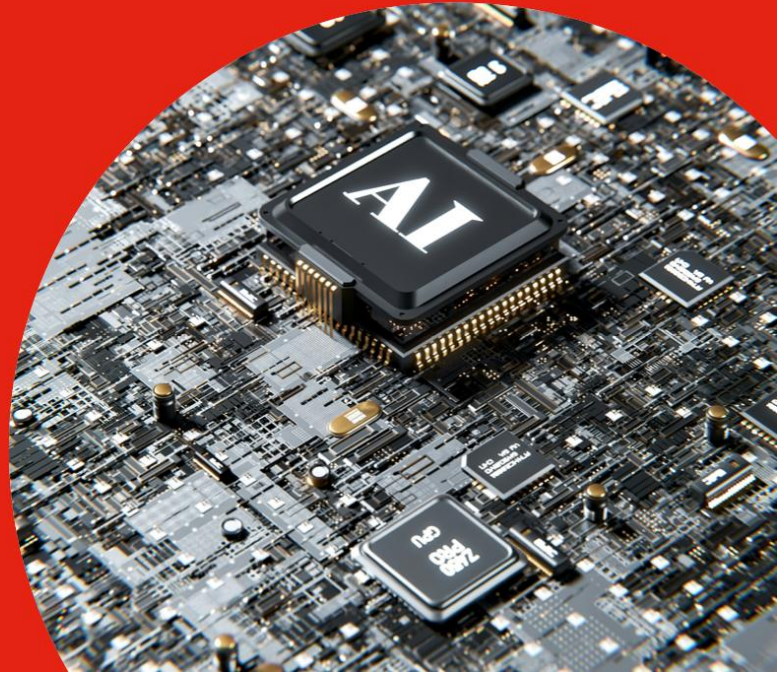# Physics for AI and AI for Physics

Institute of Physics, London, UK

**Survey results**

# The survey

The survey ran September-October 2024

The survey looked at the **level of experience with AI**

*Does your role involve the use of AI?*

*Do you collaborate, or have you been collaborating with any of the following on AI-related projects?*

*If you use AI in your role and/or elsewhere, what types of tasks do you use it for?*

*How would you identify your level of experience with different AI topics?*

## views on AI

*Do you think that AI offers potential benefits to physics research and innovation in the UK and Ireland? Where do you think AI might offer greatest potential benefit in physics research and innovation?*

*Do you think that the use of AI carries any concerns to physics research and innovation in the UK and Ireland? Which are your potential greatest concerns regarding AI in physics research and innovation?*

*What areas do you see as important to make the most of AI for physics and innovation and would like the IOP to advocate for?*
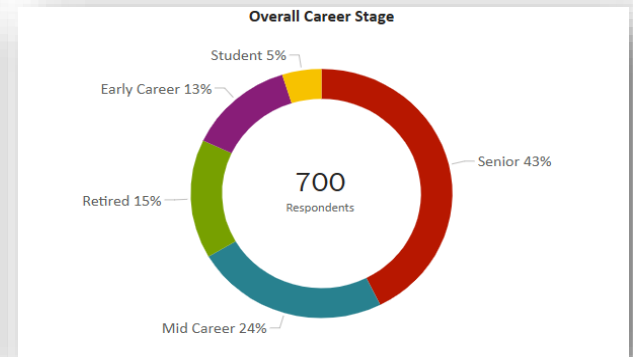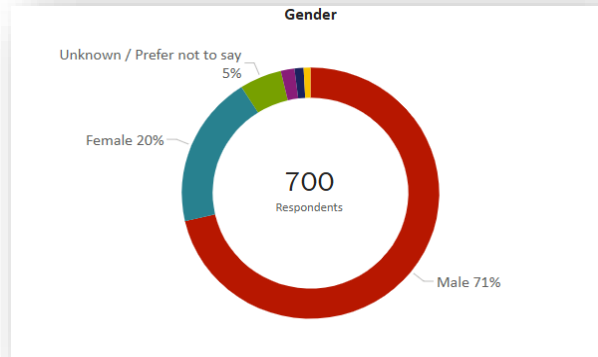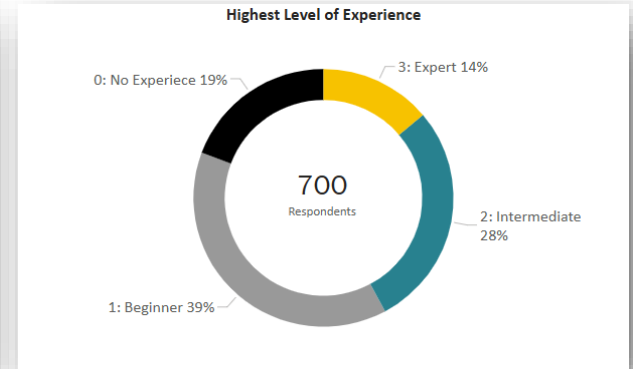
# Who responded

700 complete responses

90% were IOP members

43% at a senior career stage

>70% male

14% considered themselves expert in at least one AI-related technology



**IOP Member?**
700 Respondents
No 10%
Yes 90%

**Highest Level of Experience**
700 Respondents
0: No Experiece 19%
3: Expert 14%
2: Intermediate 28%
1: Beginner 39%

**Gender**
700 Respondents
Unknown / Prefer not to say 5%
Female 20%
Male 71%

**Overall Career Stage**
700 Respondents
Student 5%
Early Career 13%
Senior 43%
Retired 15%
Mid Career 24%
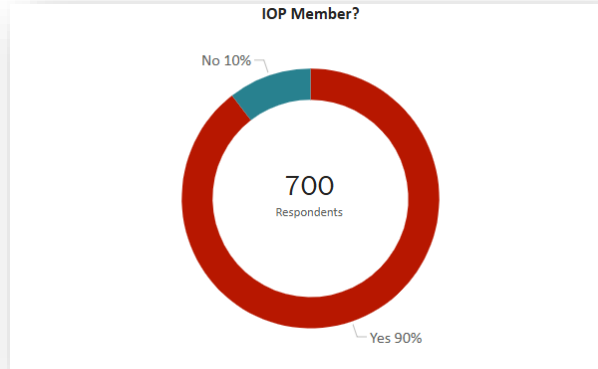
# Who responded

~40% are academics

~30% work in the private sector

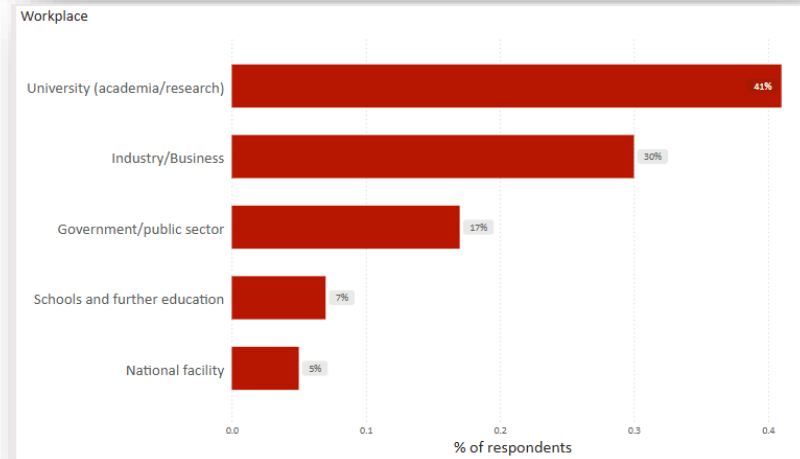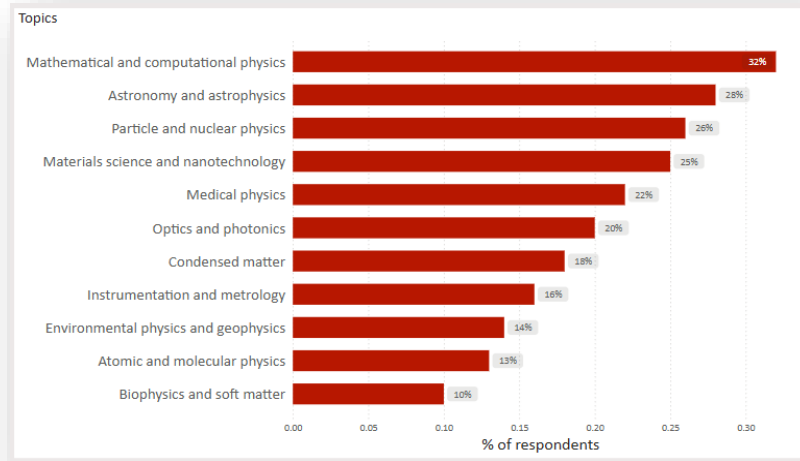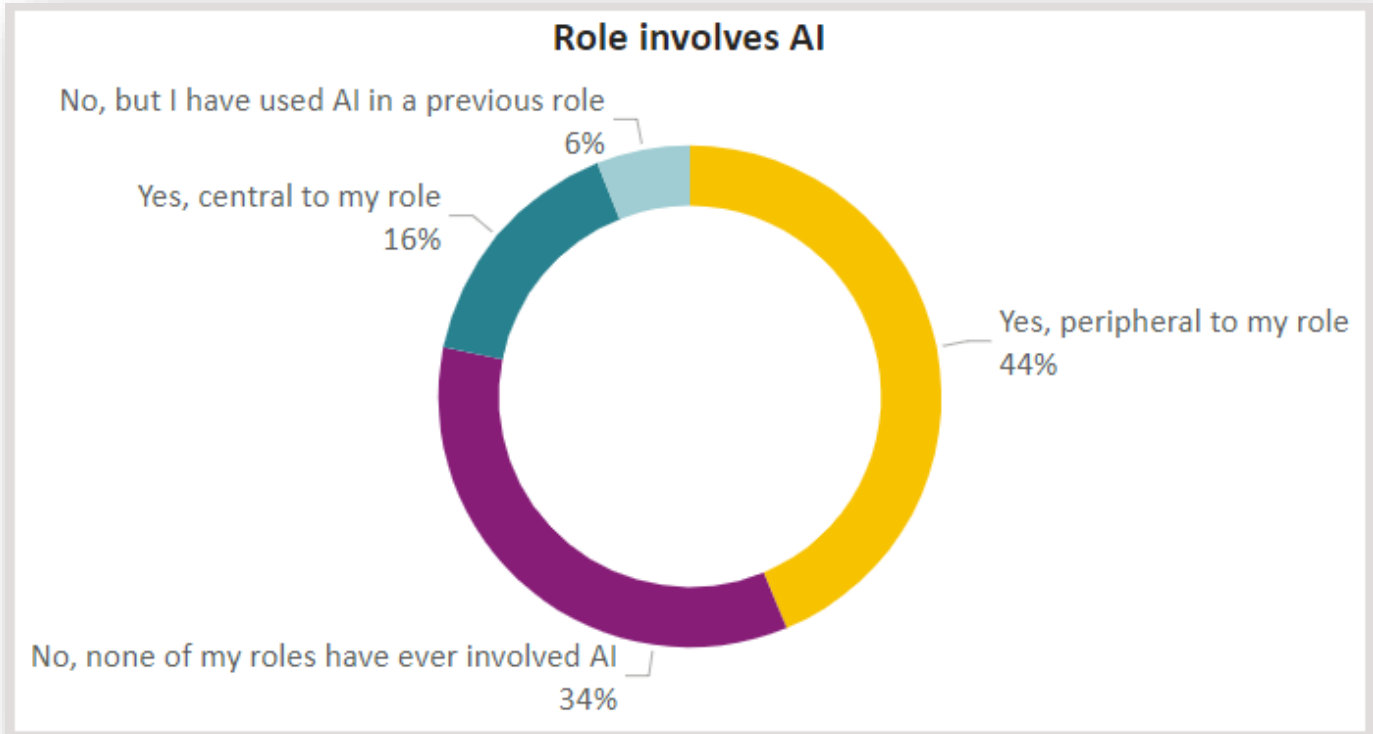Most popular physics topics of interest were **mathematical and computational physics, astronomy and astrophysics, and particle and nuclear physics**



Topics

| Topic | % of respondents |
|---|---|
| Mathematical and computational physics | 32% |
| Astronomy and astrophysics | 28% |
| Particle and nuclear physics | 26% |
| Materials science and nanotechnology | 25% |
| Medical physics | 22% |
| Optics and photonics | 20% |
| Condensed matter | 18% |
| Instrumentation and metrology | 16% |
| Environmental physics and geophysics | 14% |
| Atomic and molecular physics | 13% |
| Biophysics and soft matter | 10% |

Workplace

| Workplace | % of respondents |
|---|---|
| University (academia/research) | 41% |
| Industry/Business | 30% |
| Government/public sector | 17% |
| Schools and further education | 7% |
| National facility | 5% |

**Q:** *Does your role involve the use of AI?*



**Role involves AI**

- No, but I have used AI in a previous role — 6%
- Yes, central to my role — 16%
- Yes, peripheral to my role — 44%
- No, none of my roles have ever involved AI — 34%
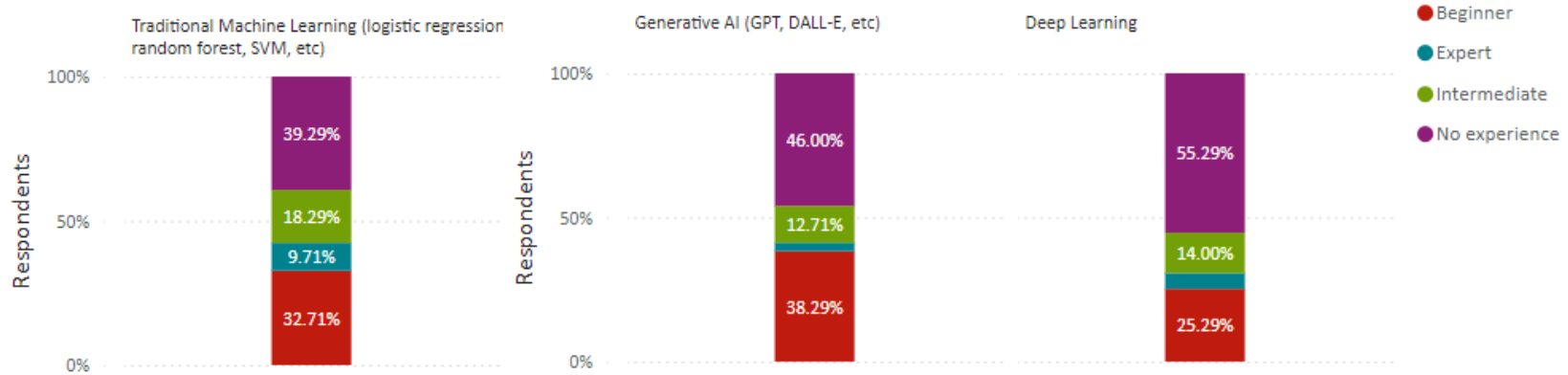
According to ONS, 25% of people in UK used AI
in their work or education in the past 12 months

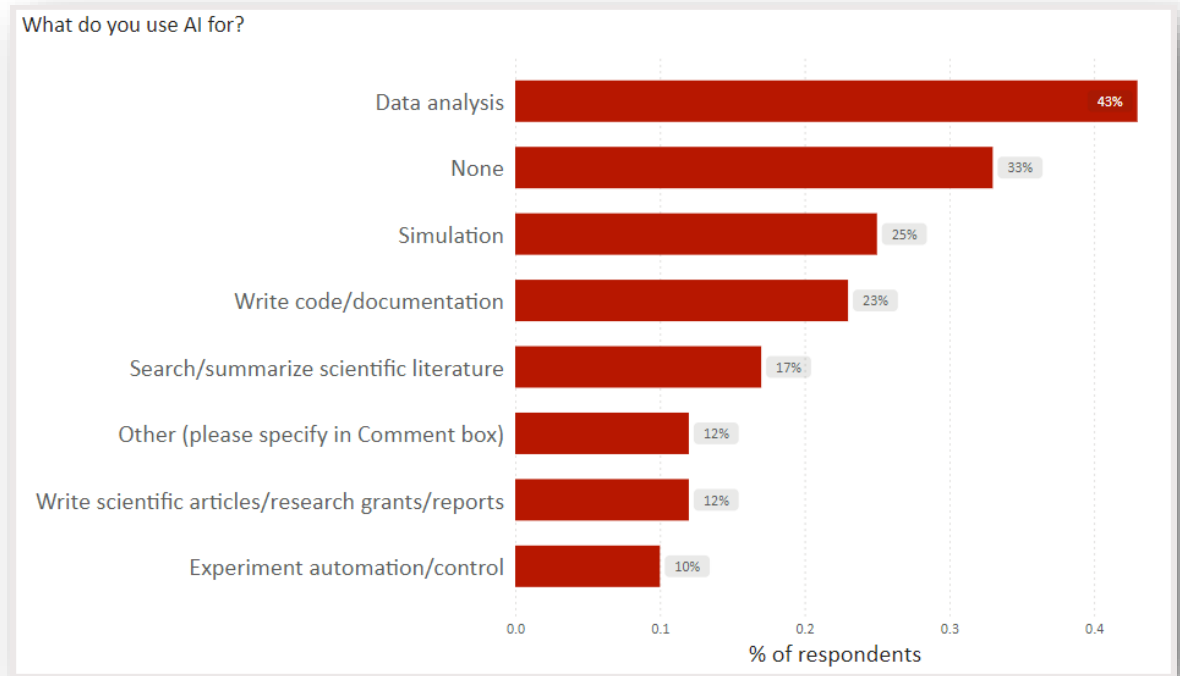IOP Institute of Physics

# Highest level of experience
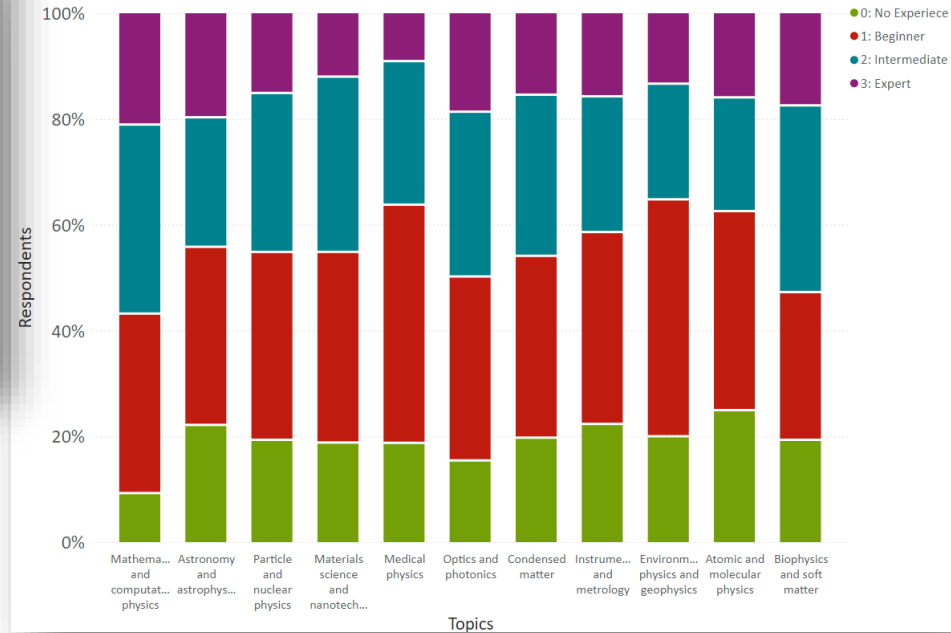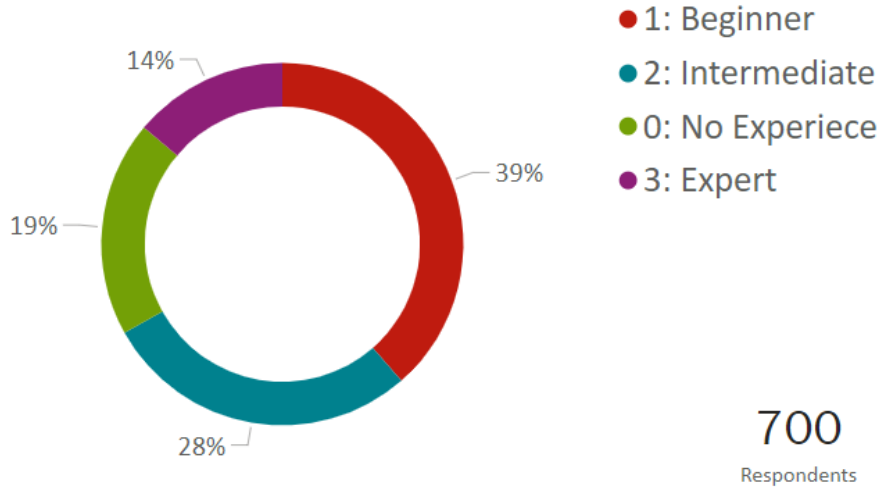
# Experience with different AI technologies

**Q:** *What do you use AI for?*

Top uses of AI are in **data analysis, simulation and writing code/documentation**.

This does not change much across physics disciplines or age groups



What do you use AI for?

| Category | % of respondents |
|---|---|
| Data analysis | 43% |
| None | 33% |
| Simulation | 25% |
| Write code/documentation | 23% |
| Search/summarize scientific literature | 17% |
| Other (please specify in Comment box) | 12% |
| Write scientific articles/research grants/reports | 12% |
| Experiment automation/control | 10% |

% of respondents

**IOP** Institute of Physics

## Q: *Do you collaborate on AI-related projects?*
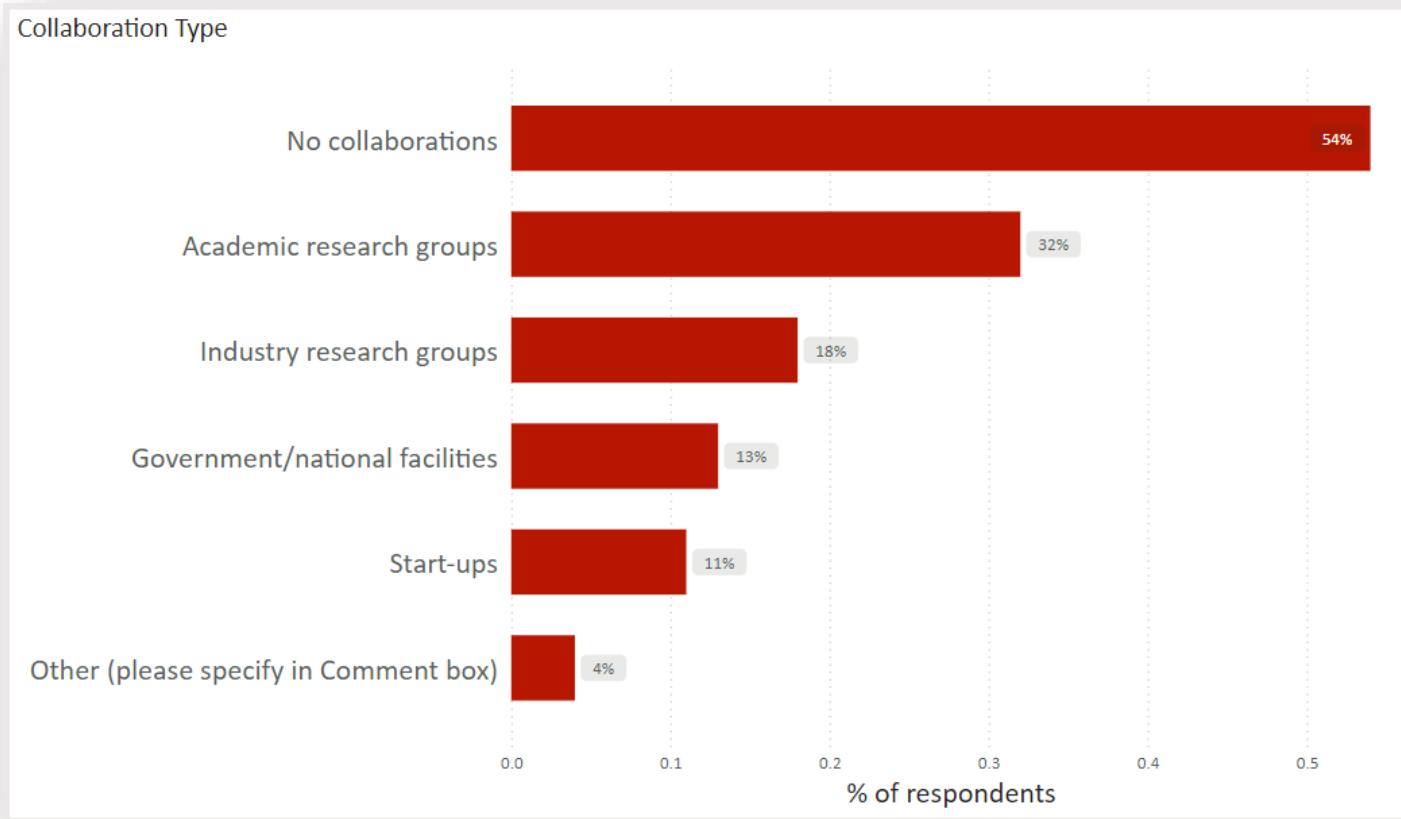
**Q:** *Do you think that AI offers potential **benefits** to physics research and innovation?*

**3/4** of the respondents answered **YES**

That view that doesn't change much across
physics disciplines and career levels

but rises to **4/5** for those who have used AI in their roles
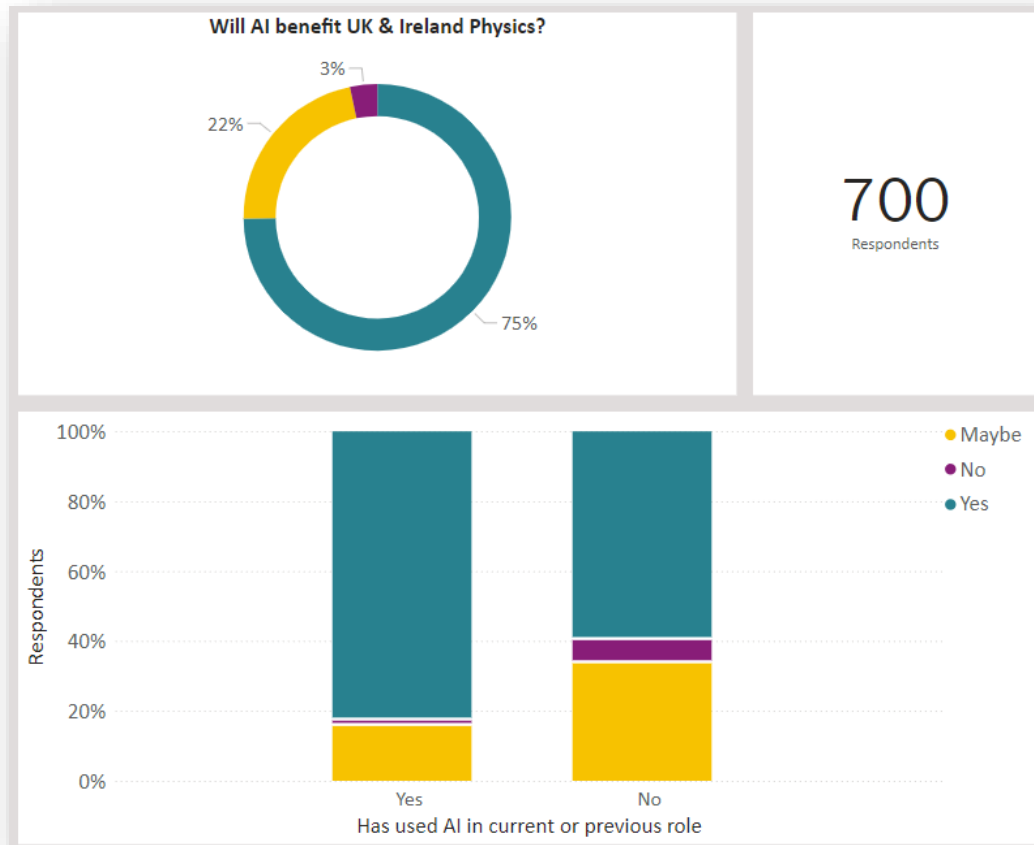


**Will AI benefit UK & Ireland Physics?**

3%
22%
75%

700
Respondents

- Maybe
- No
- Yes

Respondents

100%
80%
60%
40%
20%
0%

Yes    No
Has used AI in current or previous role

**Q:** *Where do you think AI might offer **greatest potential benefit** in physics research and innovation?*



Main Benefits

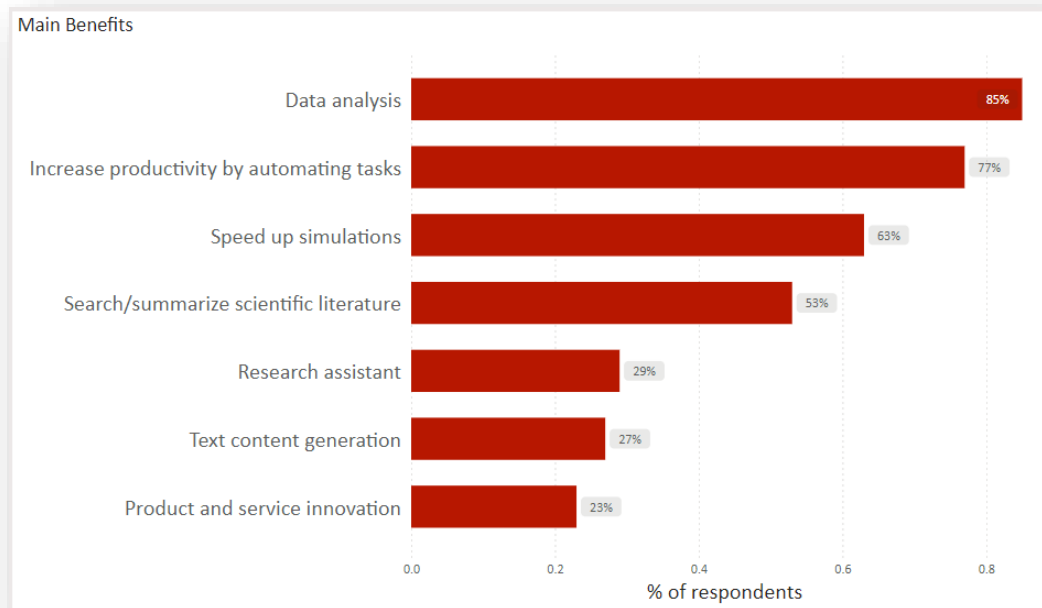| Benefit | % of respondents |
|---|---|
| Data analysis | 85% |
| Increase productivity by automating tasks | 77% |
| Speed up simulations | 63% |
| Search/summarize scientific literature | 53% |
| Research assistant | 29% |
| Text content generation | 27% |
| Product and service innovation | 23% |

% of respondents

**Q:** *Do you think that the use of AI carries any **concerns** to physics research and innovation?*

Over **2/3** of the respondents answered **YES**, a view that does not change dramatically across age groups, career levels, physics disciplines, economic sectors, and levels of expertise with AI-related technologies
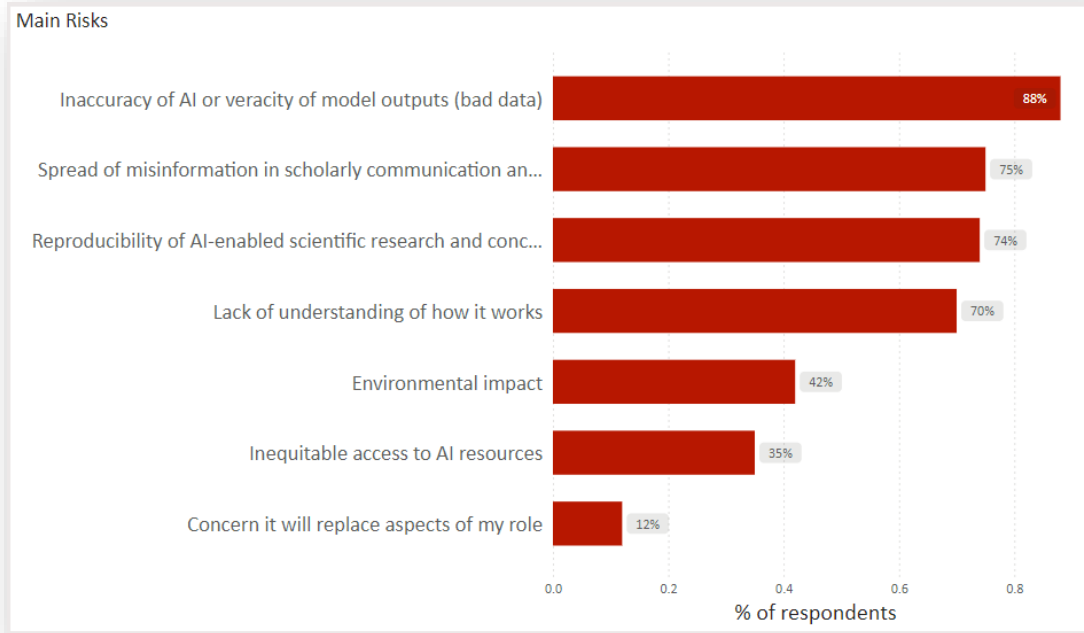


IOP Institute of Physics

**Q:** *Which are your potential* **greatest concerns** *regarding AI in physics research and innovation?*



Main Risks

| Risk | % of respondents |
|------|------------------|
| Inaccuracy of AI or veracity of model outputs (bad data) | 88% |
| Spread of misinformation in scholarly communication an... | 75% |
| Reproducibility of AI-enabled scientific research and conc... | 74% |
| Lack of understanding of how it works | 70% |
| Environmental impact | 42% |
| Inequitable access to AI resources | 35% |
| Concern it will replace aspects of my role | 12% |
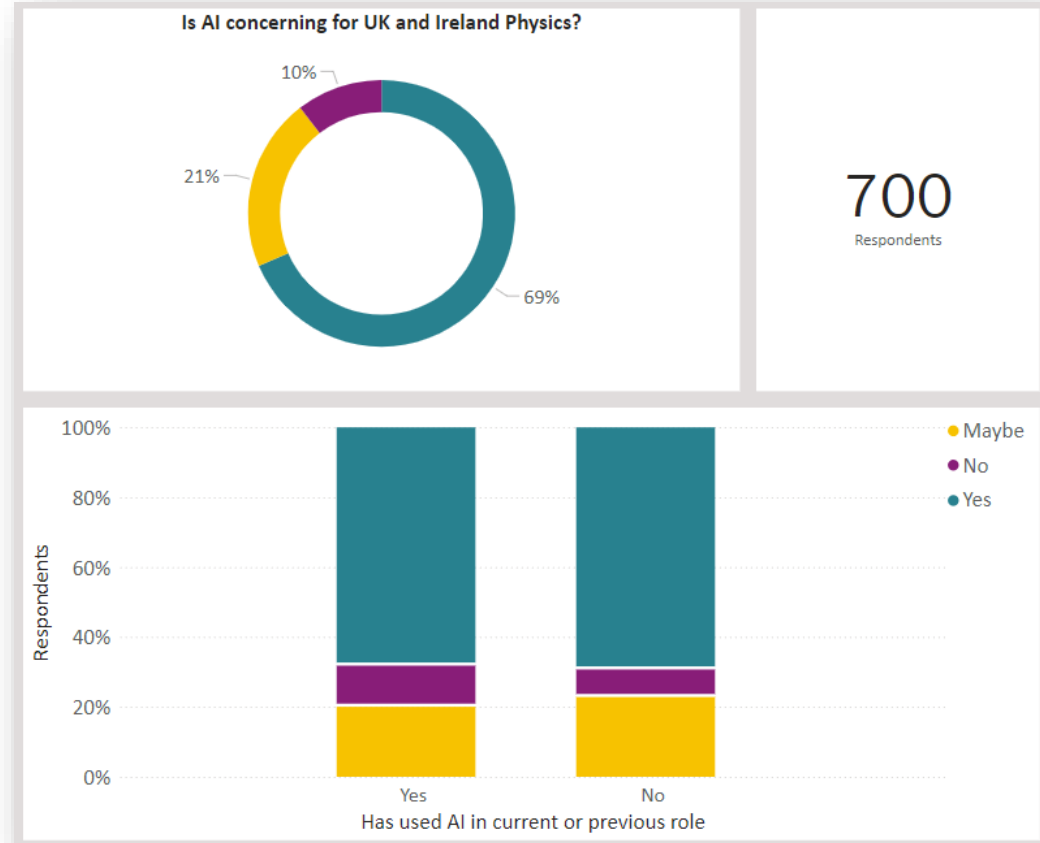
% of respondents

# Other concerns

**Loss of critical thinking/physical understanding**

- *"Loss of basic understanding of physics models and too great a reliance on AI to build models rather than thinking about things from first principles. **End up with a generation of 'physicists' who don't know how to do real physics**."*

**Changes how we do research**

- *"I have strong reservations - **while there is much potential benefit, we also lose a lot - in certainty and repeatability of results for starters, without which we don't have 'science' anymore**."*

**Environment**

- *"**We physicists are very well placed to understand our precise impact on the environment, and we have a responsibility to minimise it**. We therefore should avoid using more power-hungry technologies save where we are certain the benefit significantly outweighs the costs."*

# Take-home messages

97% of respondents think that **AI has or might have some benefits**

90% of respondents think that **AI has or might have some risks**

66% of respondents **have used AI at some point**

For 16% of respondents **AI is central** to their current role and for 44% **AI is peripheral** to their current role

25% of respondents use AI for **data analysis**, 14% for **simulation** and 13% for **writing code/documentation**

In general, views do not change much across age groups, career levels, physics disciplines, economic sectors, and levels of expertise with AI-related technologies. An in-depth analysis will reveal differences, if any.

**Q:** *What areas do you see as important to make the most of AI for physics and innovation and would like the IOP to advocate for?*
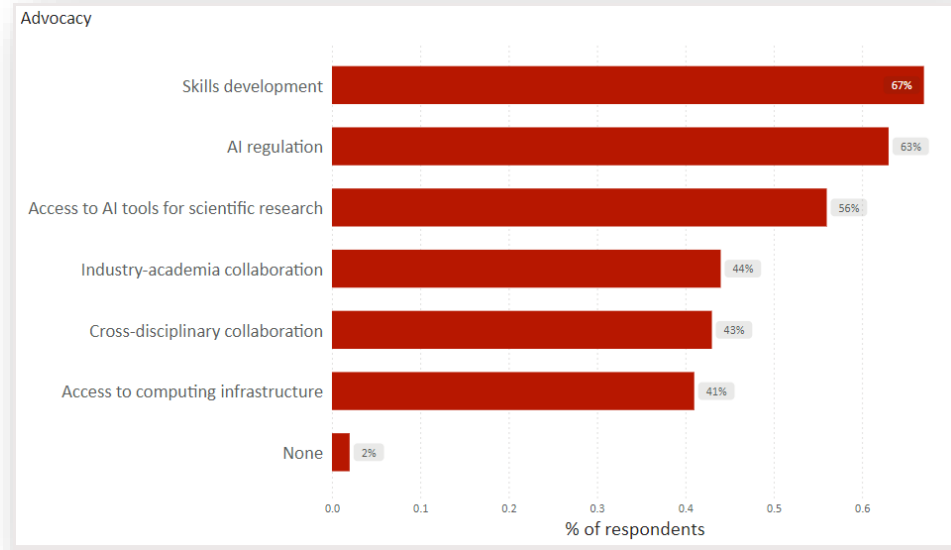
## Regulation
- *"Regulation! We need to be led by competent and flexible regulation"*
- *"Remove all regulations"*
- Standards

## Training
- Code of best practice
- Education about the limitations of AI

## Environment
- *"Environmentally responsible use of AI given the energy requirements"*
- *"Wider recognition of the environmental / energy impact"*



Advocacy

| | % of respondents |
|---|---|
| Skills development | 67% |
| AI regulation | 63% |
| Access to AI tools for scientific research | 56% |
| Industry-academia collaboration | 44% |
| Cross-disciplinary collaboration | 43% |
| Access to computing infrastructure | 41% |
| None | 2% |

# Guide to limitations and Code of best practice

*"**Training to understand when the results can be relied upon**, and losing this trend of using a magic black box without careful interpretation and judgement"*

*"Education about what it can and CANNOT do. The importance of understanding things BEFORE applying AI to a problem"*

*"Greater public understanding of what AI is and does, its benefits and its limitations."*

*"A lot of education is needed for users to understand what the limitations are of AI."*

*"**Broad general education on the uses and limitations of AI** so that those not directly involved in its use have realistic expectations of what it can achieve."*

*"**Develop a code of best practice**"*

*"Access to guidance on best practice, this is more than just skills development"*

*"**Code of practice needs to be developed**, and the current speed of technology development is overtaking the community's ability to understand the implications of AI use, understand suitable mitigation strategies (NB this is not the same as understanding "how it works"), and reach consensus about best practice"*