



# Institut national de physique nucléaire et de physique des particules



Sonder les infinis : des particules au cosmos

IN2P3, and HEP research in France

*Ursula Bassler*

# IN2P3 : a national institute

MISSION : COORDINATE RESEARCH IN THE  
FIELDS OF **NUCLEAR, PARTICLE** and  
**ASTROPARTICLE PHYSICS**

## COORDINATE

National Research  
Programs and French  
participations in major  
Research  
Infrastructures

## OPERATE

Research Units,  
many in partnership  
with Universities  
and/or Research  
Organisations

## EXPLORE

The Physics of the *two  
infinities*: from  
elementary particles to  
cosmology

## DEVELOP

Associated technologies,  
Applications and  
Interdisciplinary research

**PROVIDE** Expertise  
Teaching Training

# HEP research landscape in France

**IN2P3** overarching institution to coordinate research activities for:

- **CNRS** : national centre for scientific research
  - Basic and applied research: 10 institutes: humanities and social sciences, **mathematics**, chemistry, biology, engineering, environment, computing physics, **astro- and geophysics**, **nuclear and particle physics**
  - 1100 laboratories, 95% joint with Universities or RO
  - 33000 personnel/29000 scientists
  - 3,8 Md € annual budget
- **Universities in HEP**: Aix-Marseille, Bordeaux, Caen, Clermont, Grenoble Alpes, Lyon, Nantes, Montpellier, Paris-Sorbonne, Paris-Cité, Paris-Saclay, Savoie-Mont Blanc, Strasbourg, Toulouse
- **Engineering Schools in HEP**: Polytechnique, IMT Atlantique, ENSI Caen

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**CEA** : atomic and alternative energies commission

research and technology (nuclear power, defense, technology oriented research, fundamental research in physics, chemistry and biology)

- 9 research centres in France (Saclay, Cadarache...)
- 21 000 personnel, 5,5 Md € annual budget
- **Irfu** laboratory in Saclay dedicated to HEP, nuclear and astrophysics
  - ≈700 scientists, engineers and technicians



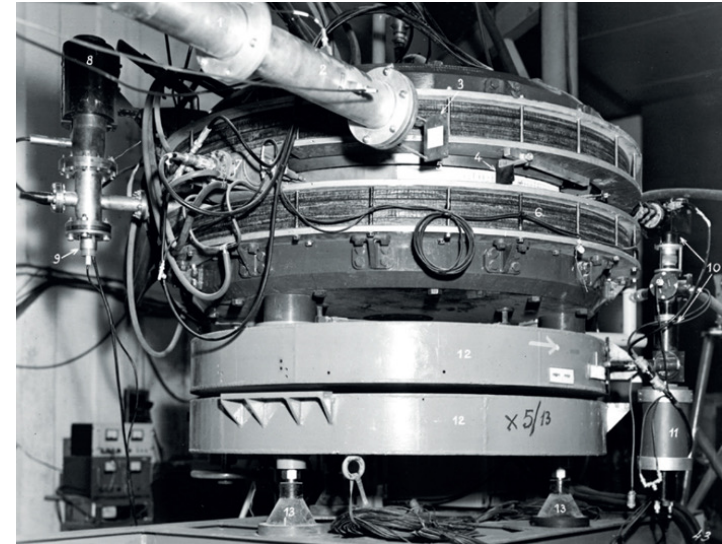
# IN2P3 history

Created in 1971 to structure the research in French laboratories in nuclear and HE physics

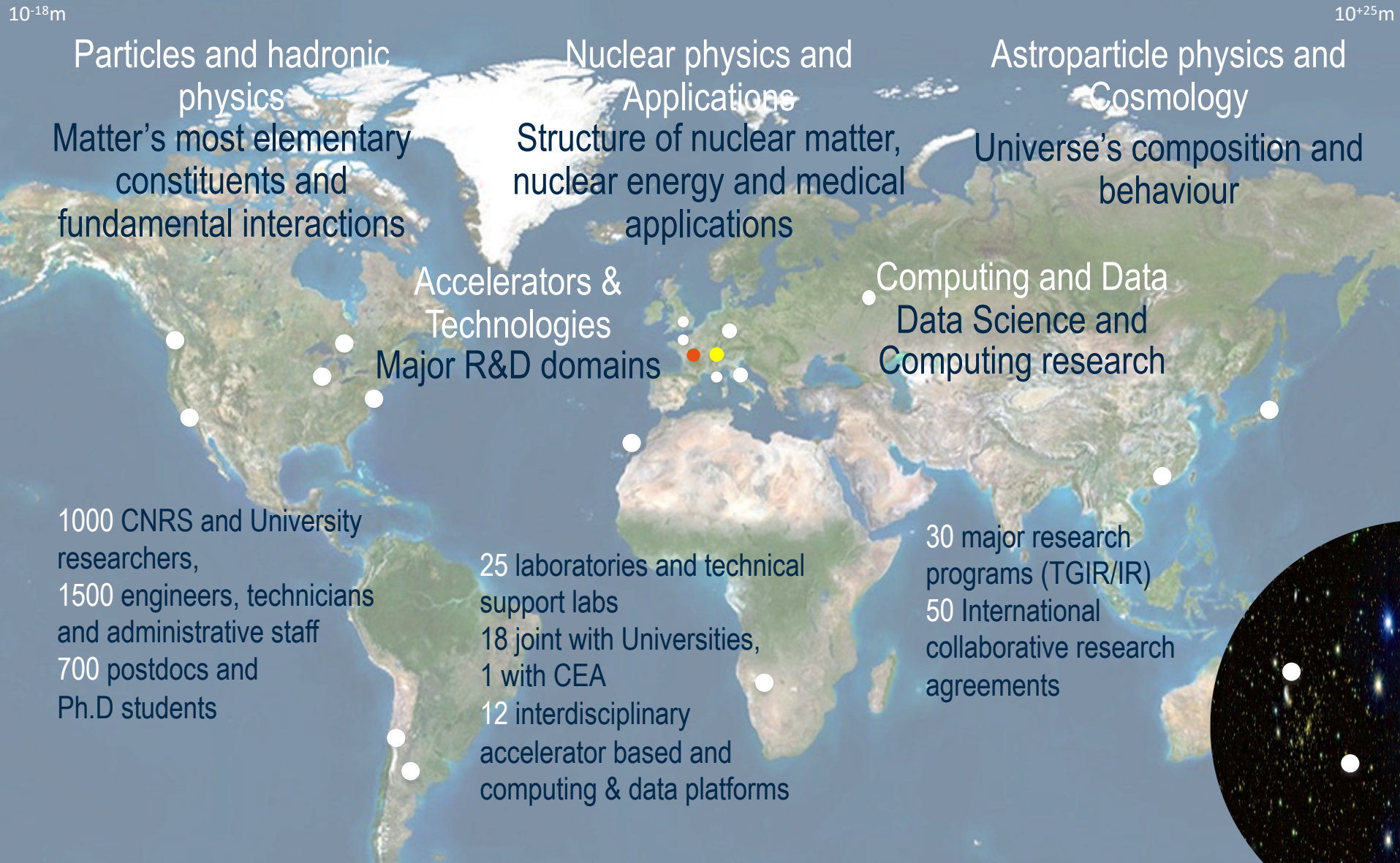
→ Similar structure than INFN in Italy, created in 1951

→ Installations grew in size and budget and required national coordination for nearly 10 laboratories

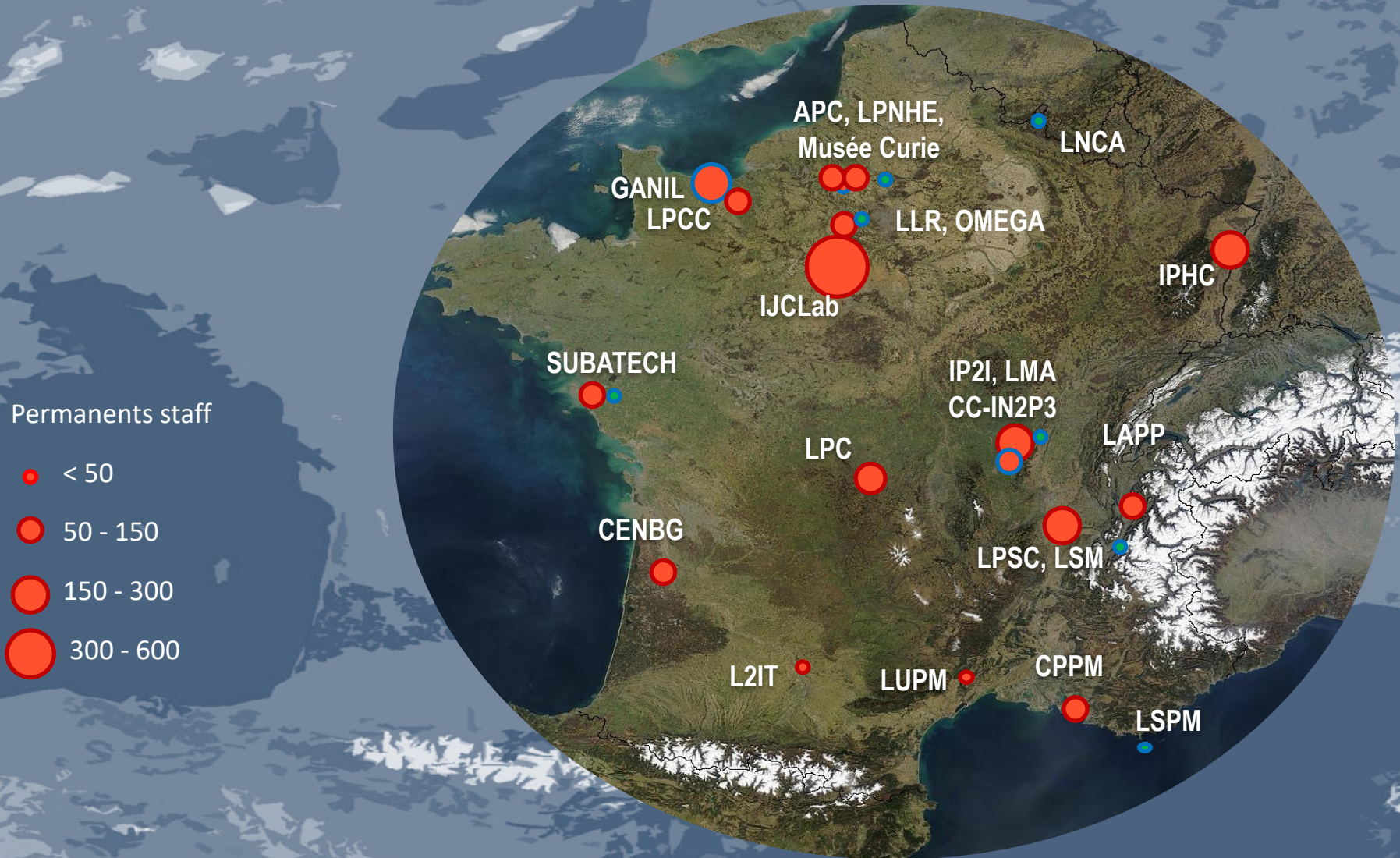
→ Decisions on national infrastructures and participation in international projects (CERN, DESY, GANIL)



# IN2P3 : 5 Major Research Areas - 25 Research Units



# Labs and Research Infrastructures in France



# International Research Infrastructures and Labs

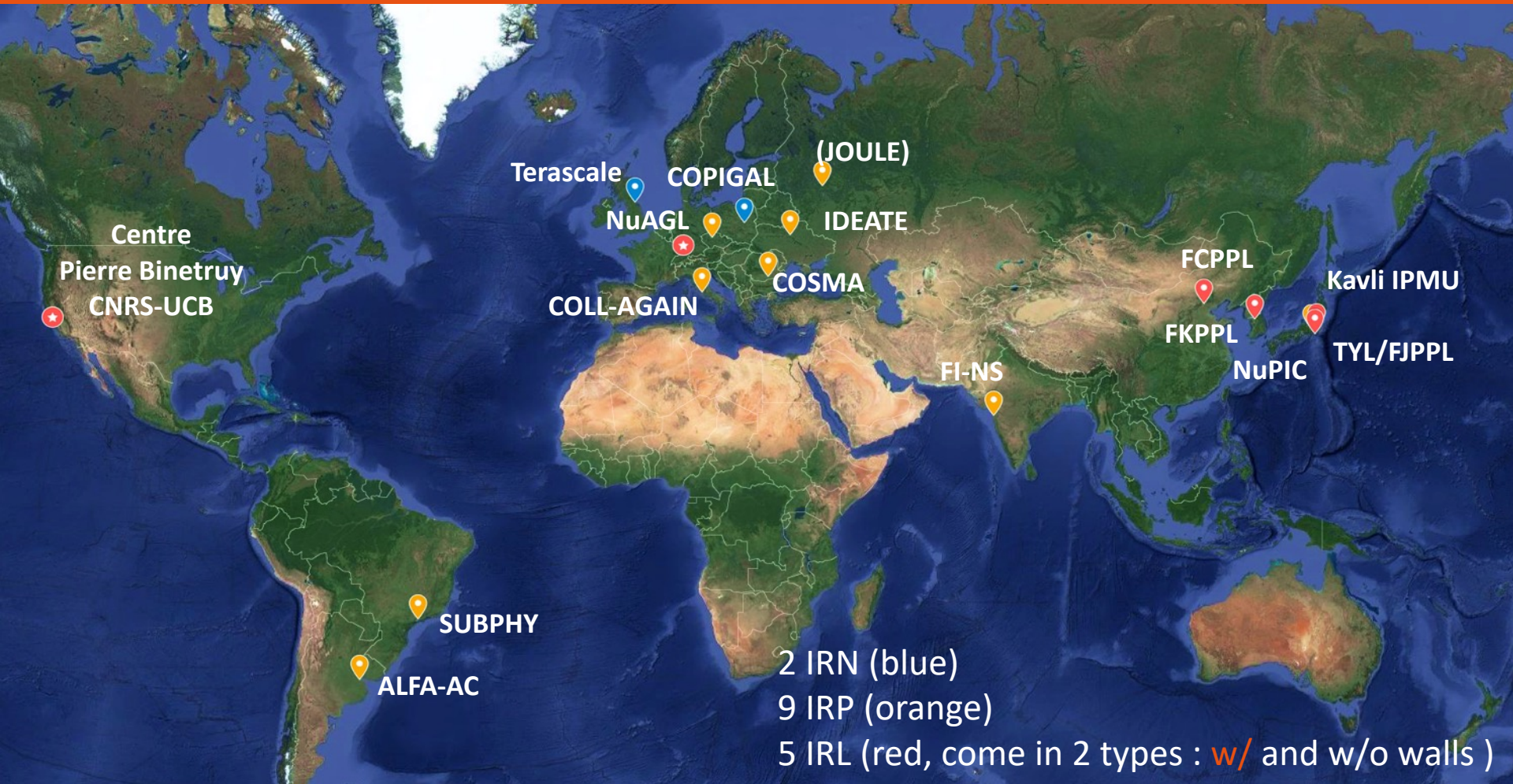


# European Research Infrastructures and Labs





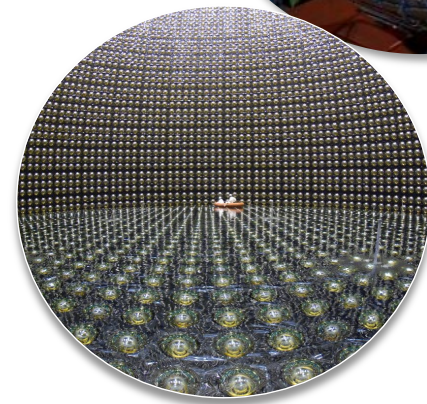
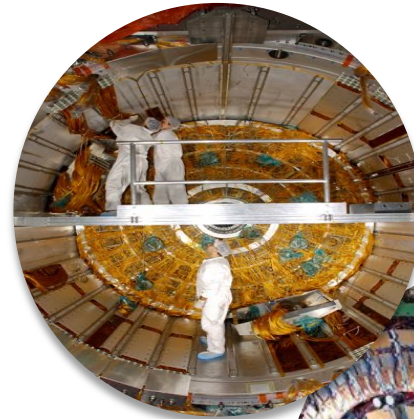
# CNRS International Research Agreements : IRN, IRP, IRL\*



IN2P3 is leading 2 International Research Networks (IRN), 9 International Research Projects (IRP) and 5 International Research Laboratories (formely LIA) : FCPPL, FKPPL, TYL/FJPPL, APC-KIPMU, and CPB (CNRS-UCBerkeley) + 3 in preparation (Helmholtz, Univ Tokyo, CAS)

# Particle and hadronic physics

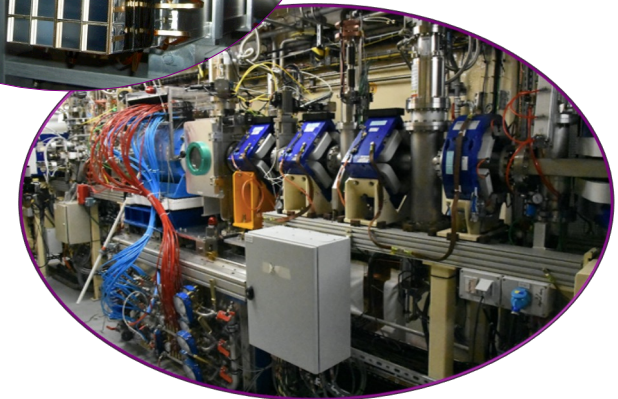
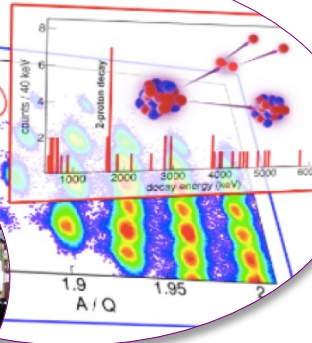
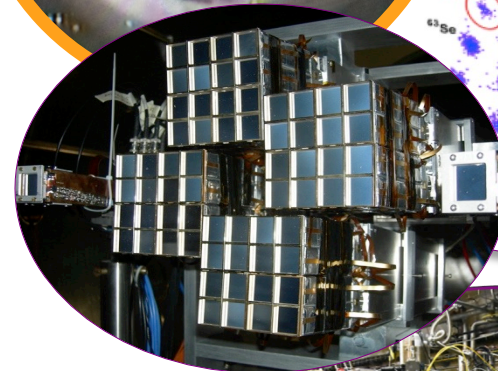
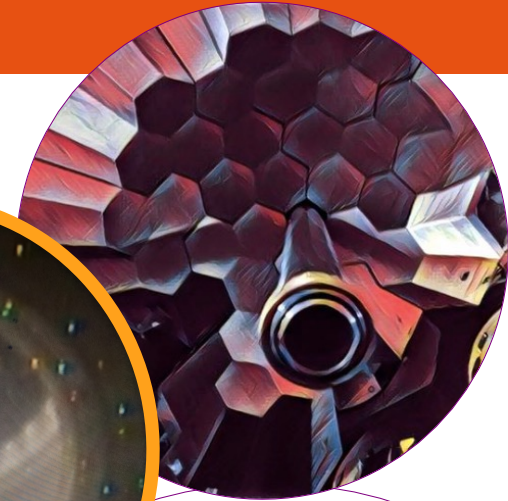
- Participation in all 4 major LHC experiments at CERN :
  - Physics at and beyond the standard model
  - B-physics and fundamental symmetries
  - Heavy-Ion physics
- Participation in precision physics experiments  
nEDM (PSI), Comet (J-PARC), Gbar/Aegis (CERN), ...
- Accelerator based neutrino physics
  - T2K/SK-HK, DUNE (ProtoDUNE at CERN)
- B physics at KEK (Belle-II )
- Structure of the nucleon (Jlab, EIC)



# Nuclear physics and Applications

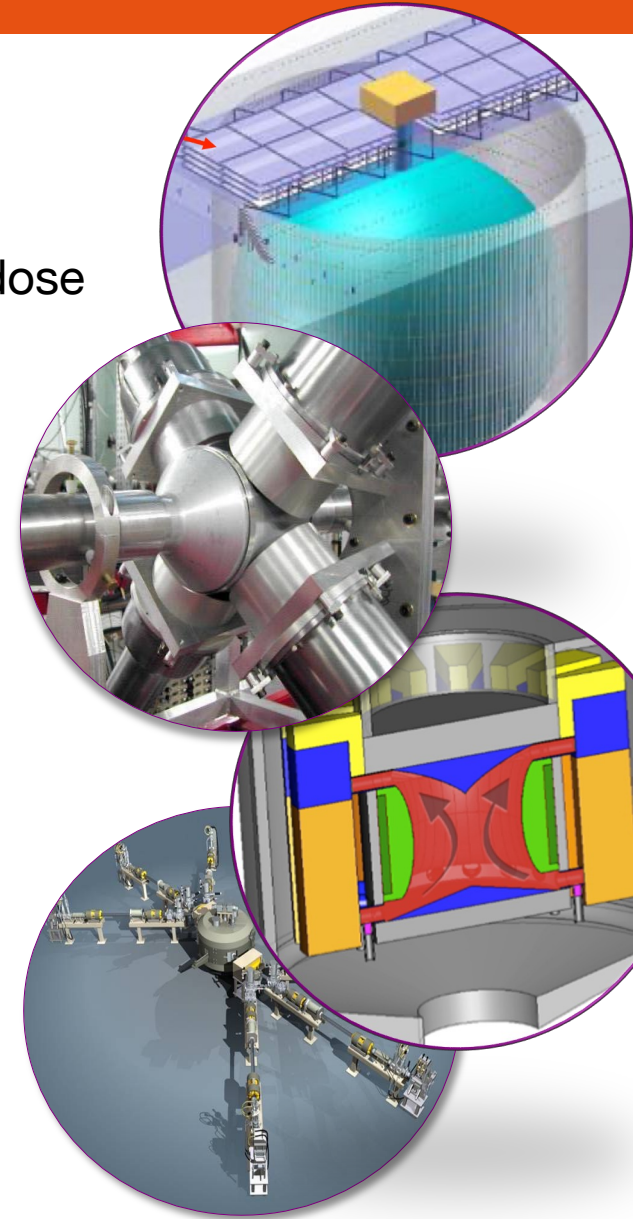
## Nuclear physics and astrophysics

- Structure of exotic nuclei (AGATA@GANIL, ISOLDE Riken)
- New modes of radioactivity (ACTAR-TPC@GANIL, Riken)
- SHE structure and production (GARIS@ Riken)
- EOS of nuclear matter (neutron-star collapse, FAZIA)



# Nuclear physics and Applications

- **Reactor based neutrino physics**  
Stereo, Solid, JUNO - R&D activities
- **Health and life-science applications** Hadrontherapy, dose control, radioisotope production, imaging technics, simulations
- **Nuclear Energy**  
Modelisation of reactors and scenarios  
Experimental reactor physics (ADS)  
Nuclear data  
Material irradiation  
Radioisotopes in material and environment



# Astroparticle physics and Cosmology

Understanding the history of the Universe, Inflation Dark Energy

- LSST, DESI, EUCLID, QUBIC

Search for Dark matter

- EDELWEISS, XENON

Gravitational Waves

- VIRGO, LISA

→ Mirror production for all interferometers!

Gamma-astronomy

- FERMI, HESS and CTA

Studying Cosmic Rays

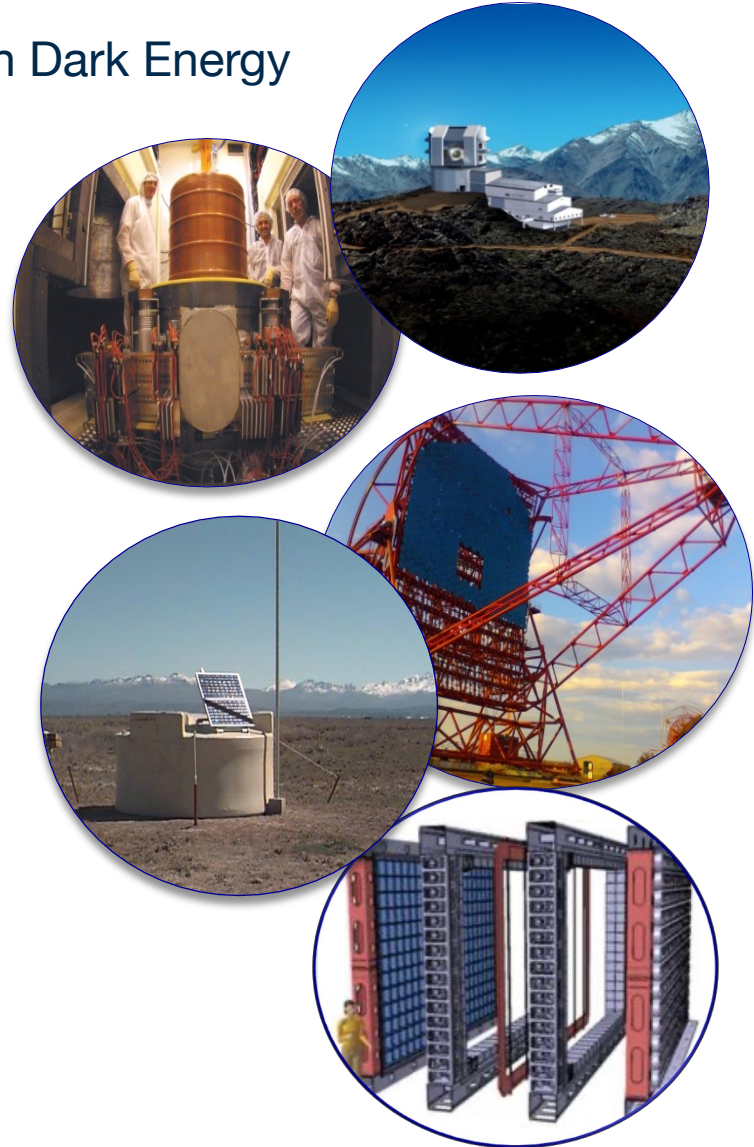
- Pierre Auger Observatory, AMS

Cosmic neutrinos

- ANTARES, KM3NET

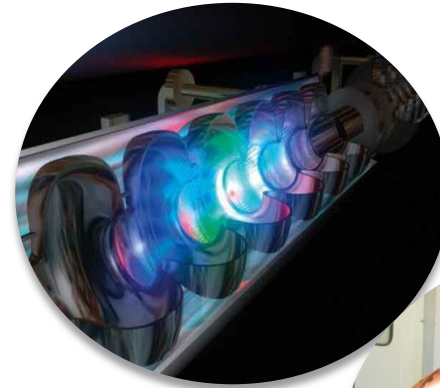
Low background double beta decay experiments

- SuperNEMO, Lumineu, DAMIC, ...



# Accelerators and Technologies

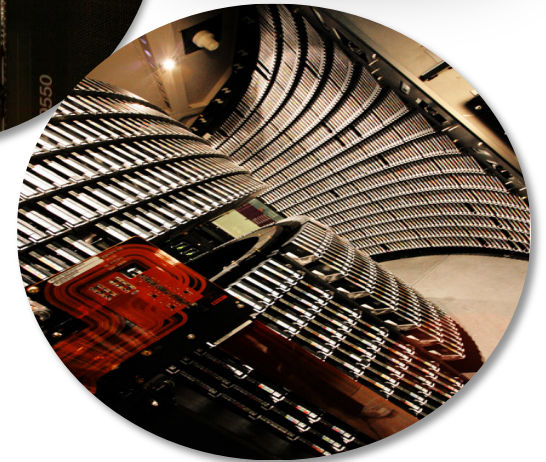
- Development of superconducting cavities and cryotechnology
- Ion and electron sources
- Beam targets for radioactive beams
- Beam dynamics
- Laser/accelerator synergies
- Detector developments : Si-detectors, photo-detectors, gaseous detectors, calorimeters, bolometers, ...
- Micro-electronics



# Computing and Data

## CC-IN2P3 in Lyon:

- National Datacenter
- Tier 1 for WLCG, but also computing for 70 other projects
- Major challenge to come:  
HL-LHC, LSST, Euclid and CTA
- France Grille: distributed grid and cloud computing over 9 regional site
- Participation in EOSC → collaborative project with CNRS's HPC Center IDRIS
- Software developments: machine learning, IA....



# Opportunities in HEP in France

≈ 200 doctoral or post-doctoral positions in IN2P3 laboratories through various funding sources

≈ 10 CNRS permanent positions, mostly CRCN (researchers)

profile : 2-5 years after PhD

competition on national level opening in December:

<https://www.dgdr.cnrs.fr/drhchercheurs/concoursch/default-en.htm>

+ positions for engineers and technicians (electronics, mechanics, instrumentation, computing)

<https://emploi.cnrs.fr>

≈5 assistant professor and professor positions @ French Universities

(prior qualification necessary)

<https://www.galaxie.enseignementsup-recherche.gouv.fr/ensup/candidats.html>

≈ 5 tenure track positions at CNRS or Universities

<https://www.cnrs.fr/en/cnrsinfo/join-cnrs-25-tenure-track-positions-available>

[https://www.galaxie.enseignementsup-recherche.gouv.fr/ensup/cand\\_CPJ.htm](https://www.galaxie.enseignementsup-recherche.gouv.fr/ensup/cand_CPJ.htm)

+ positions at CEA/Irfu (≈1-2 physicists + engineers and technicians):

<https://irfu.cea.fr/en/index.php>





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Thank you for your attention