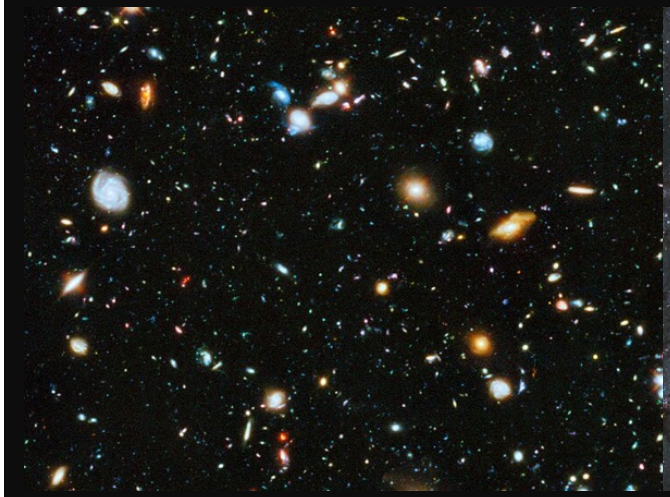
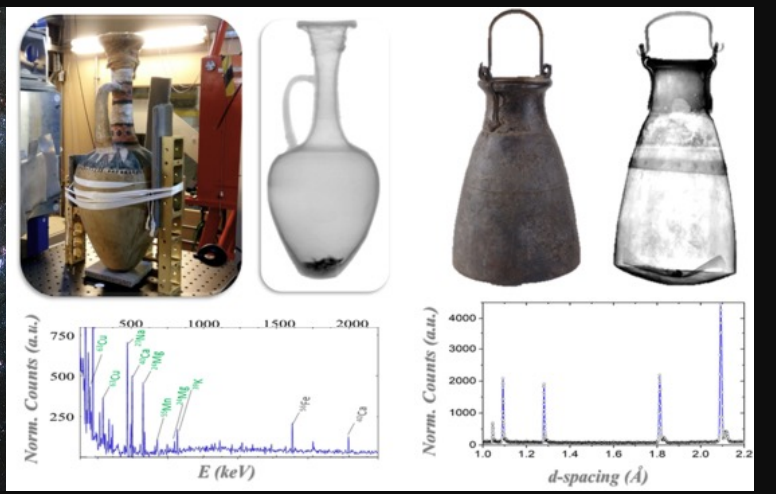
– User Needs –

– Future Trends in Neutron Science –

– Community Interactions –

WG: Universe Essentials and Society





Universe Essentials and Society

Activation
Archeometry
Art
Cultural Heritage
Forensic
Geological and Planetary Science
Irradiation
Nuclear Physics
Particle Physics
Other non-scattering applications

Programme Committee:


Hartmut Abele


Klaudia Hradil


Tobias Jenke (chair)


Masaaki Kitaguchi


António Moreira dos Santos


Stéphanie Roccia

Threat: Decreasing Community

Action: Dedicated Reinforcement Programs

Possibilites:

- Actions driven by large-scale facilities:
  - reinforce PhD- and PostDoc programs
  - Be open-minded for new ideas of new groups
  - help in building up own groups
  - Accept/reinforce education programs
  - Travelling support for young researchers
    (national funding agencies hardly fund travelling)
- Actions at Universities:
  - Fight against decrease of neutron-related posts
  - Reinforce teaching of Neutron Scattering at University
  - Reinforce the link to students
- Be aware of disadvantages from remote-experiments, automatic data processing etc.
  (lack of expertise on the long run)

Cultural Heritage

Data Analysis Tools

Trend:

- Increasing need for Data analysis/interpretation by neutron facilities

Needs:

- Scientifically diverse review panels to find a good balance between applied and fundamental science.

Nuclear- and Particle Physics

Needs: Visibility of the available Infrastructure

Experiments in NPP are often structured as long-term research projects, including a long planning phase, the design and construction of dedicated spectrometers, and data-taking over several years.

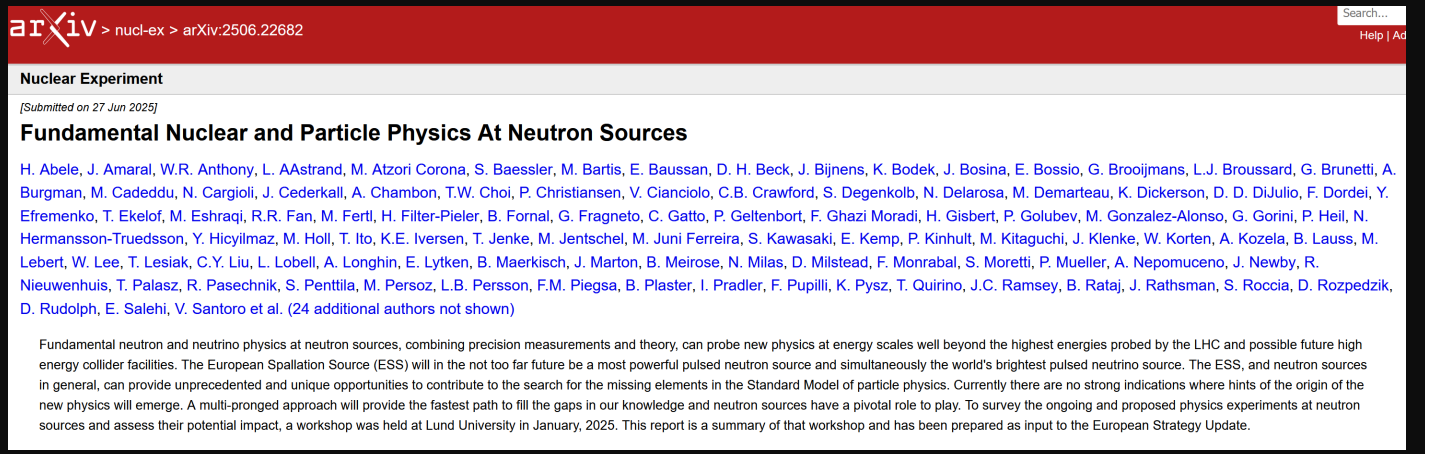
Trend:

- larger collaborations, separation of tasks, more sophisticated spectrometers

Needs:

- stable long-term strategy of the facilities
- Clear visibility of the available infrastructure
- firm committments

arXiv:2506.22682



arXiv > nucl-ex > arXiv:2506.22682

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Nuclear Experiment

[Submitted on 27 Jun 2025]

Fundamental Nuclear and Particle Physics At Neutron Sources

H. Abele, J. Amaral, W.R. Anthony, L. AAstrand, M. Atzori Corona, S. Baessler, M. Bartis, E. Baussan, D. H. Beck, J. Bijnens, K. Bodek, J. Bosina, E. Bossio, G. Brooijmans, L.J. Broussard, G. Brunetti, A. Burgman, M. Cadeddu, N. Cargioli, J. Cederkall, A. Chambon, T.W. Choi, P. Christiansen, V. Cianciolo, C.B. Crawford, S. Degenkolb, N. Delarosa, M. Demarteau, K. Dickerson, D. D. DiJulio, F. Dordei, Y. Efremenko, T. Ekelof, M. Eshraqi, R.R. Fan, M. Fertl, H. Filter-Pieler, B. Fornal, G. Fragneto, C. Gatto, P. Geltenbort, F. Ghazi Moradi, H. Gisbert, P. Golubev, M. Gonzalez-Alonso, G. Gorini, P. Heil, N. Hermansson-Truedsson, Y. Hicyilmaz, M. Holl, T. Ito, K.E. Iversen, T. Jenke, M. Jentschel, M. Juni Ferreira, S. Kawasaki, E. Kemp, P. Kinhult, M. Kitaguchi, J. Klenke, W. Korten, A. Kozela, B. Lauss, M. Lebert, W. Lee, T. Lesiak, C.Y. Liu, L. Lobell, A. Longhin, E. Lytken, B. Maerkisch, J. Marton, B. Meirose, N. Milas, D. Milstead, F. Monrabal, S. Moretti, P. Mueller, A. Nepomuceno, J. Newby, R. Nieuwenhuis, T. Palasz, R. Pasechnik, S. Penttila, M. Persoz, L.B. Persson, F.M. Piegsa, B. Plaster, I. Pradler, F. Pupilli, K. Pysz, T. Quirino, J.C. Ramsey, B. Rataj, J. Rathsman, S. Roccia, D. Rozpedzik, D. Rudolph, E. Salehi, V. Santoro et al. (24 additional authors not shown)

Fundamental neutron and neutrino physics at neutron sources, combining precision measurements and theory, can probe new physics at energy scales well beyond the highest energies probed by the LHC and possible future high energy collider facilities. The European Spallation Source (ESS) will in the not too far future be a most powerful pulsed neutron source and simultaneously the world's brightest pulsed neutrino source. The ESS, and neutron sources in general, can provide unprecedented and unique opportunities to contribute to the search for the missing elements in the Standard Model of particle physics. Currently there are no strong indications where hints of the origin of the new physics will emerge. A multi-pronged approach will provide the fastest path to fill the gaps in our knowledge and neutron sources have a pivotal role to play. To survey the ongoing and proposed physics experiments at neutron sources and assess their potential impact, a workshop was held at Lund University in January, 2025. This report is a summary of that workshop and has been prepared as input to the European Strategy Update.

Nuclear- and Particle Physics

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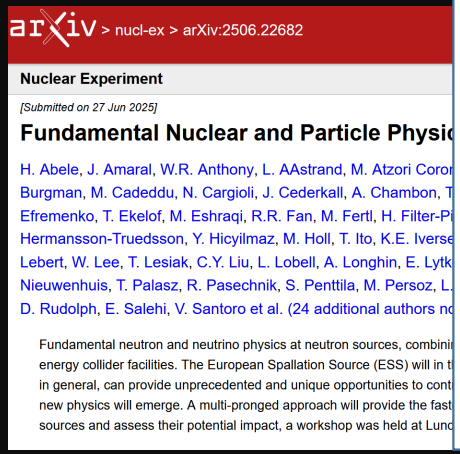

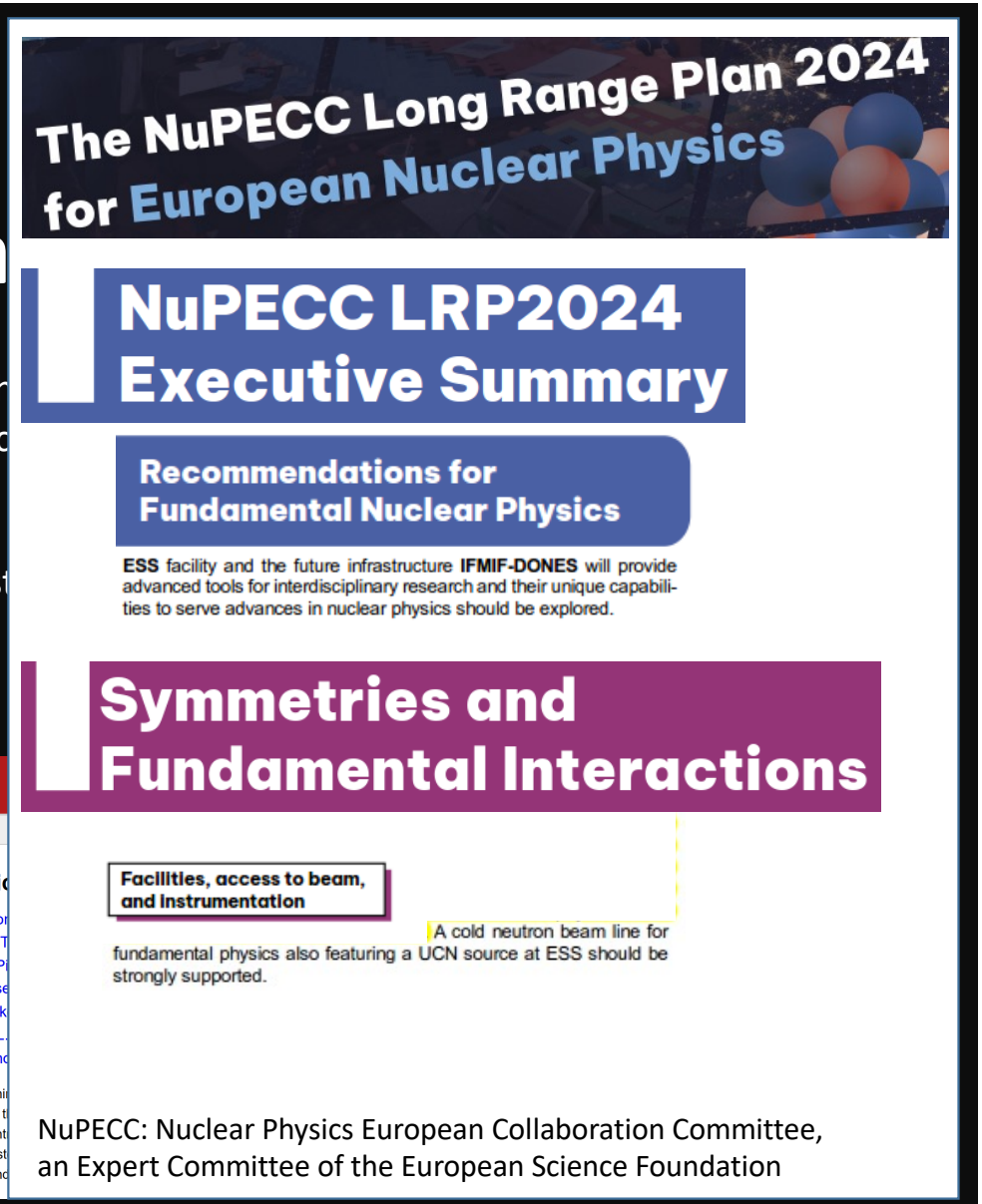

NuPECC: Nuclear Physics European Collaboration Committee, an Expert Committee of the European Science Foundation

Nuclear- and Particle Physics

Action: Be aware of dependancies

Spectrometers in NPP are often at the limit of the technically feasible (and beyond),
also in terms of neutron sources/beams.

Trend:

- Main experiments are often performed at large-scale facilities.
- Use of „special neutrons“ (UCN, VCN) or specialized instruments (Lohengrin, FIPPS).

Threat (and action):

- The European NPP community is strongly dependent on its beams at PSI (n2EDM), FRM-2 (PERC) and ILL.
- ILL hosts 12 beamlines for European NPP community:
  - Nuclear: FIPPS, Lohengrin and PF1b (rarely PF2)
  - Particle: PF1b, PF2/MAM-EDM-UCN-VCN and SuperSUN
  - Neutrino: neutrino „beamline“
  - Quantum: S18
  - Test: PF2/TES and SUN-2
- The lifetime of ILL is crucial for the community.

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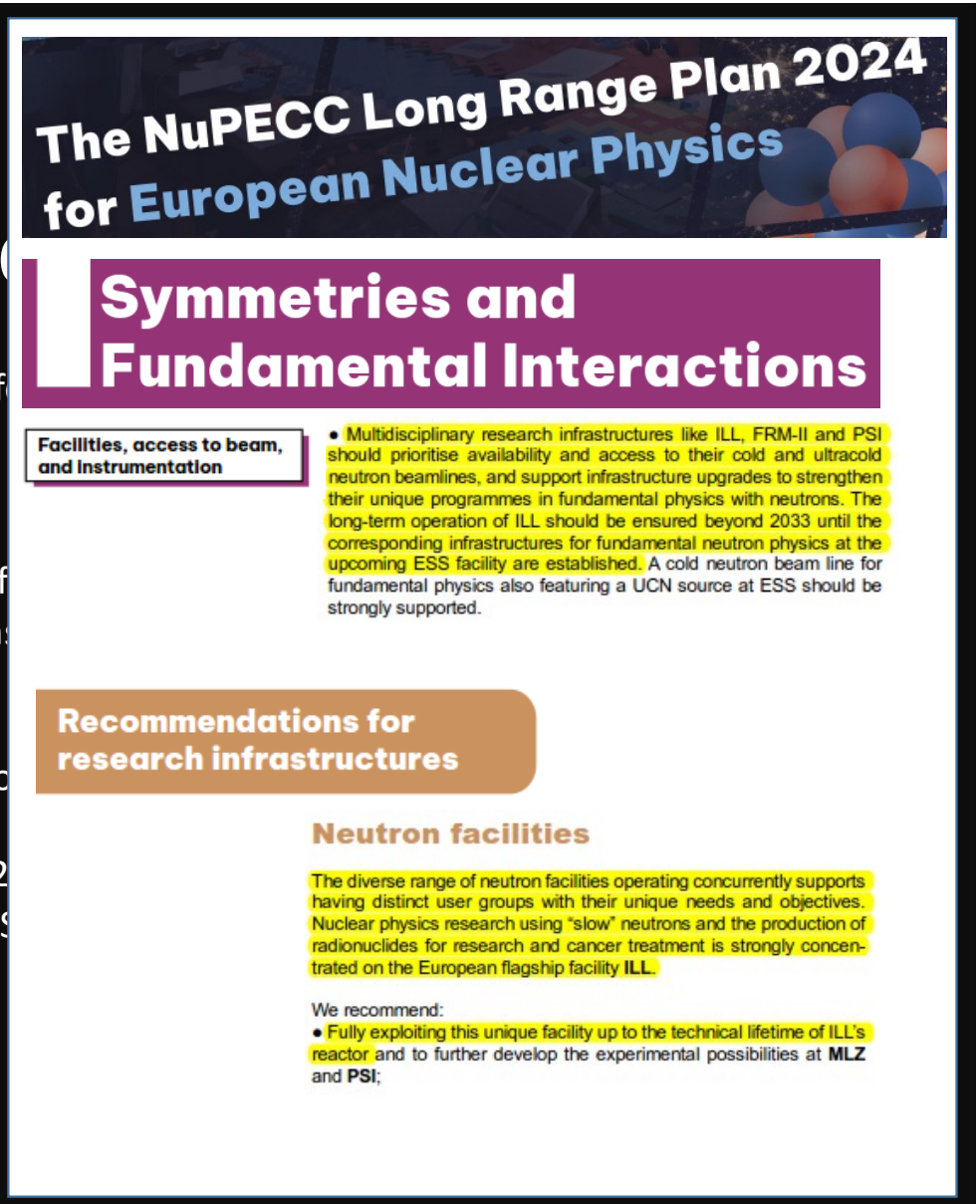

The NuPECC Long Range Plan 2024 for European Nuclear Physics

Symmetries and Fundamental Interactions

Facilities, access to beam, and instrumentation

• Multidisciplinary research infrastructures like ILL, FRM-II and PSI should prioritise availability and access to their cold and ultracold neutron beamlines, and support infrastructure upgrades to strengthen their unique programmes in fundamental physics with neutrons. The long-term operation of ILL should be ensured beyond 2033 until the corresponding infrastructures for fundamental neutron physics at the upcoming ESS facility are established. A cold neutron beam line for fundamental physics also featuring a UCN source at ESS should be strongly supported.

Recommendations for research infrastructures

Neutron facilities

The diverse range of neutron facilities operating concurrently supports having distinct user groups with their unique needs and objectives. Nuclear physics research using “slow” neutrons and the production of radionuclides for research and cancer treatment is strongly concentrated on the European flagship facility **ILL**.

We recommend:
• Fully exploiting this unique facility up to the technical lifetime of ILL’s reactor and to further develop the experimental possibilities at **MLZ** and **PSI**;

Discussion

- The community gets strengthened due to small, local sources well-embedded into the university structure.
  Example: TRIGA Wien operated by TU Wien -> 5 groups in neutron physics -> PostDocs, PhD-students, teaching etc.
- Particle Physics:
  - It is also today possible to start new projects and attract excellent students etc.
  - Particle Physics is slow (long experiments....), which is a disadvantage in a rapidly changing world (result: some projects suffer).
- Some European infrastructure is without nuclear/particle physics agenda (ISIS, ESS).
- The European NPP community is organized within NuPECC.