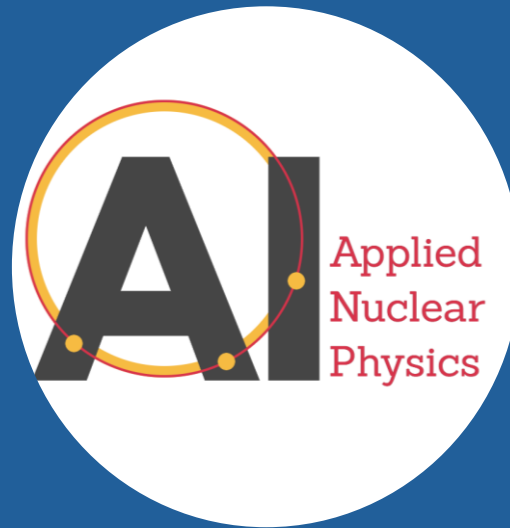

Towards a Centre for AI in Applied Nuclear Physics



NuSec 2026 | Community update

IOP Community Consultation 2024

The impact project pathfinder highlights:

- the **extensive use of AI** in all areas of physics and its importance for future progress
- the **views physicists hold regarding AI** and discipline-specific perspectives
- the **needs of the physics community** regarding the adoption of AI technologies
- the role of **physics as both enabler and beneficiary of AI** and its relevance for AI for science
- the **opportunities for physics to contribute to the development of AI**

IOP Community Consultation 2024



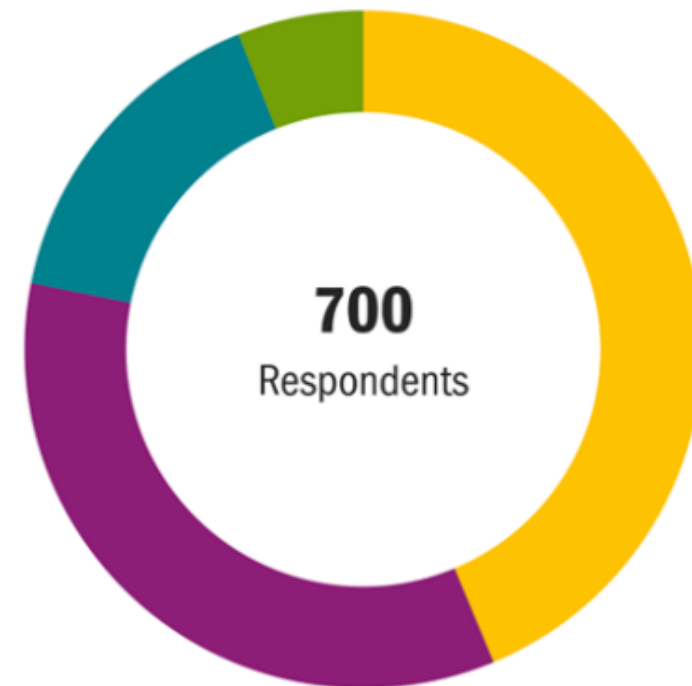
IOP Institute of Physics
Physics and AI
A physics community perspective





University of Cambridge, ATLAS Experiment © 2024 CERN



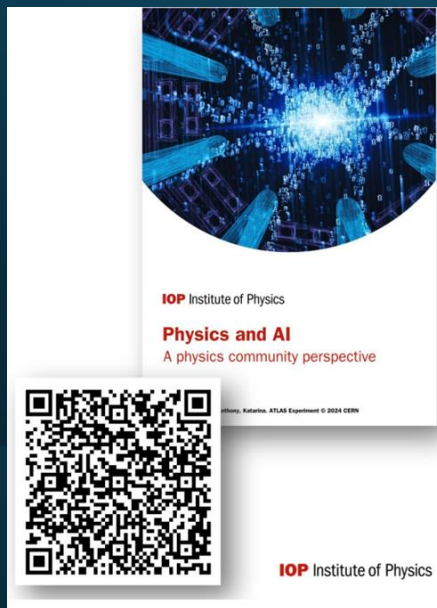
IOP Institute of Physics

Role Involves AI

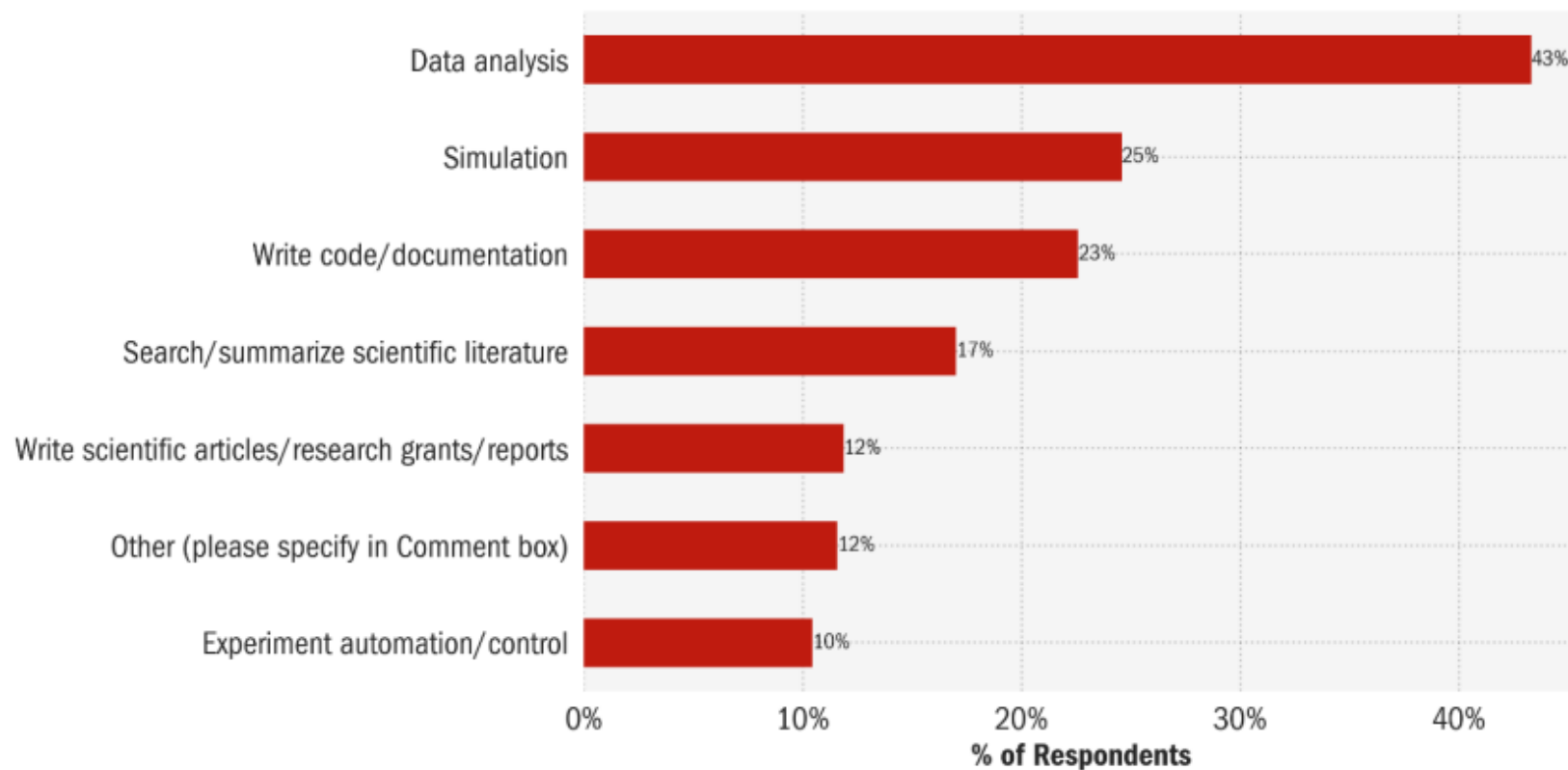


-  Yes, peripheral to my role 44%
-  No, none of my roles have ever involved AI 34%
-  Yes, central to my role 16%
-  No, but I have used AI in a previous role 6%

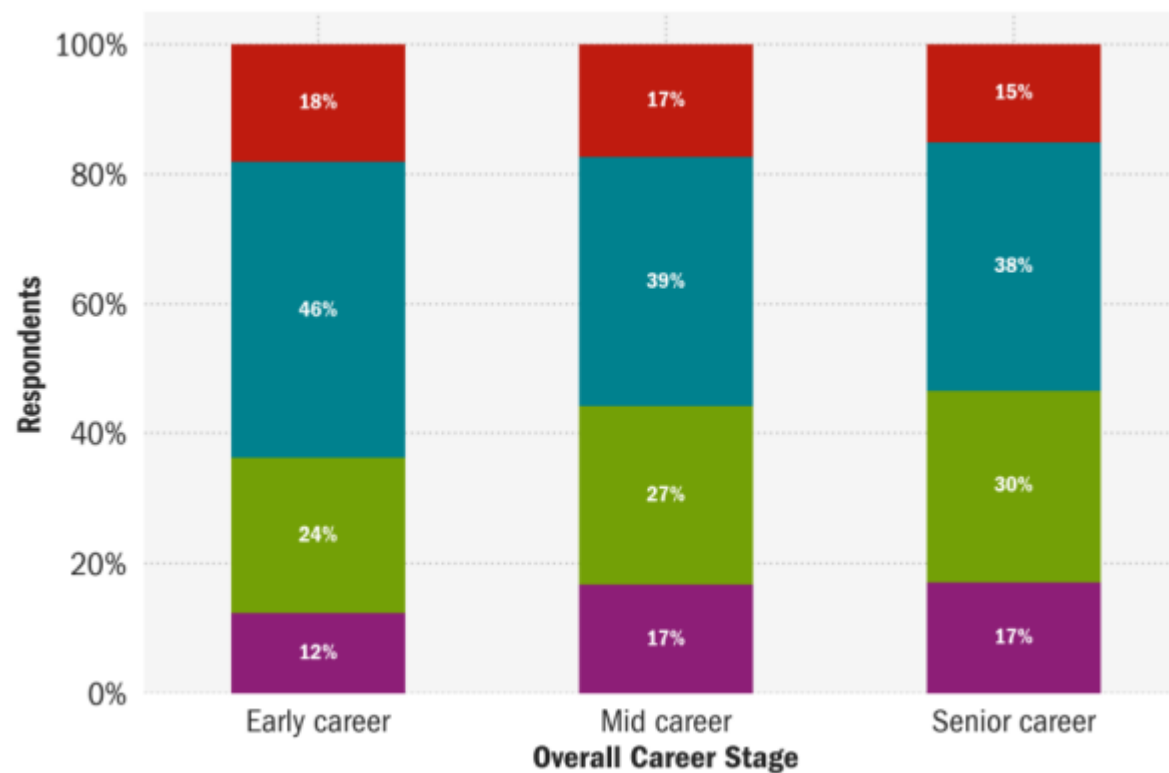
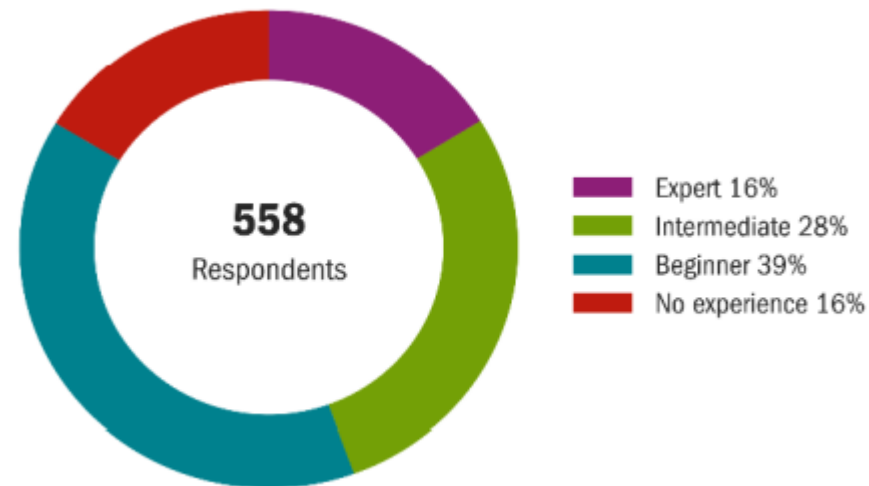
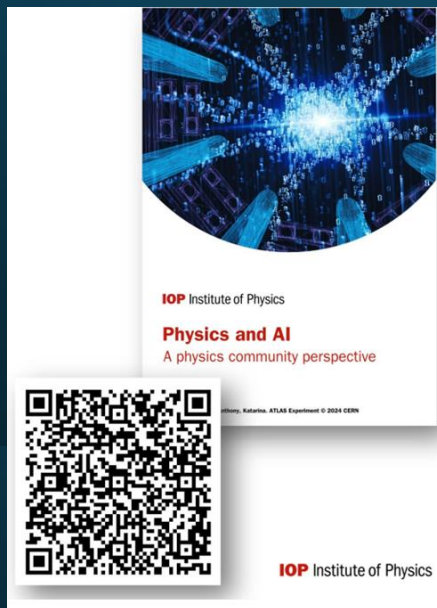
IOP Community Consultation 2024



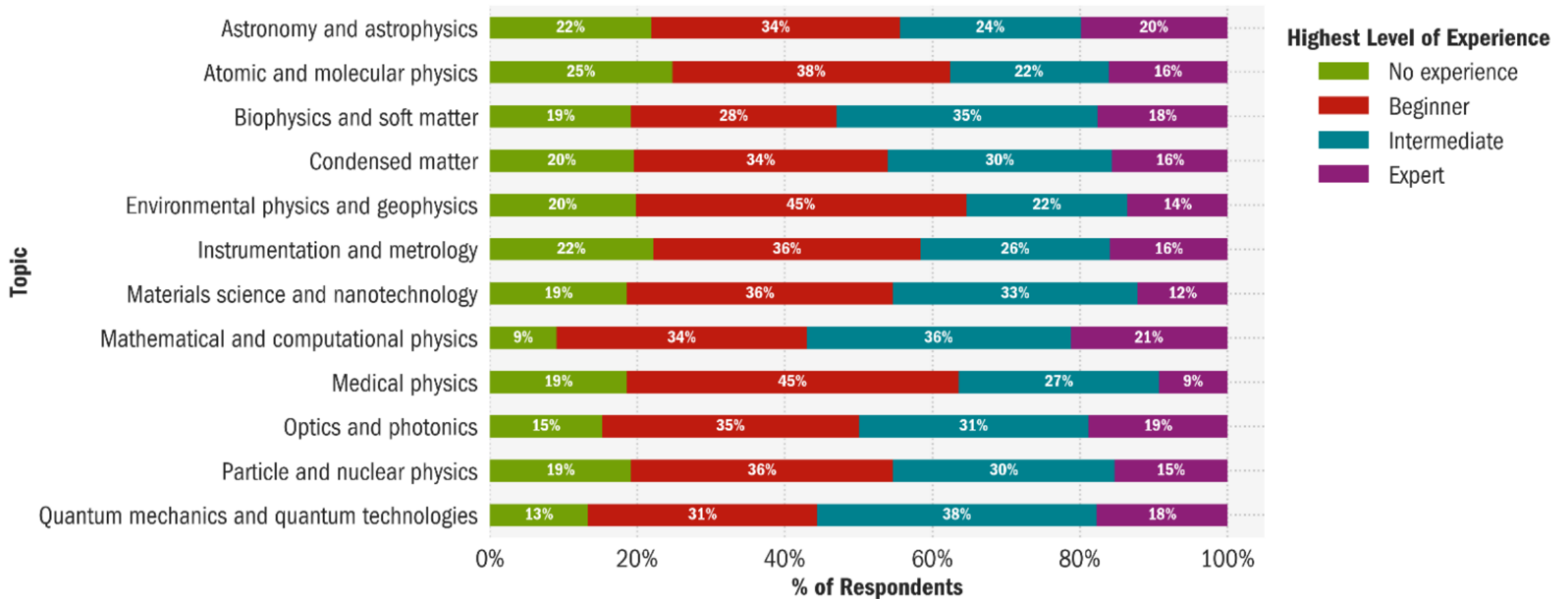
What Do You Use AI For?



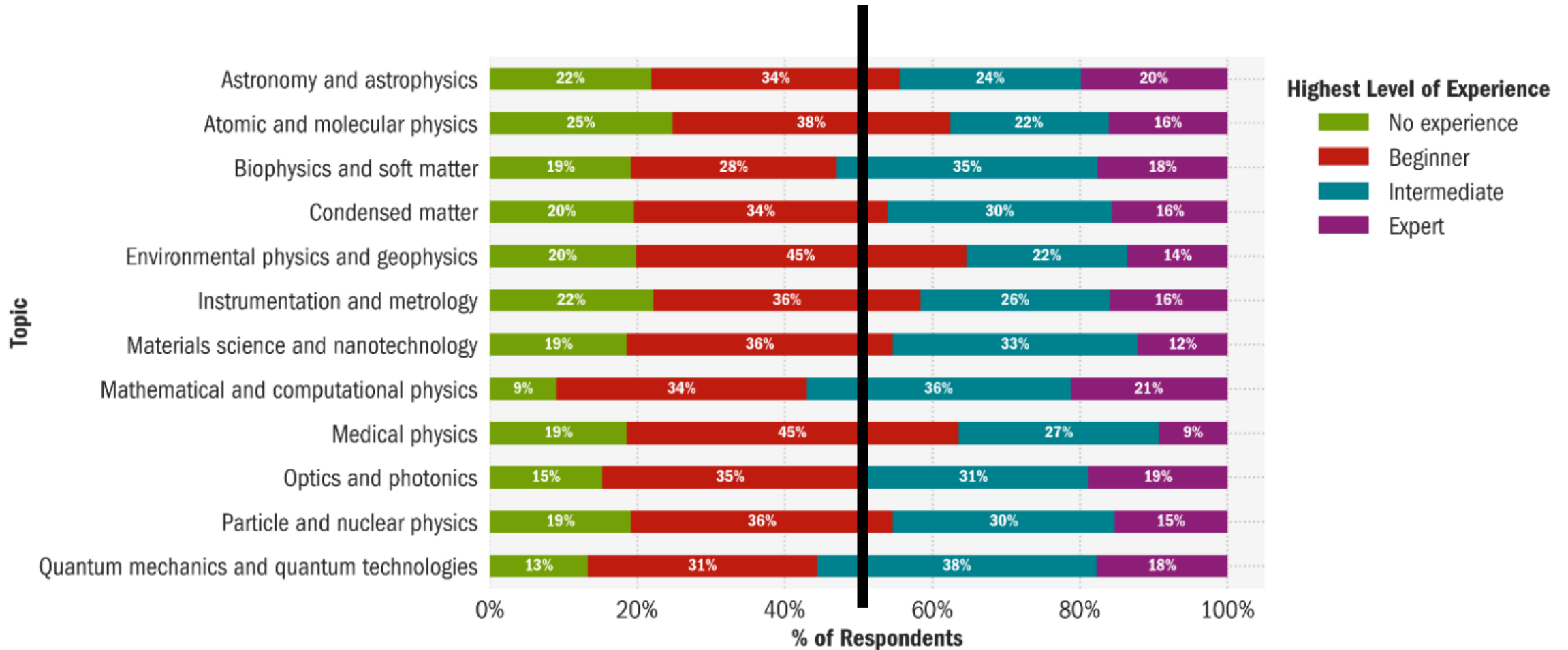
IOP Community Consultation 2024



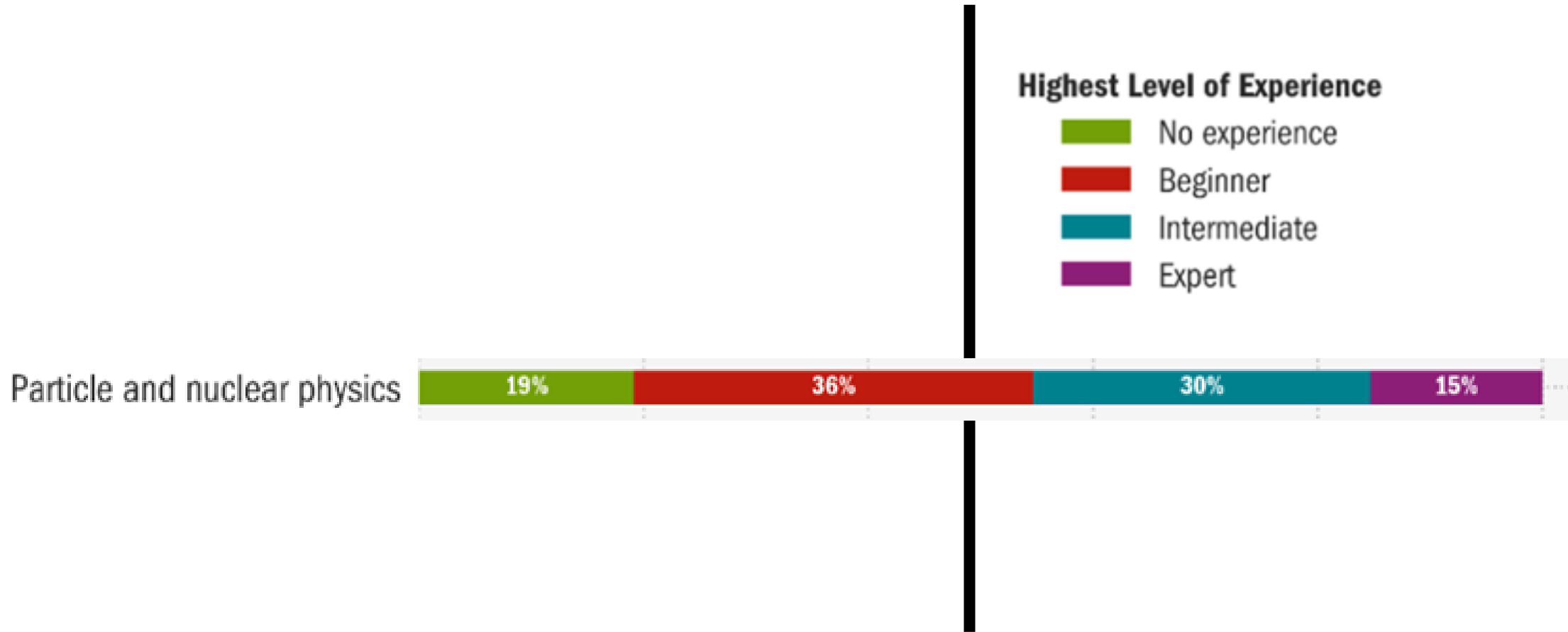
IOP Community Consultation 2024



IOP Community Consultation 2024



IOP Community Consultation 2024



Is there a need for a centre for AI in Applied Nuclear Physics ?

Is there a need for a centre for AI in Applied Nuclear Physics ?

2024

2025

Oct

Nov

Dec

Jun

Oct



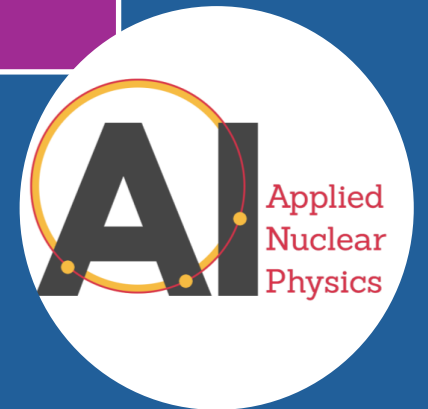
Proposal document

Collected community expressions of interest in a UK Centre in AI applied nuclear physics at NuFor

Collected community expressions of interest at IOP Materials

Awarded funding from the IOP Nuclear Group for a workshop to allow community to discuss the proposal

Workshop held 10th Oct 2025



Keynote
10.15-10.45

Kimberley Lennon

UKAEA and Sheffield Hallam University

...this keynote will introduce some of the areas within UK Atomic Energy Authority (UKAEA) that have started to investigate AI

Exercise 1
10.45-11.15

What skills do / should nuclear physicists have regarding AI?

Refreshments
11.15 – 11.45

Opportunity to view the displayed posters.

Exercise 2
11.45-12.45

1. How best to share code
2. How to connect the researcher to policy maker
3. Challenge of making data open access for publication

Lunch
12.45 – 1.45

Keynote
1.45-2.15

Dr Ren Cooper

Lawrence Berkeley National Laboratory

...use of Artificial Intelligence/Machine Learning to enable advanced radiation detection and imaging methods for nuclear non-proliferation applications

Keynote
2.15-2.45

Dr Nadia Smith

TÜV SÜD, UK and Royal Surrey NHS Foundation Trust, UK

...will examine the evolving regulatory and standards landscape in the UK and highlight a detailed case study of AI in breast cancer screening

Exercise 3
2.45-3.15

What resources or support would help you the most from this Centre?

Workshop held
10th Oct 2025

Timeline

We will be collecting and collating exercise outputs into a post-event report to be shared with the community.

Why are you attending today?

What skills do / should nuclear physicists have regarding AI?

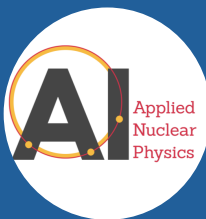
How best to share AI code?

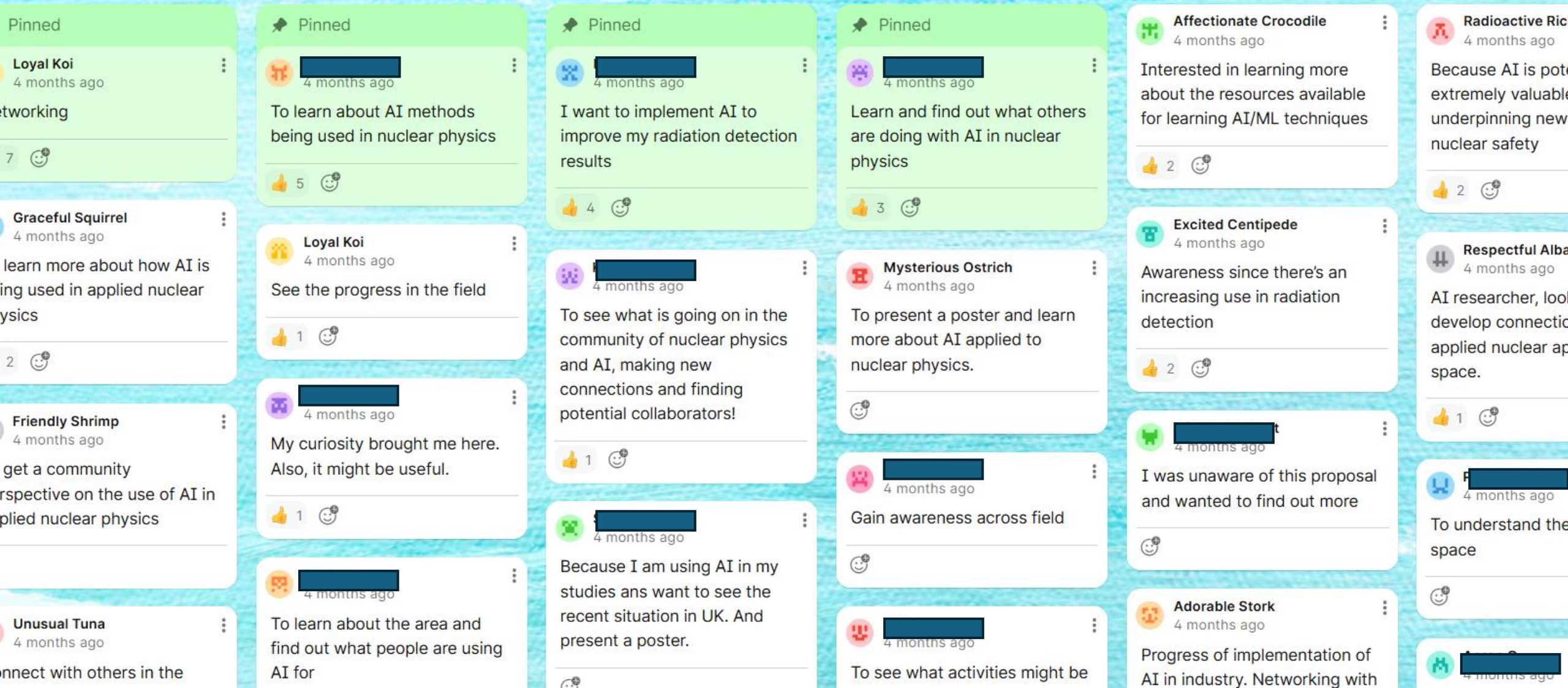
How to connect the researcher to policy maker?

Challenges of making data open access for publication?

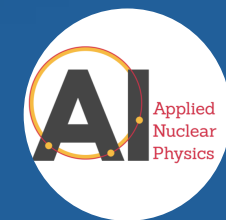
What resources or support would help you the most from this Centre?

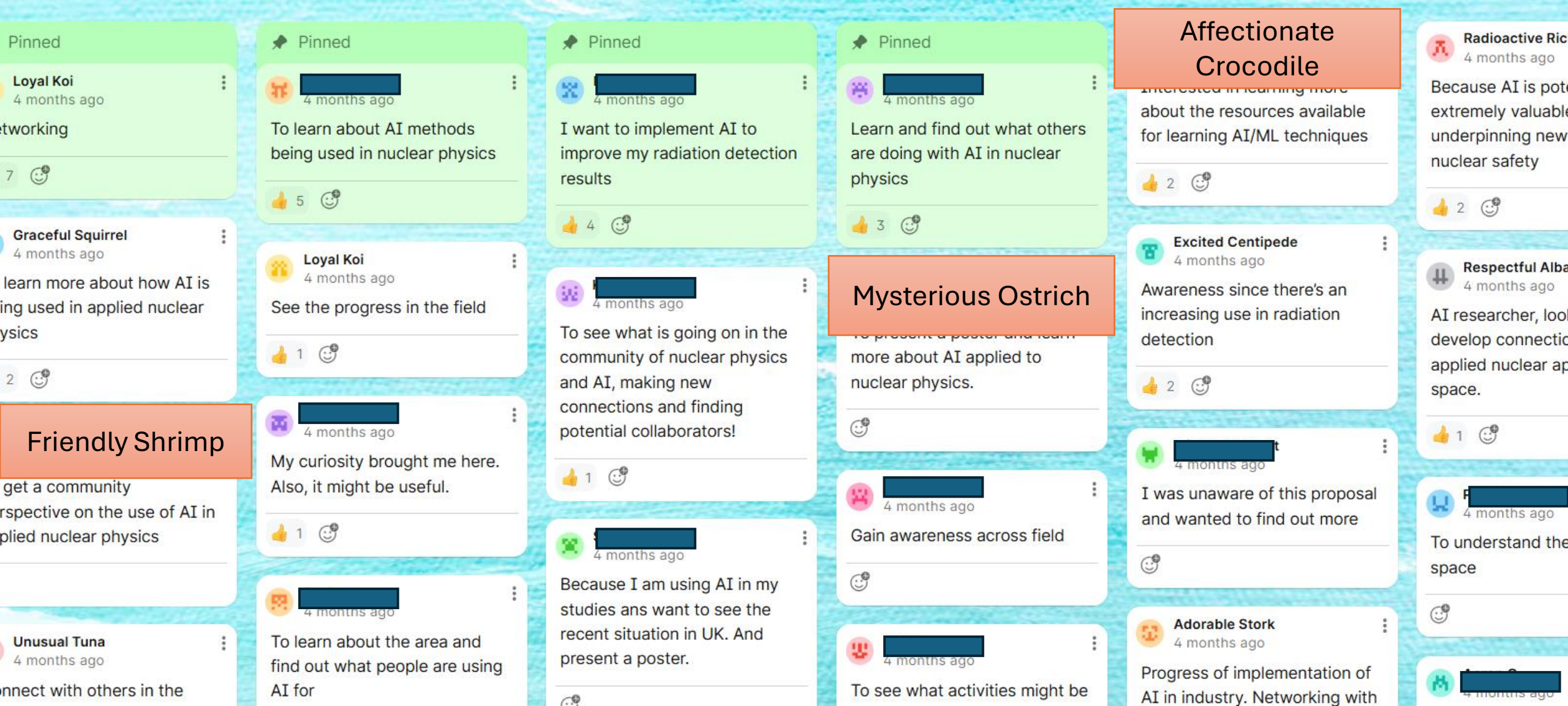
What is the 'mission' of the Centre i.e., what does the community think is missing when it comes to AI, and how could the Centre help fill that gap?





Why are you attending today?



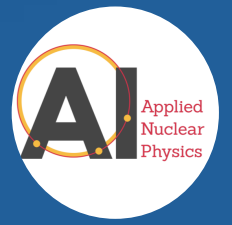


Affectionate Crocodile

Mysterious Ostrich

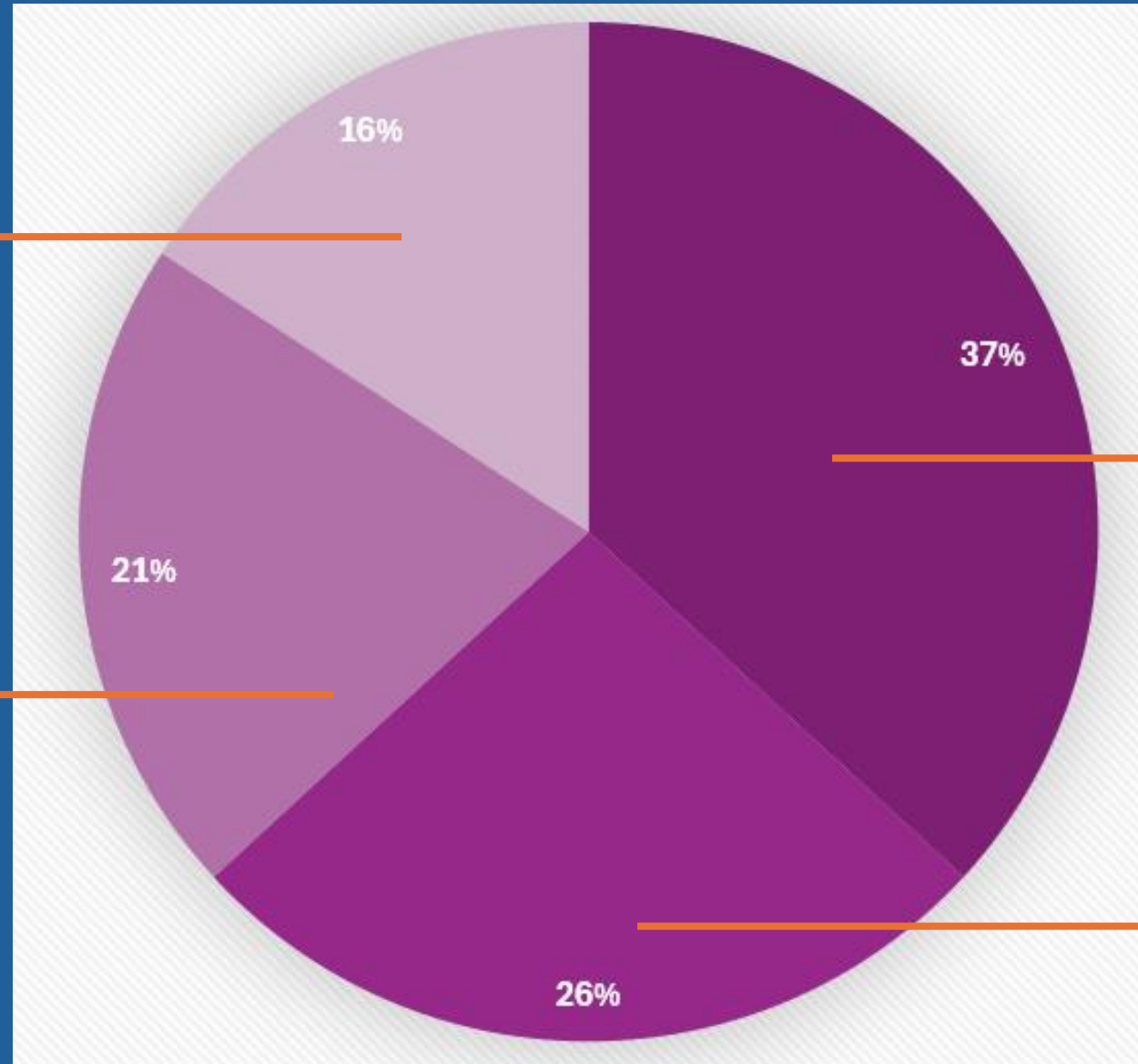
Friendly Shrimp

Why are you attending today?



Learn and find out what others are doing with AI in nuclear physics

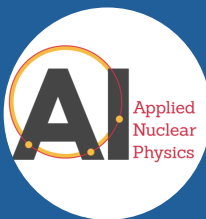
Want to implement AI to improve my radiation detection results



Networking

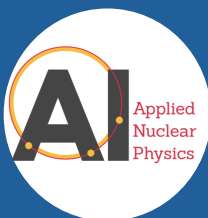
Learn about AI methods being used in nuclear physics

Why are you attending today?



Undergraduate / Masters	Graduate Entry Scientist	PhD Researcher	Researcher / Research Scientist	Lecturer / Senior Scientist	Professor / Principal Scientist	Technical Manager
<p>Programming</p>	<p>Supportive Firefly 4 months ago</p> <p>Statistical techniques; Python programming; Working with labeled data</p>	<p>Relevant programming skills and data analysis skills (both for data preparation and evaluating model performance)</p>	<p>Blushing Macaw 4 months ago</p> <p>Using Python</p>	<p>Radioactive Ricky 4 months ago</p> <p>Academics should build an online teaching resource for AI in physics/nuclear which provides training modules that you can take for free that allows students to build their own learning as they see fit</p>	<p>Fantastic Fox 4 months ago</p> <p>Have the ability to not just do AI for the sake of AI, this level Will input heavily to technical direction.</p>	<p>Loyal Koi 4 months ago</p> <p>Validation</p>
<p>Radioactive Ricky 4 months ago</p> <p>Coding, statistical techniques, data stewardship (processing, refinement, secure storage and transmission), understanding of security issues</p>	<p>Fantastic Fox 4 months ago</p> <p>Ability to assess the performance/value of an AI approach</p>	<p>Supportive Firefly 4 months ago</p> <p>Applied AI/ML skills anchored in domain specific problems areas; advanced computing skills (model development/deployment, working with cloud/remote HPC; how to communicate to audiences yet to understand/appreciate value of AI/ML</p>	<p>4 months ago</p> <p>Ability to follow the thought process of the program</p>	<p>Groovy Beetle 4 months ago</p> <p>Awareness/applicability of different methods. Relation to knowledge and scientific "intuition". Recognition of when it is/isn't appropriate.</p>	<p>4 months ago</p> <p>Communicate the reasoning behind AI-led decisions to help others overcome their 'black box' problem</p>	<p>4 months ago</p> <p>Maintain the skills base of their team and know which skills are in danger of being outsourced to AI</p>
<p>Happy Boar 4 months ago</p> <p>Understanding how to prepare experimental data for use in ML training/ML models</p>	<p>Fantastic Fox 4 months ago</p> <p>Best practice for data preparation</p>	<p>Fantastic Fox 4 months ago</p> <p>Feature extraction</p>	<p>Excited Centipede 4 months ago</p> <p>Understanding the limits, false positive rates and the implications of that on the end application</p>	<p>4 months ago</p> <p>They should know how AI can be applied in the problem, which one is suitable for which type of problem, but not to be very intetested in developing the AI models</p>	<p>4 months ago</p> <p>Identifying appropriate use cases and which form of AI would work best</p>	<p>Supportive Firefly 4 months ago</p> <p>Understanding of the technical/ethical challenges involved in using AI/ML, in particular resource implications</p>
<p>Supportive Firefly 4 months ago</p> <p>Solid foundation in statistics as applied to physical sciences Solid Python foundation</p>	<p>Fantastic Fox 4 months ago</p> <p>Network effectively to identify what techniques to consider</p>	<p>Determined Owl 4 months ago</p> <p>Debugging</p>	<p>Supportive Firefly 4 months ago</p> <p>Training in enabling technologies (that are AI/ML based) to complement/enhance their planned work.</p>	<p>Adequate Human 4 months ago</p> <p>A physicist should consider AI skills as core as other computing or mathematical skills that are typically taught as foundational skills in any physics degree</p>		

What skills do / should nuclear physicists have regarding AI?



Undergraduates

Mathematical methods
Python programming
Ethics of AI use

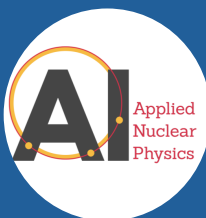
Graduate Entry

Python programming
Data preparation
Choice of AI method

PhD Student

HPC/ cloud access
Advanced computing
Interpretation of results

What skills do / should nuclear physicists have regarding AI?



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Advanced computing
Interpretation of results

Research Scientist

Postdoc Researcher

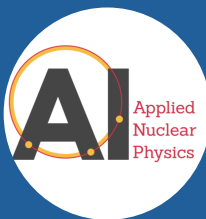
Python programming
AI interpretability
AI performance

Scientist

Lecturer

Advise on AI method
Know data curation
Share AI limits of use

What skills do / should nuclear physicists have regarding AI?



Undergraduates

Mathematical methods
Python programming
Ethics of AI use

Graduate Entry

Python programming
Data preparation
Choice of AI method

PhD Student

HPC/ cloud access
Advanced computing
Interpretation of results

Research Scientist

Postdoc Researcher

Python programming
AI interpretability
AI performance

Scientist

Lecturer

Advise on AI method
Know data curation
Share AI limits of use

Principal Scientist

Professor

Appropriate use of AI
Policy and wider influence
on AI

Technical Manager

Understand ethics of AI and
monitor impact on
workloads

Other

Not to be fooled!
Aware of export control.

What skills do / should nuclear physicists have regarding AI?

Undergraduates

Graduate Entry

PhD Student

- Python programming
- Data preparation and HPC use.

Research Scientist

Postdoc Researcher

Scientist

Lecturer

- Python programming
- Advise AI selection
- AI interpretability
- AI limits of use

Principal Scientist

Professor

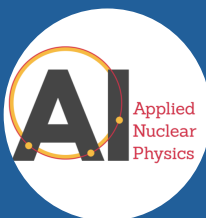
- AI policy
- State of wider influences on AI

Technical Manager

Other

- Impact on tasks
- Legal concerns

What skills do / should nuclear physicists have regarding AI?

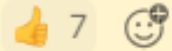


How best can we share AI code / tools / approaches ?



Pinned

GIT hub



4 months ago

Difficult to ensure secure and curatable data for more sensitive information



Whimsical Capybara

4 months ago

File size upload/commit restrictions

+ Add comment

Through trusted organisations such as IAEA

Challenges?



Security on institutional levels



Groovy Beetle

4 months ago

Especially for nuclear data

+ Add comment

Data privacy and ethics



4 months ago

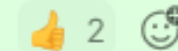
In particular for medical applications/data

+ Add comment

Solutions?



Central "accessible" repository with entirely separate ones for AI using sensitive material



Amazing Ardvark

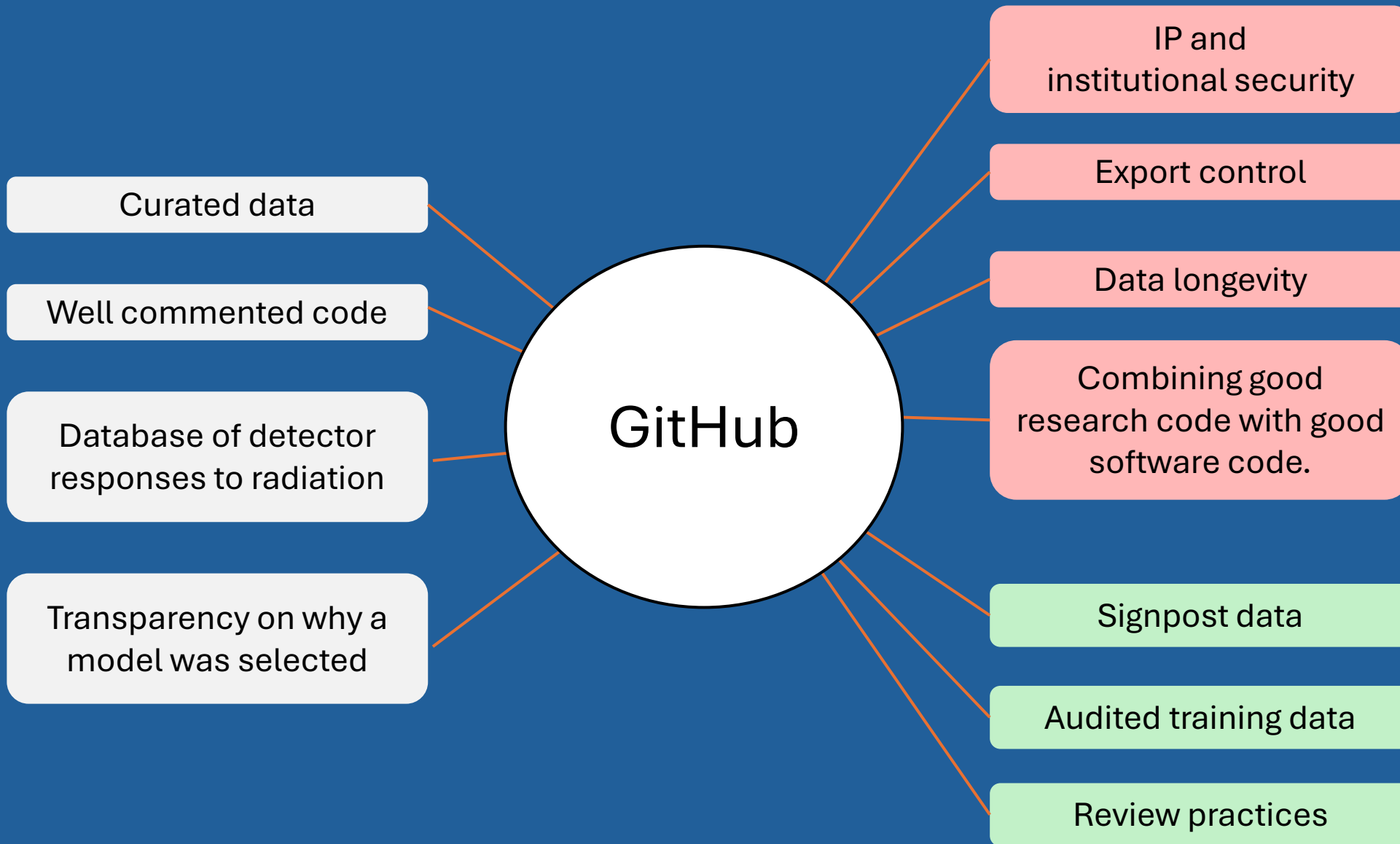
4 months ago

You can signpost data rather than fully share e.g. meta data and institutions might work for classified data, less work and still allows requests to be made

+ Add comment

Enforce publicly funded primary research being publicly available

How best to share AI code?



How best to share AI code?

Nuclear data can be excellent, fragmented, outdated, or behind institution firewalls.

A **shared, responsibly governed centre** for nuclear data used for learning and research

Like a **public reference library**: structured, controlled, and purpose-limited

Improves education, safety research, and informed policy discussion

Reduces duplication and errors by sharing verified data

Builds transparency and public trust through responsible access

Sharing Nuclear Data

Storage

— Keeping data safe and organised over time is hard

Movement

— Large datasets are hard to move; work is best local

Standardisation

— Consistent formats and units make data usable

Access Control

— Not all users should see everything; control matters

Documentation

— Clear instructions and context are essential for usability

Costs

— Sharing data requires continuous upkeep and resources

Governance

— Rules are needed to manage changes and ensure trust

How do we connect the researcher to the policy maker?

Challenges of data open access for education?

Solutions?

Connecting researcher to policy maker and the challenge of open access data.

Have a "translator" to bridge the knowledge gap between the science and policy



1



Amazing Ardvark

4 months ago

This can bring out the value of any given piece of work



Add comment



Excited Centipede

4 months ago

Clear understanding on both parts of what the policy makers require/expect, and what

Sharing code - needs to be useable/readable. Journals could check code for specific standards (e.g. commenting). But, who pays for this (the time to fix code)? Neat, usable code is important for future work to encourage further development. Messy code would just get dropped and not developed further - wasted opportunities.



4 months ago



4 months ago

Pushing application industry without regulation at present. Journals should take more ownership for how data should be stored, access etc. in



3



Excited Centipede

4 months ago

A separate data set that has been given to a community that has some kind of validation that everyone can then have access to (like a calibration)?



Add comment



Polite Oyster

4 months ago

Publishing reports can't publish the

It could be

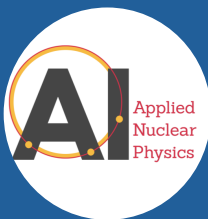


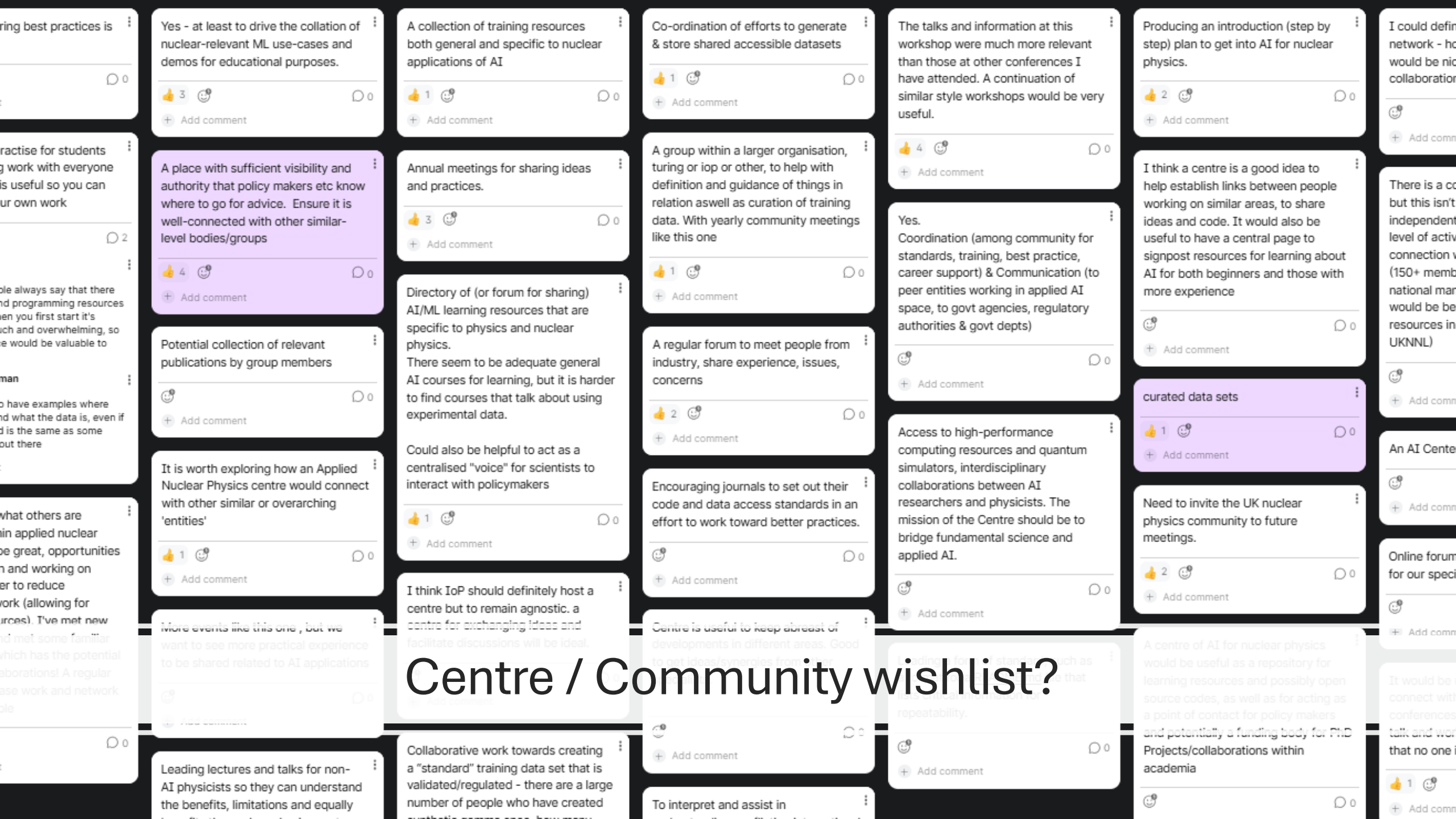
Should there be some form of a “centre”?

95 % of the attending workshop audience were positive

Some participants suggested others may be better placed to lead i.e.

Nuclear Institute, Turing





Centre / Community wishlist?

Yes - at least to drive the collation of nuclear-relevant ML use-cases and demos for educational purposes.

3 thumbs up, 1 smiley

+ Add comment

A collection of training resources both general and specific to nuclear applications of AI

1 thumbs up, 1 smiley

+ Add comment

Co-ordination of efforts to generate & store shared accessible datasets

1 thumbs up, 1 smiley

+ Add comment

The talks and information at this workshop were much more relevant than those at other conferences I have attended. A continuation of similar style workshops would be very useful.

4 thumbs up, 1 smiley

+ Add comment

Producing an introduction (step by step) plan to get into AI for nuclear physics.

2 thumbs up, 1 smiley

+ Add comment

A place with sufficient visibility and authority that policy makers etc know where to go for advice. Ensure it is well-connected with other similar-level bodies/groups

4 thumbs up, 1 smiley

+ Add comment

Annual meetings for sharing ideas and practices.

3 thumbs up, 1 smiley

+ Add comment

A group within a larger organisation, tutoring or iop or other, to help with definition and guidance of things in relation aswell as curation of training data. With yearly community meetings like this one

1 thumbs up, 1 smiley

+ Add comment

Yes. Coordination (among community for standards, training, best practice, career support) & Communication (to peer entities working in applied AI space, to govt agencies, regulatory authorities & govt depts)

+ Add comment

I think a centre is a good idea to help establish links between people working on similar areas, to share ideas and code. It would also be useful to have a central page to signpost resources for learning about AI for both beginners and those with more experience

+ Add comment

Potential collection of relevant publications by group members

+ Add comment

Directory of (or forum for sharing) AI/ML learning resources that are specific to physics and nuclear physics. There seem to be adequate general AI courses for learning, but it is harder to find courses that talk about using experimental data.

+ Add comment

A regular forum to meet people from industry, share experience, issues, concerns

2 thumbs up, 1 smiley

+ Add comment

Access to high-performance computing resources and quantum simulators, interdisciplinary collaborations between AI researchers and physicists. The mission of the Centre should be to bridge fundamental science and applied AI.

+ Add comment

curated data sets

1 thumbs up, 1 smiley

+ Add comment

It is worth exploring how an Applied Nuclear Physics centre would connect with other similar or overarching 'entities'

1 thumbs up, 1 smiley

+ Add comment

Could also be helpful to act as a centralised "voice" for scientists to interact with policymakers

1 thumbs up, 1 smiley

+ Add comment

Encouraging journals to set out their code and data access standards in an effort to work toward better practices.

+ Add comment

Online forum for our special interest group

+ Add comment

Need to invite the UK nuclear physics community to future meetings.

2 thumbs up, 1 smiley

+ Add comment

More events like this one, but we want to see more practical experience to be shared related to AI applications

+ Add comment

I think IoP should definitely host a centre but to remain agnostic. a centre for exchanging ideas and facilitate discussions will be ideal.

+ Add comment

Centre is useful to keep abreast of developments in different areas. Good to get ideas/synergies from other centres.

+ Add comment

Leading lectures and talks for non-AI physicists so they can understand the benefits, limitations and equally important the risks of AI in their field

+ Add comment

A centre of AI for nuclear physics would be useful as a repository for learning resources and possibly open source codes, as well as for acting as a point of contact for policy makers and potentially a funding body for PhD Projects/collaborations within academia

+ Add comment

Leading lectures and talks for non-AI physicists so they can understand the benefits, limitations and equally important the risks of AI in their field

+ Add comment

Collaborative work towards creating a "standard" training data set that is validated/regulated - there are a large number of people who have created synthetic gamma rays, how many

+ Add comment

To interpret and assist in the development of AI models for nuclear physics

+ Add comment

Collaborative work towards creating a "standard" training data set that is validated/regulated - there are a large number of people who have created synthetic gamma rays, how many

+ Add comment

It would be useful to have a central page to signpost resources for learning about AI for both beginners and those with more experience

+ Add comment

I could definitely see a network - how would be nice for collaboration

+ Add comment

...ing best practices is

0 replies

...practise for students

...g work with everyone

...is useful so you can

...ur own work

2 replies

...le always say that there

...nd programming resources

...en you first start it's

...ch and overwhelming, so

...e would be valuable to

...man

...o have examples where

...nd what the data is, even if

...d is the same as some

...ut there

...what others are

...ain applied nuclear

...be great, opportunities

...n and working on

...er to reduce

...ork (allowing for

...ources). I've met new

...nd met some familiar

...which has the potential

...aborations! A regular

...ase work and network

...ole

0 replies

Should there be some form of a “centre”?

95 % of the attending workshop audience were positive

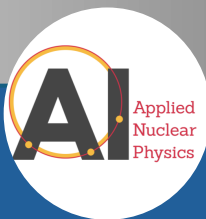
Some participants suggested others may be better placed to lead i.e.

Nuclear Institute, Turing

Forum • Connect Researchers • Signpost access to AI materials

Access • Curated datasets • Algorithms • Publications • Training resources

Influence • Standards • Policy • Inform best practice



Centre for AI in Applied Nuclear Physics – What next?

2025

Oct



Workshop held
10th Oct 2025

2026

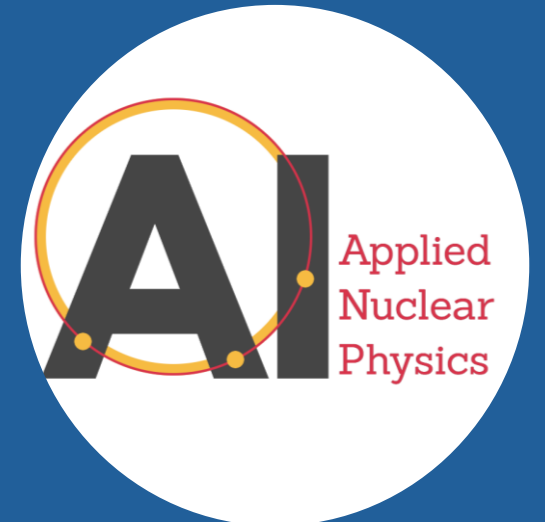
Feb



NuSec meeting,
share headline
findings from
workshop



?



Towards a Centre for AI in Applied Nuclear Physics

1. What kind of connection would be most valuable to you right now?

- Finding collaborators
- Finding datasets / tools
- Learning from experienced users
- Being mentored
- Hiring / being hired
- Talking to policy/funders
- Other: _____

Towards a Centre for AI in Applied Nuclear Physics

2. What interactions would you wish to attend?

(Select all that apply)

- Monthly 60-min online meetup (talk + discussion)
- Themed discussion forum / e.g. Slack channel
- Quarterly virtual networking session
- Mailing list with curated opportunities & updates
- Recorded talks / resources I can watch
- Problem-pitch sessions; people bring real challenges
- Short collaborative meetings; 1–2 days, focused goal
- Cross-sector matchmaking; industry ↔ academia
- I'm interested but time-limited right now
- Other _____



Towards a Centre for AI in Applied Nuclear Physics

3. Which of these would you realistically use in the next 6–12 months?

(Check all that apply)

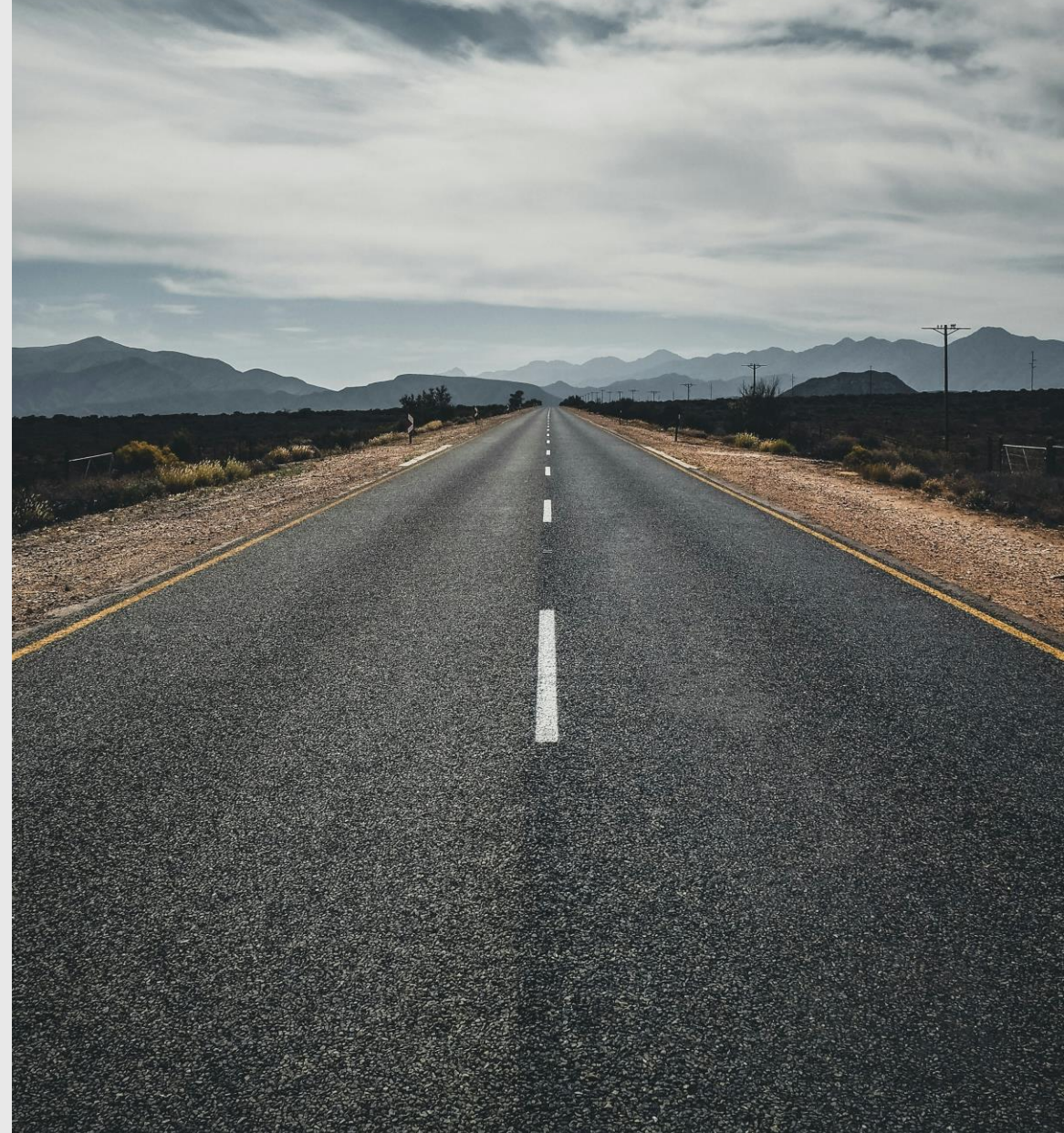
- Intro to AI tools for nuclear physicists
- Hands-on Python model training workshops
- Short “how-to” sessions (1–2 hours)
- Example-driven case studies (real applications)
- Online self-paced learning materials
- Shared code repositories with guided walkthroughs
- Other (please specify):** _____

Towards a Centre for AI in Applied Nuclear Physics

4. Where should this community focus to influence or inform policy?

(Select up to two)

- Data governance & access
- AI safety & assurance
- Nuclear regulation & licensing
- Research funding priorities
- International collaboration norms
- Workforce development
- Other (please specify):**

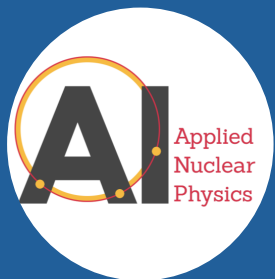


Towards a Centre for AI in Applied Nuclear Physics

5. Would you be willing to contribute in the next year?

(Check all that apply)

- Join a mailing list / online forum
- Participate in themed working groups
- Help design or deliver training content
- Share use cases, examples, or datasets
- Host or co-host a session or event
- Advise on strategy or direction
- Not right now, but keep me informed
- Other (please specify):** _____



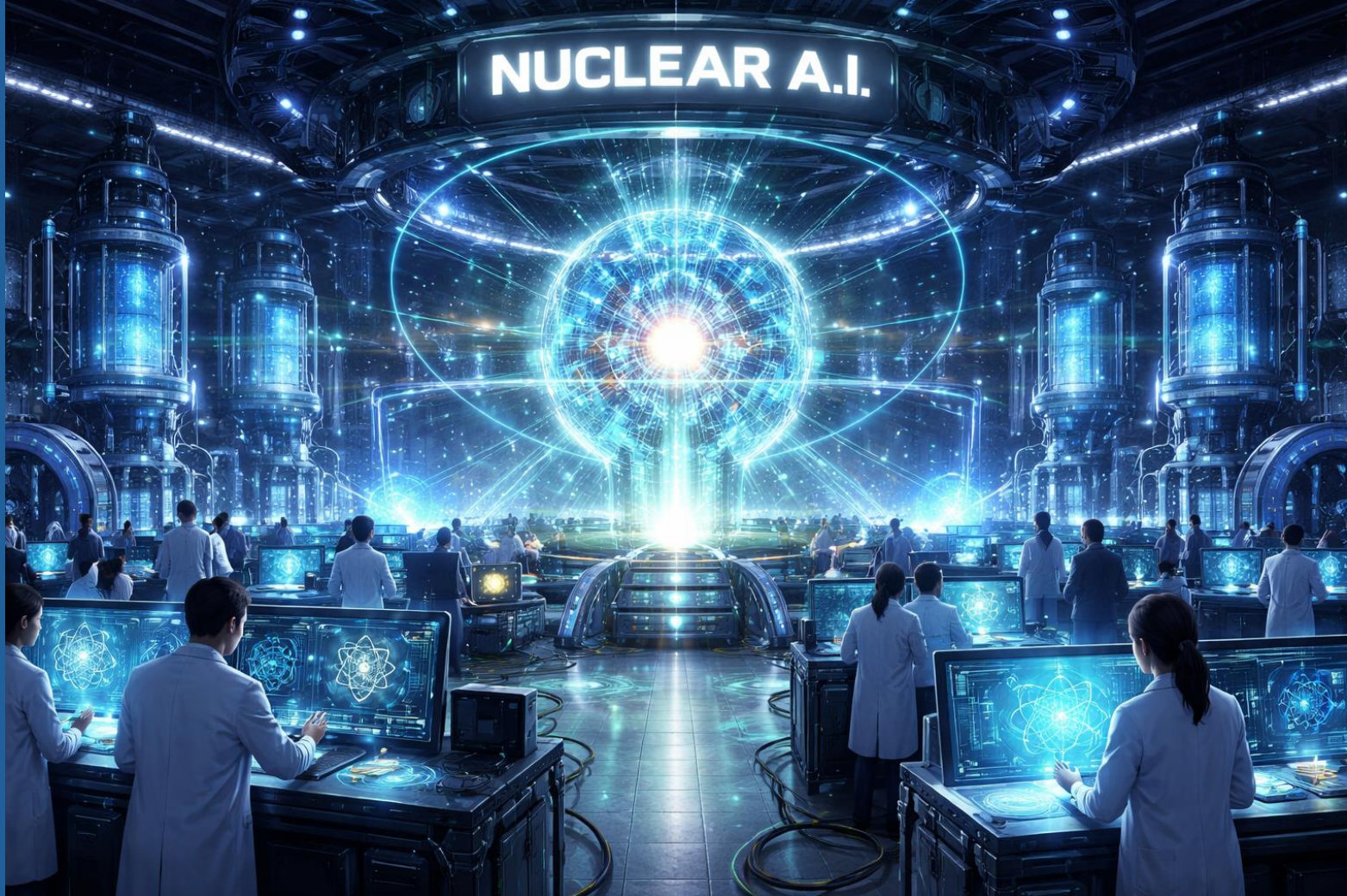
Caroline Shenton-Taylor
University of Surrey

Ren Cooper
Lawrence Berkeley National Laboratory

Jack Henderson
University of Surrey

Kimberely Lennon
UK Atomic Energy Authority, Sheffield Hallam University

Philip Martin
AWE Nuclear Security Technologies



What would make participation in this community valuable for you?