDOFIH (EUROFIDAI, IdG, LPSC...)

Scientific Instrumentation collaborations with ILL, LNCMI, INAC, Neel, IPAG...

# Teaching and Accademic training

## Physics Fields at the LPSC

Nuclear, particle and astroparticle physics; nuclear energy, accelerators, ions sources, plasma

- Experimental Techniques : L2, L3 et M2R & M2Pro
- Data analysis : L3, M2R & M2Pro
- Theoretical physics : L3, M2R
- Interdisciplinary : radio-protection, application to medical science

## Teaching and accademic training

Master endorsed at the LPSC

- Subatomic Physics, Astro-particle & cosmology, accelerators & ion sources
- Nuclear Engineering and Energetic (école PHELMA)
- Engineering, traçabilité et Développement durable (UJF, Master)
- Medical applications & radioprotection (Master Physique Médicale)
- EEATS (Electronics, Electrotechnics and plasma)

Accademic training Plateformes on site at the LPSC

- UJF/INPG: 500 students/year (Master & engineers 2/3 year)
- Plateforme PLATINE for nuclear and subatomic physics
- Plateforme SIREP (Simulation of REP reactor)

European Schools in Archamps (CERN) : JUAS (accelerator), ESIPAP (instrumentation)

# Technological Plateformes

## Computing Grid (LCG, CIMENT, Institut des grilles)

Projects LHC : Tier-2 (ATLAS, ALICE), biomed, ILC, grille Rhone-Alpes  
Performance: 95 servers, 780 To storage, connected to 10 Gb/s network

## Plateforme PEREN (Etude & Recherche sur l'Energie Nucléaire)

Molten salts: boucle FFER (operated at 600 deg. in August for the first time !!)  
Neutronics: Générateur de Neutrons pulsés accelerator (GENEPI-2)

## Plateforme IA3P (Procédés et Plasma Avancés)

Reactors for plasma multi-dipolar (pulvérisation deposition), reactors plasma (gravure Si, Ge, Sn..)  
Reactor DECR6 (Implantation of ions using plasma)  
Academic training platform for UJF/INP, test benches (~50 students/year)

## Beam lines & equipment for ion sources & accelerators

Clean room installations & test benches (coupleurs ...)  
6 lines of electrostatic accelerator beams (at different energies)

## Laboratoire de Basse Activité

Member of IN2P3 Becquerel Network  
Measurement of radioactivité for industrials



# Axis 1 : from particles to nuclei

## Experiments at the LHC: ATLAS & ALICE (CERN)

*Search for new physics, top quark physics*

*Characterization of quark-gluon plasma, jet quenching, Gamma-hadron*

## Futur Collider e+e-

*Precision measurement in top quark physics*

*R&D calorimetry within CALICE collaboration, ADC developments (old)*



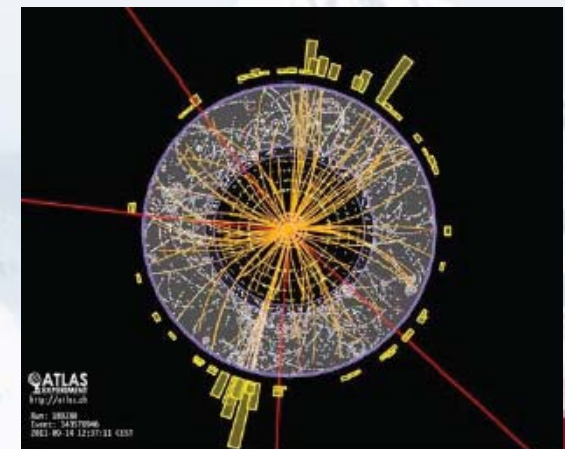
## Nuclear Structure @ ILL, GANIL

*Physics of heavy and deformed nuclei*

## Ultra-cold neutrons @ ILL (Grenoble) & PSI (Switzerland)

*Dipolar moment of the neutrons (nEDM)*

*Determination of quantum states in gravitational field (ILL)*



## Theoretical Physics

*Supersymmetry, Higgs boson, (nuclear, particle) pdf, Dark Matter*

# Axis 2: astroparticle, cosmology, neutrinos

## Group DARK (AMS-CREAM-LSST)

*High energy Cosmic rays, antimatter search, dark matter, dark energy*

Balloon experiment (CREAM), Spatial Station experiments (AMS, ISS-CREAM)

LSST Telescope

## Group PLANCK-NIKA

*Physics of cosmic microwave background @ 2.73K, cosmology, structure of early universe*

Experiments PLANCK, IRAM telescope with l'IRAM

## Group AUGER

*Ultra High energy cosmic rays, Radio signal in the MHz-GHz band*

*Composition of RC*

Observatoire Pierre Auger (detection array of 1600 km<sup>2</sup>)

## Group Dark Matter MIMAC

*Direct directional Détection of Dark Matter*

R&D, Prototype detector at the Laboratoire Souterrain de Modane

## Group Neutrinos

*Search for sterile neutrinos @ ILL*

Stereo experiment at ILL (for 3 years)





# Axis 3 : activities towards society

## Group: Reactor Physics

Interdisciplinary framework in CNRS & beyond (CEA, IRSN EDF, ...)

"Transmutation" : Accelerator Driven System, Guinevere

→ Contributions to Myrrha program (accélérateur, physics)

"Solid combustible", Thorium cycle:

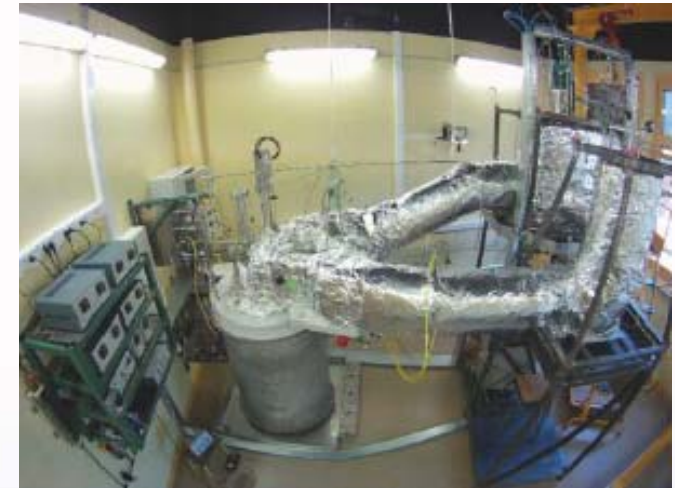
→ Scénarios, Thorium cycle in present reactor parks

"4<sup>th</sup> generation reactors" : Molten salt, Thorium cycle

→ Modelisation, neutronics-thermo-hydraulic couplings

Transverse Experimental axis: nuclear data, FFFER Molten salt

→ Measurement of input nuclear data @ FIPPS (ILL), scientific exploitation of FFFER



## Group: Application to Medical Physics DAME

Beam profiler for application in radiotherapy-X, irradiation/use of metallic nanoparticles

Beam profiler : tight collaboration with CHU (grenoble) and ESRF

→ Validation at DOSEO (IRFU) then valorisation (2 brevets déjà)

Nanoparticules: dosimétrie, imaging, therapy

→ Development with IN2P3, MI2B and locally (ESRF, INSERM, CHU, Labex PRIMES)

# Axis 4 : accelerator, ion sources, plasma

## Accelerators & ion sources

Accelerators for ADS, ion sources, ECR, charge boosters

Ion Sources (PHOENIX) for Spiral-2

Booster of charges

ECR 60 GHz sources

Pulsed Neutron Generator for ADS (GENEPI-3C, Guinevere, SCK Mol Belgium)

Power Couplers for Spiral-2

Low Energy Beam Line for Spiral 2

## Pôle plasma & materials

Cold Plasmas, Plasma reactor (2.45 GHz, 350 MHz), applications, deposition ...

Microwave Plasma and applications, interaction plasma-surface,  
layer depositions for selected species, etc...

Materials for energy (hydrogen H- for Iter...)

## Key fields for valorisation

Several patents in both fields

Creation of a start-up at the LPSC in 2014

(application of ion sources)

