

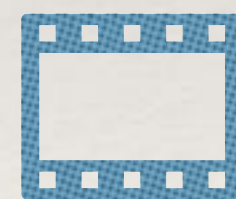
1ère journée prospectives IP2I 2022 - retour sur les prospectives IN2P3
30 Juin 2022

GT02

Physique et Astrophysique Nucléaire

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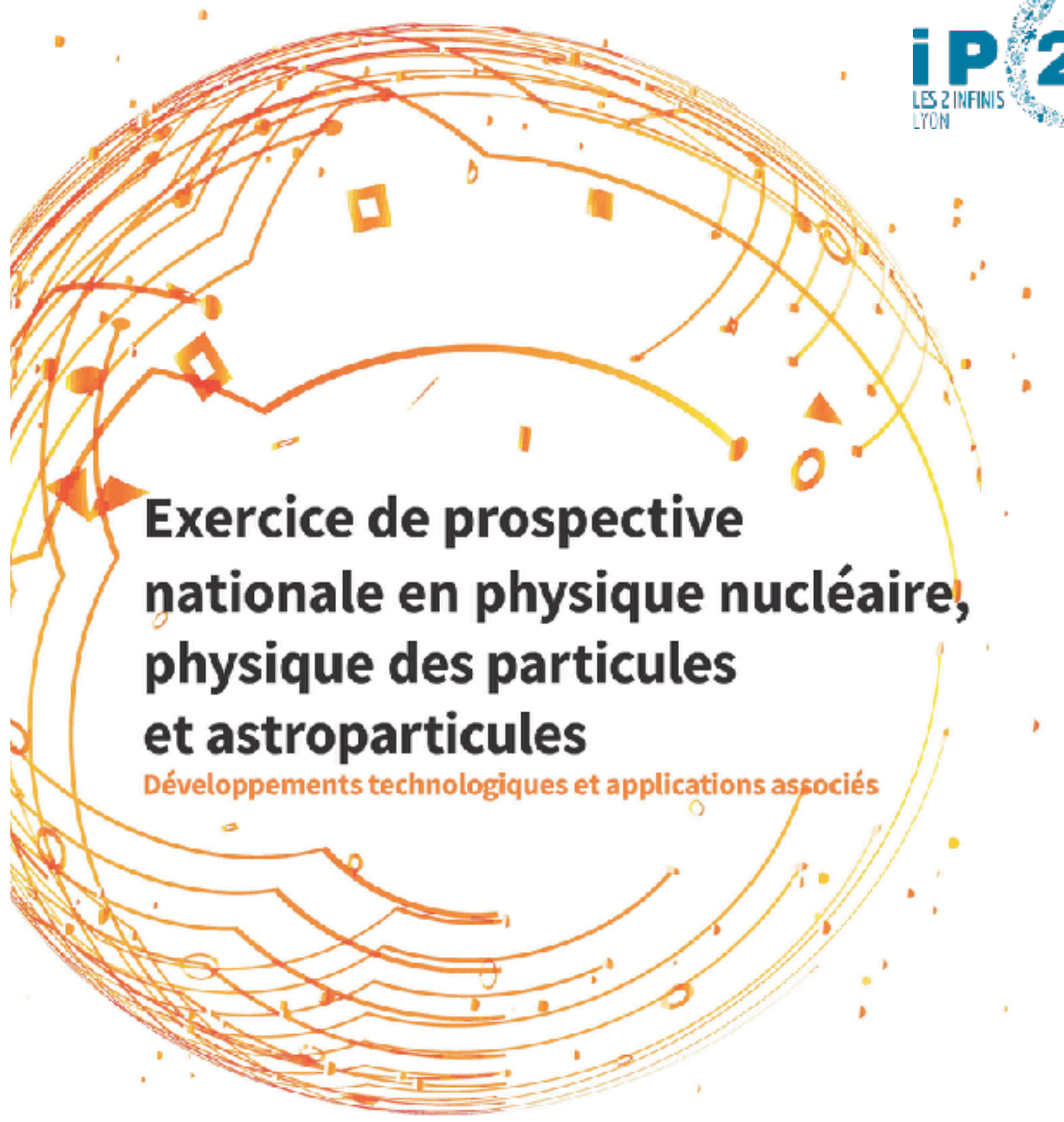

Présentation au colloque de restitution



Discussions
Questions




Rapport du Groupe de Travail 02



Exercice de prospective nationale en physique nucléaire, physique des particules et astroparticules
Développements technologiques et applications associés

L'IN2P3 organise et conduit, en y associant les organismes et acteurs concernés, un exercice de prospective nationale dans ses domaines de compétence: physique nucléaire, physique des particules et astroparticules, ainsi que les développements technologiques et applications associés.

Pour plus d'informations:
<https://prospectives2020.in2p3.fr>



Contexte ... très simplifié !!

International

Race for Exotic Nuclei production
@ large scale facilities

Star Merger as new site
in galactic chemical evolution

Advanced arrays such as AGATA or GRIT
Sophisticated Beyond Mean field models - advanced shell model

National

Démarrage de GANIL Spiral2

+ Many new detectors : GRIT / ACTAR-TPC / PARIS / FAZIA ...

ALTO @ Orsay

Drivers et Recommandations du GT02

SD1: How do nuclear systems evolve far from stability and in extreme conditions? 

SD2: How does nuclear physics allow a better understanding of the Universe? 

SD3: How does nuclear physics contribute to the understanding of the Standard Model?

SD1.1: Understand and predict the evolution of shells, the competition between single-particle properties and collective behaviour.

SD1.2: Explore the properties of nuclear states near particle thresholds and drip line phenomena

SD1.3: Explore the nuclear behaviours at extreme angular momentum

SD 1.4: Understand the nuclear structure towards super-heavy elements

SD 1.5: Enlarge systematics for the comprehension of fission process

SD2.1 Nuclear reactions for astrophysics 

SD2.2 Exploration of the phase diagram around saturation density through nuclear collisions.

SD2.3 Understanding compact stars and matter under extreme conditions from observations.

Plusieurs Theoretical (TM) and Experimental (EM) méthodes déclinées pour réaliser ces avancées

EM1: Spectroscopy of fundamental properties of nuclei

EM1.1: State-of-the-art electromagnetic traps

EM1.2: SHE spectroscopy

EM2: Reaction spectroscopy

EM2.1 High resolution in-beam spectroscopy and direct reaction spectroscopy

EM2.2 Fission

EM2.3: Heavy-ion collisions

EM3: Electron scattering

TM1. Developments in EDF 




TM2. Developments in shell model

TM3. Merging nuclear structure and reaction

TM4. HPC based on new technologies (AI and QC)

Recommandations classées suivant trois grands 'thèmes'

Develop the national facilities for nuclear physics

1. S3 spectrometer,
2. S3-LEB (including fast gas-cell)
3. DESIR hall and equipment
4. New injector $A/Q=7$ 
5. Dedicated fission-fragment driver at GANIL
6. Increase the capabilities of the national facilities
 - a. Increase beam time at ALTO and GANIL
 - b. Increase variety of S1 beam 
7. Increase the target developments capabilities (standard, actinide and cryogenic) 
8. Engage the long-term future of GANIL
 - a. Development of in-beam studies capabilities (post-acceleration, rings...)
 - b. Studies towards an e-RI collider

Develop high-resolution spectroscopic tools in international collaboration framework:

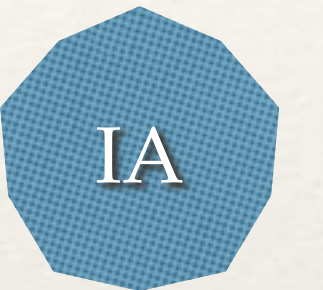
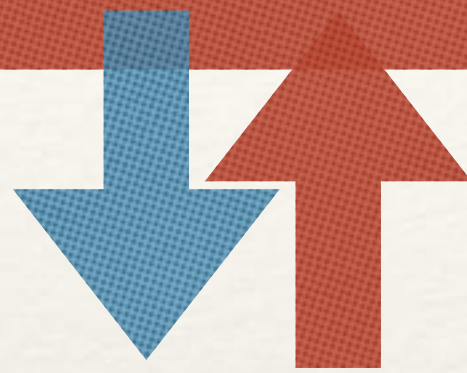
9. AGATA 
10. GRIT

Re-inforce nuclear theory

11. Support more strongly the theory activities
 - a. Maintain a fair support of the groups, and fellowships.
 - b. Support ambitious theory master projects for national collaborations towards nuclear experiments and towards astrophysics
 - c. Encourage the use of HPC and new technologies for global modelling (developing the interface between physicists and computer engineers), as well as scientific emulation through national GDR and European networks.

Projets et Timeline @ IP2I

Théorie

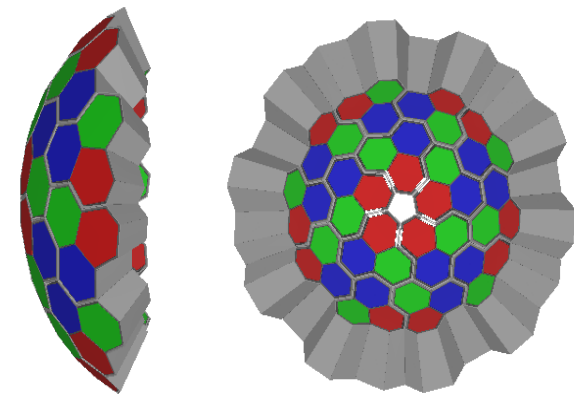


Tracking gamma, Germanium segmenté

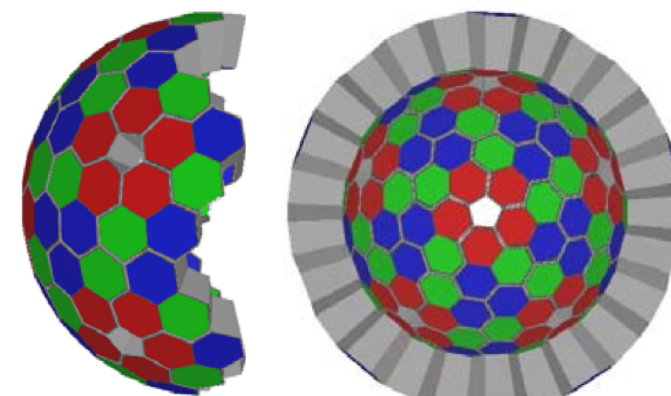
New MoU ... Nomade ... upgrade continue + production ... engagement fort laboratoire (Software production)



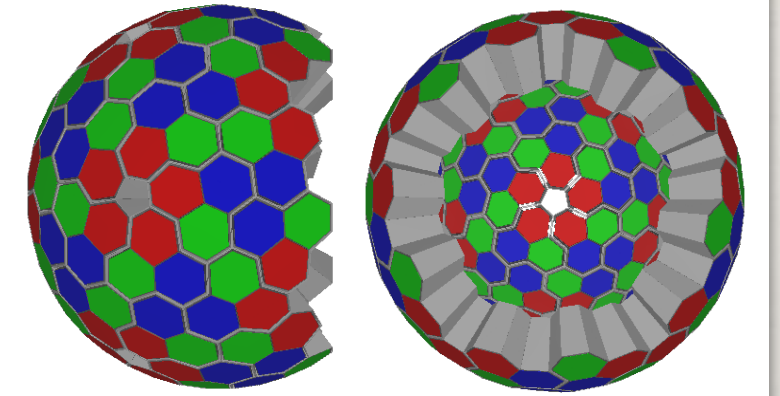
4PI/3
60 Ge
20 TC



2PI
90 Ge
30 TC



3PI
135 Ge
45 TC



Stable beams & accelerated ISOL beams

LNL 2022-2025

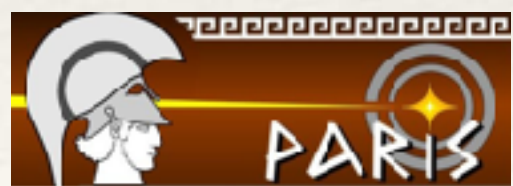
Radioactive ion beams
(projectile fragmentation & fission)

FAIR/ISOLDE
2026-2028

Stable beams & accelerated ISOL beams

JYFL/GANIL 2029-2030 ?

INFRATECH IMATRA (large R&D program) ?



Calorimètre gamma, phoswich LaBr3/NaI ... New MoU ... Nomade ... début phase production ...

Un des détecteurs pour notre programme astro p-process @ SPIRAL2-NFS

Collaboration LGL : p-process & micrométéorites

Questions / Discussions

Questions / Discussions

QC?

IA?

HPC

Théorie

Théorie

Structure

ML

Théorie

Astro

...

R&D

Cibles ?

LGL

GW