Physique nucléaire et science ouverte

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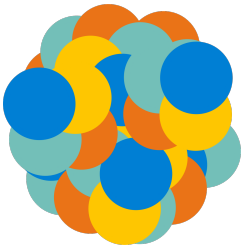
Normandie Université

Nuclear physics 101

Structure



N neutrons + Z protons

- masses, level, spin
- shape, decay ...

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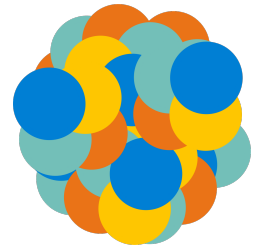

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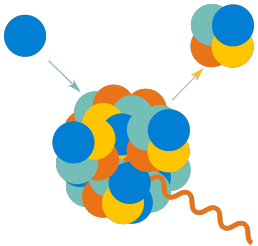
Probe + Nuclei at Energy E:

- predict all final states
- predict C.S. for each one



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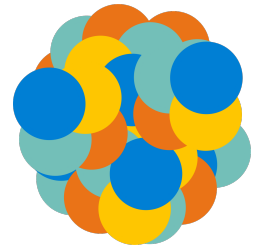

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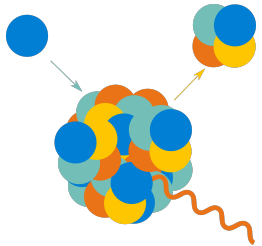
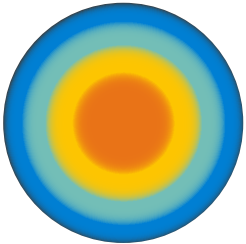


Equation of State (EOS)



Temperature & Density

- Phase transition
- Symmetric vs Asymmetric ...

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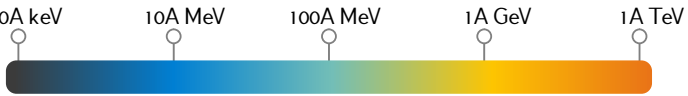

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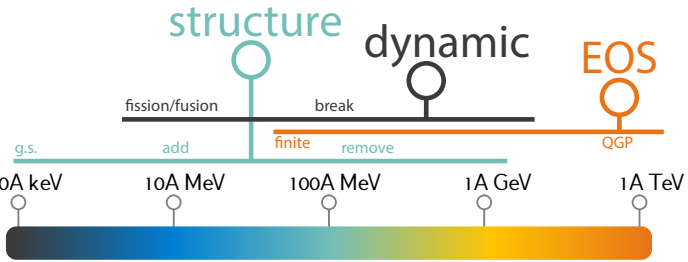

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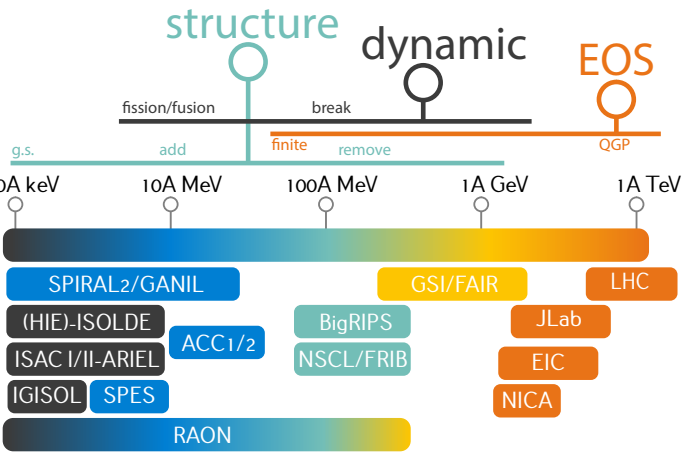

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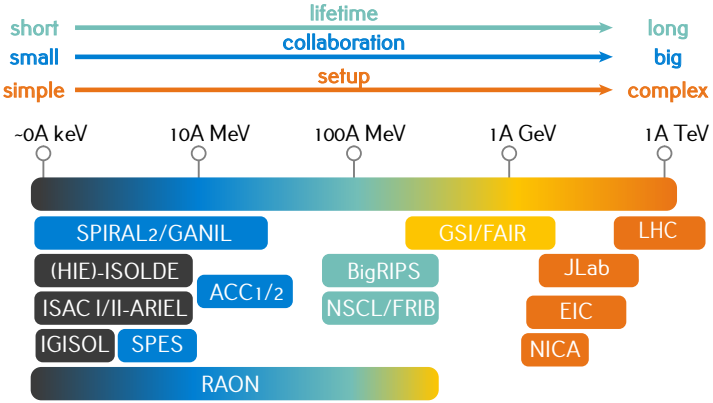


State of Open Science culture

General context:

- ✓ Sub-communities are enthusiast about Open Science
- ✓ Nuclear physics is a diverse discipline
  - → Multi-scale problematic: short vs long, big vs small, simple vs complex
  - → Many sub-communities with different needs & cultures

Early in the life cycle:

- ✓ Open collaborations, with resource sharing (detector system, beam production, technical know-how)

Late in the life cycle:

- ✓ Most publication are open access
- ✓ Results repositories exist and are working (e.g. EXFOR, NNDC, AME,...)
  - ✓ Open access
  - ✓ Essential part of reviewing process → pushing accuracy
  - ✗ Not open submission and therefore slow

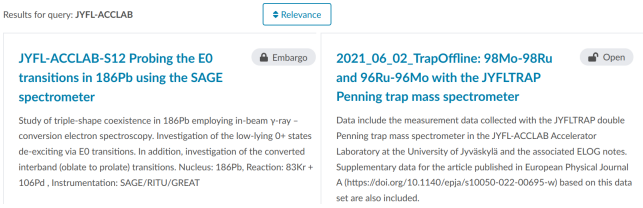
In between:

- ✗ No standard practices, collaboration at various level of readiness

Examples at the extremes : Data and Results catalogues

Raw-data catalogue : ETSIN (Finland)

- ✓ Finnish FAIR data portal
- ✓ Permission Management
- ✗ Include software as snapshot archive
- ✗ All field but Finland only



Refined-data catalogue : NNDC (Brookhaven)

- ✓ Comprehensive portal to repositories
- ✓ Mostly US and AIEA drived
- ✓ Slow update of data
- ✗ Little software integration
  - → TkN-Lib (LPC Caen - IP2I Lyon)

Open source software framework

Kaliveda (2002-present): indra.in2p3.fr/kaliveda

- Indra-Fazia community
- Specific scope but allow analysis as a service and support re-analysis of old data-set

FairRoot (2006-present): fairroot.gsi.de

- Design for large computing infrastructure
- Very suitable for large scale experiment (CBM, R3B,...)

nptool (2009-present): nptool.org

- Very suitable for small scale heterogeneous experiments (GANIL,ISAC,ISOLDE,RIBF,FRIB,...)
- V4 designed to solve some of open science challenges: workflow, logging, archiving, and more

AGAPRO (2010-present): agata.org

- Specific tool kit for AGATA collaboration: DAQ, Analysis, ...
- Allow running of AGATA on multiple infrastructure (travelling detector LNL/GSI/GANIL)

Analysis as a service: Indra-Fazia collaboration

Pros

- ✓ Software environment
- ✓ Efficient use of computing power at CC-IN2P3
- ✓ Data-set DB with interactive selection tool
- ✓ Calibration DB with interactive selection tool
- ✓ User entry point for custom analysis

Cons

- ✗ Not open: require a CC-IN2P3 account & and permission from the collaboration
- ✗ Limited in scope: very specific case of charged particle identification at intermediate-energy

OpenNP : a novel initiative within EURO-LABS

EURO-LABS

- European scale project: GANIL, LPC Caen, IJCLab, GSI/FAIR, INFN, Jyvaskyla
- Organise and facilitate access to European facilities

In a nutshell

- Open science initiative dedicated to nuclear physics
- Catalogue of data-set, related information and tools
- ESCAPE-like, for future integration

Work packages

1. Open science desk (GANIL/LPC Caen): promote good practice: DMPs, source repo., ...
2. OpenNP catalogue (GANIL/LPC Caen): the product itself
3. AAI (GSI/IJCLab): Provide necessary infrastructure to access and manage the catalogue

OpenNP : a novel initiative

Short-term goals (i.e. within EUROLABS)

- **E** Overview of existing raw-data sets
- **E** Overview of existing apparatus: ion sources, accelerator, separator and detector
- **I** Associated aux-data (i.e. log book)
- **I** Associated software to exploit raw-data and aux-data
- **I** Overview of existing analysed and simulated data set
- **D** Associated software to exploit and produce analysed and simulated data

Difficulty scale

- **E** Technically easy and little work required
- **I** Technically easy but lot of implication by all actors
- **D** Technically difficult, and require a lot of implication by all actors

OpenNP : a novel initiative

Getting the community on board

✓ **Automatic aggregation: only small, easy action required**

→ Create habits, integrate OpenNP in everyday workflow
→ Everybody involved: ITA, researcher, collaboration, direction
→ Elementary task: better definition of each actor responsibilities

✓ **Easier bibliography, experiment planning, and re-use of existing data set**

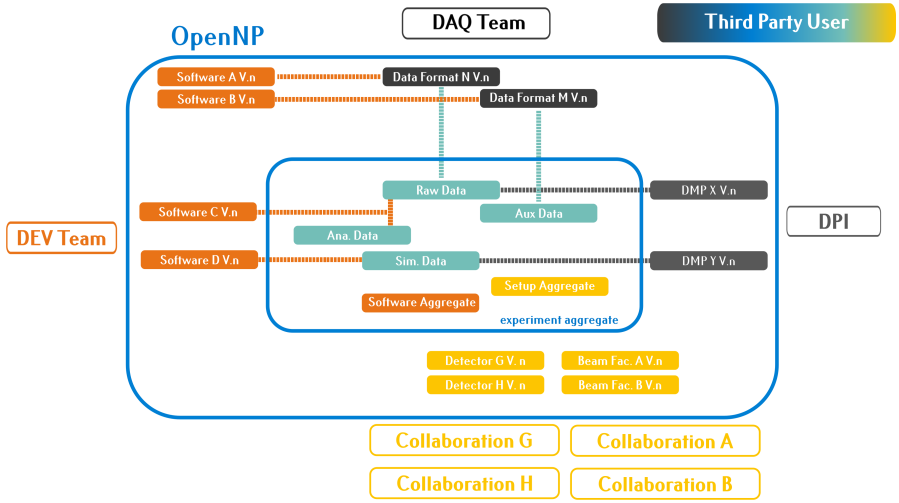
→ Does a dataset exist where ^{54}Ca was populated?
→ Which facility provide the most intense ^{18}C beam?
→ Was ^{10}He ever measured by missing mass?
→ Mixing information from different data-set (e.g. Fission with VAMOS/LICORNE/ILL)

✓ **Provide metric: increase visibility, facilitate evaluation**

→ 25% of publication on Coulex reaction used the AGATA array
→ FASTER has been used in 54 exp. over the last 5 years
→ VAMOS has been used in 16 different focal plane configurations

OpenNP : a novel initiative

Schematic interaction map



OpenNP beyond EURO-LABS

A complete road-map

Short-Term:

- A fully functional catalogue

Mid-Term:

- OpenNP synergy and integration with other initiative (ESCAPE/PANOSC/...)
  - → Learning from other fields
  - → Bridging gap at domain interfaces
  - → Seamless integration to data lake

Long-Term:

- Analysis and simulation as a service
  - → Shared computing platform
  - → Analysis and simulation tool at the ready
- Including Hardware design
  - → ASIC, board, and associated Firmware development

Nuclear physics and the Open Science culture

Take home messages

Context:

- Sub-communities are enthusiast about Open Science
- Diversity is both a blessing and a curse

State of play:

- ✓ Most publications open access
- ✓ Long term storage of data (but not accessible and usually not referenced)
- ✓ Most software are open source (but not always well maintained and documented)
- ✓ No unified catalogue of existing data set but **OpenNP** is coming
- ✗ Total absence of open source hardware but existing resources accessible

Preparing the future:

- Finding practically applicable principles of operation
- Challenging standardisation of non-standard experiments

Thank you!