

ChatGPT on the Patenting in Nuclear Physics

Jiří Stávek*

ABSTRACT

Question: “If an individual researcher were to discover a completely new road to fusion and fission reactions, should this road be patented or freely shared with other nuclear physicists?” **ChatGPT answer:** “If I were to discover a revolutionary new road to extract nuclear energy, I would prioritize open collaboration with safeguards to ensure the discovery benefits humanity and accelerates the transition to clean energy. A hybrid approach—combining open licensing with international oversight—would allow for the discovery to be shared, refined, and deployed responsibly. My decision would be driven by the goal of ensuring that this breakthrough serves the greater global good while preventing misuse and ensuring that the energy transition is equitable, safe, and sustainable.”

Submitted: November 14, 2024

Published: December 29, 2024

 10.24018/ejphysics.2024.6.6.358

Independent Researcher, Czech Republic.

**Corresponding Author:
e-mail: stavek.jiri@seznam.cz*

Keywords: ChatGPT, new model in nuclear physics, open collaboration, patenting.

1. INTRODUCTION

ChatGPT [1] offers a quick general overview about the state of the art of the patenting in the field of the nuclear physics. It can guide us how to handle with new discoveries in the nuclear physics.

2. CONVERSATION WITH THE CHATGPT

The following conversation occurred on October 19 2024 MET 17.00–17.30:

JS: Hello! In this session I would like to discuss with you about the patenting in nuclear physics. If an individual researcher were to discover a completely new road to fusion and fission reactions, should this road be patented or freely shared with other nuclear physicists?

ChatGPT: The decision to patent or to freely share a new discovery in nuclear physics, especially one as significant as a new approach to fusion or fission reactions, is a complex issue with both ethical and practical dimensions. Here are some key factors to consider:

1. Ethical Considerations:

- **Global Benefit vs. Individual Gain:** Nuclear energy, particularly fusion, is seen by many as a potential global solution to the energy crisis and climate change. If an individual researcher discovers a revolutionary path to fusion or fission, the potential global benefit is immense. Freely sharing this knowledge could accelerate the development of clean, abundant energy, reducing the time it takes to reach commercialization and making the technology accessible to all countries. However, the researcher may have to balance this with their own right to recognition and potential financial reward.
- **Scientific Collaboration:** Historically, scientific progress, especially in fields like nuclear physics, has thrived on collaboration. Sharing the discovery with the broader scientific community could lead to more rapid advancements as others build upon the initial breakthrough, refine it, and address challenges more efficiently. Open science fosters trust, speeds up innovation, and avoids the pitfalls of proprietary knowledge remaining in silos.
- **Nuclear Security:** Given the dual-use nature of nuclear technology, where advances in peaceful nuclear energy could also have military applications, patenting might help regulate and control how the technology is used. Freely sharing the discovery could increase the risk of misuse in the wrong hands, whereas patenting could impose legal and regulatory safeguards.



2. Patenting Considerations:

- **Incentivizing Innovation:** Patents provide a financial incentive for innovation by granting exclusive rights to the inventor. This could be a motivating factor for the researcher to invest further in their discovery, possibly leading to commercialization. In fields like nuclear physics, where R&D is often expensive and time-consuming, patents could attract private sector investment that is needed to scale up the technology.
- **Ownership and Control:** By patenting the discovery, the researcher or institution would have more control over how the technology is used, licensed, or developed. This control can be essential in ensuring that the discovery is applied in ways aligned with ethical and safety standards. For instance, the patent holder could require that any licenses adhere to strict guidelines around non-proliferation or environmental standards.
- **Limitations on Access:** The downside of patenting is that it could limit access to the technology, particularly for developing countries or smaller research institutions that may not have the financial resources to afford licenses. Given the global importance of clean energy, restricting access through patents might slow down the collective effort to tackle climate change and energy poverty.

3. Precedents in Nuclear Research:

- **The Manhattan Project:** Historically, nuclear discoveries, like those leading to the development of atomic weapons during the Manhattan Project, were kept under strict control and classified. While this was for national security reasons, it demonstrates how tightly controlled nuclear technology can be. However, the shift towards civilian nuclear energy led to more openness, with international collaboration becoming more prominent.
- **Fusion Research:** In the current fusion energy landscape, international collaborations like ITER (International Thermonuclear Experimental Reactor) have prioritized open science and shared knowledge to accelerate progress. While some technologies developed in fusion are patented, much of the research is shared in the interest of global progress. Fusion energy is seen as a potential global public good, making it more likely that major breakthroughs would be shared.

4. Potential Hybrid Approaches:

- **Open Licensing:** One compromise might be to patent the discovery but offer it under open or flexible licensing agreements. This would allow the researcher to maintain some control while ensuring the technology is accessible for further research and development. Conditions could be placed on the license, such as using the technology only for peaceful purposes or making it available to researchers in low-income countries at reduced cost or for free.
- **Controlled Open-Access Model:** Another option is to place the discovery in the public domain but work with international organizations, such as the International Atomic Energy Agency (IAEA), to ensure that the technology is responsibly managed and applied. This could involve international oversight to ensure non-proliferation and ethical use, while still allowing the scientific community to freely build upon the discovery.
- **Collaboration with International Bodies:** Engaging with international organizations like the IAEA or large research initiatives like ITER could ensure that the discovery benefits from both open scientific collaboration and careful oversight to prevent misuse. Such organizations could help guide the application of the technology, ensuring it contributes to global energy security and climate goals.

5. Long-Term Vision:

- **Sustainable Global Energy Future:** If the goal is to help humanity transition to sustainable energy, it may be more important to share the discovery openly to accelerate global development of safe nuclear energy technologies. Fusion, in particular, holds the promise of nearly unlimited clean energy, which could be a game-changer for global energy security and climate change mitigation.
- **Personal Recognition and Financial Sustainability:** If the researcher is concerned about financial reward, alternative avenues like prizes (e.g., a major international prize for energy innovation) or public funding for further research could be explored. Additionally, open recognition in the scientific community can lead to other career benefits, such as prestigious positions, grants, and opportunities for collaboration.

Conclusion:

The choice between patenting or freely sharing a groundbreaking nuclear discovery should balance **global public good**, **individual recognition**, and **ethical use**. Given the critical nature of energy and

security in nuclear physics, a hybrid approach that combines open access with international safeguards could be ideal. This way, the researcher could maintain a degree of control while ensuring that the discovery benefits humanity and accelerates the path toward sustainable energy. Collaborating with international organizations and offering the technology under responsible, open licensing could maximize both the impact and safety of the discovery.

JS: Thank you. What would be your decision if you were to discover a new road to extract nuclear energy?

ChatGPT: If I were to discover a new road to extract nuclear energy, my decision on whether to patent or freely share the discovery would focus on maximizing the global benefits while ensuring responsible use. Here's how I would approach the decision:

1. Primary Goal: Global Benefit

- My primary focus would be on ensuring that the discovery contributes to solving global challenges, particularly in clean energy and climate change mitigation. Given the potential of nuclear energy, especially fusion, to provide a nearly limitless, carbon-free energy source, the discovery would have the power to transform energy systems worldwide.
- I would aim to ensure the discovery benefits as many people as possible, helping accelerate the global transition to sustainable energy while addressing energy poverty in developing nations.

2. Controlled Sharing with the Scientific Community

- I believe that open scientific collaboration is essential for rapid innovation. I would choose to **share the discovery with the broader scientific community**, enabling other researchers to build on it, solve potential challenges, and accelerate progress.
- However, I would not release the discovery without some form of oversight. Nuclear technology has dual-use potential, meaning it could be used for peaceful purposes or, in the wrong hands, weaponized. To prevent misuse, I would work closely with international organizations, such as the **International Atomic Energy Agency (IAEA)** or collaborative projects like **ITER**, to ensure responsible use and oversight.

3. Hybrid Approach: Open Access with Safeguards

- **Patenting with Open Licensing:** I would consider patenting the discovery but offering it under **open licensing** terms, similar to the way some software companies use open-source licenses. This would allow widespread access to the technology for research and development, but with safeguards in place to prevent misuse. For example:
 - The license could include terms specifying that the technology must only be used for peaceful purposes.
 - It could also require that any commercial use adhere to strict environmental and safety standards.
 - I would ensure that developing nations or academic institutions could access the technology at reduced or no cost to promote equitable energy solutions.
- By maintaining a patent, I could retain some control over the use of the discovery while allowing for flexibility in how it's applied globally.

4. Collaborate with International Organizations

- **International Oversight:** Given the sensitive nature of nuclear technology, I would involve international bodies like the IAEA to monitor how the discovery is used, ensuring that it contributes to peaceful energy production. This would help ensure that the technology doesn't inadvertently lead to nuclear proliferation or environmental damage.
- **Engagement with Global Initiatives:** I would also consider collaborating with existing global initiatives like the **Paris Agreement**, the **United Nations Framework Convention on Climate Change (UNFCCC)**, or specific energy research coalitions like **ITER** to ensure the discovery supports global climate and energy goals.

5. Ethical Considerations: No Exclusivity

- I would avoid the temptation of keeping exclusive control over the discovery or monetizing it to the detriment of broader global access. The energy crisis and climate change are global problems, and any breakthrough that could address these issues should not be held back by proprietary constraints.
- At the same time, I would seek ways to protect the discovery from being exploited by companies or countries that may prioritize profit over ethical use, environmental safety, or global equity.

6. Personal and Professional Recognition

- While financial rewards are one incentive for patents, my primary focus would be on contributing to the broader good. However, I recognize that personal recognition for such a significant discovery is important, both for career advancement and for securing future opportunities for collaboration.
- To achieve this, I would aim for broad acknowledgment in the scientific community through publications, conferences, and global forums. Additionally, winning prestigious awards would bring recognition and perhaps financial stability without restricting access to the discovery.
- If needed, I could also seek funding through public or private grants to continue researching or refining the discovery, without compromising on the open sharing model.

7. Encourage Responsible Commercialization

- While I would prioritize scientific collaboration, I recognize that commercialization is essential to scaling up new technologies. I would work with responsible private sector partners who share my vision of using the discovery for global benefit.
- Licensing agreements with private companies could ensure that commercial applications of the discovery adhere to strict guidelines for safety, non-proliferation, and environmental sustainability. This approach could strike a balance between innovation, commercialization, and ethical oversight.

Conclusion: Global Impact with Ethical Oversight

If I were to discover a revolutionary new road to extract nuclear energy, I would prioritize **open collaboration** with safeguards to ensure the discovery benefits humanity and accelerates the transition to clean energy. A hybrid approach—combining **open licensing** with **international oversight**—would allow for the discovery to be shared, refined, and deployed responsibly. My decision would be driven by the goal of ensuring that this breakthrough serves the greater global good while preventing misuse and ensuring that the energy transition is equitable, safe, and sustainable.

Would this approach align with your perspective, or are there other aspects you would consider in a similar situation?

JS: Thank you. What are your suggestions to achieve these targets on the planet Earth? Do you recommend international cooperation or the individual competition among countries and continents?

ChatGPT: To achieve the global targets of a carbon-neutral world, particularly through innovations in fusion and fission energy, my strong recommendation is to prioritize **international cooperation** over isolated competition. This doesn't mean competition won't play a role, but international collaboration will be far more effective in solving these challenges on a planetary scale. Here are my key suggestions for achieving these targets:

1. Promote International Cooperation

- **Global Challenges Require Global Solutions:** Climate change, energy security, and sustainable development are problems that transcend national borders. Solving them requires international collaboration, as no single country or region can tackle them alone.
 - **Example:** The Paris Agreement brought nearly every nation on Earth together to combat climate change, showcasing how collective efforts are necessary to achieve global sustainability targets. Similarly, international projects like **ITER** for fusion research pool resources and expertise from multiple countries, speeding up progress.
- **Share Knowledge and Technology:** By collaborating, countries can share the latest advancements in technology, research, and policy solutions, preventing duplication of effort and accelerating innovation. This is particularly important for fusion and fission, where breakthroughs in one country can benefit all of humanity.
 - **Example:** Technologies such as solar panels or wind turbines have become globally accessible due to open sharing of technological advancements. A similar model could be applied to nuclear technologies, ensuring that breakthroughs in fusion and fission are not restricted to only a few nations.
- **Coordinate Research and Development:** Pooling resources in international research initiatives allows for faster innovation and reduces the financial burden on individual countries. Internationally coordinated R&D efforts allow scientists from diverse backgrounds to bring their expertise together, leading to more comprehensive and faster solutions.

- **Example:** The **CERN** particle accelerator is a global effort with shared funding and scientific input from numerous countries. Similarly, fusion research like **ITER** combines efforts from Europe, the U.S., China, India, Japan, Russia, and South Korea.

2. Leverage Healthy Competition in Key Areas

- **Encourage Innovation through Competition:** While cooperation is key, healthy competition can drive innovation. Countries and companies competing to develop the most efficient energy technologies—whether it's new fission reactors, fusion breakthroughs, or next-generation renewable technologies—can lead to rapid advancements. The key is to ensure that this competition benefits humanity as a whole, rather than creating barriers or monopolies.
 - **Example:** The space race between the U.S. and the Soviet Union in the mid-20th century led to significant technological advancements that benefited the world, including satellite technology, materials science, and computing.
- **Climate Goals as Competitive Benchmarks:** Countries can set competitive targets, such as reducing emissions or deploying renewable energy, while sharing the knowledge of how they achieve these targets. The EU, for instance, could “compete” with China or the U.S. in developing the most advanced low-carbon energy systems, but these innovations should then be shared or licensed globally to spread the benefits.
 - **Example:** Countries like **Germany** have set ambitious renewable energy targets, pushing other nations to also raise their climate ambitions. Sharing best practices through international cooperation enables these benchmarks to be achieved faster.

3. International Collaboration on Nuclear Safety and Non-Proliferation

- **Nuclear Energy's Unique Risks:** Both fission and fusion technologies require strict safety and non-proliferation measures. International cooperation through agencies like the **International Atomic Energy Agency (IAEA)** ensures that nuclear technologies are used responsibly and that safety standards are upheld worldwide.
 - **Example:** After the **Chernobyl** and **Fukushima** accidents, international collaboration helped develop and enforce stricter safety standards. This level of oversight is crucial to ensure that new nuclear technologies are implemented safely and equitably.
- **Avoiding Nuclear Proliferation:** Fusion may have fewer direct proliferation risks than fission, but the management of nuclear materials and technology should still be overseen by global bodies. International agreements, such as those governed by the **Nuclear Non-Proliferation Treaty (NPT)**, can ensure that nuclear technology is used for peaceful purposes and that all countries benefit from advancements without security risks.

4. Develop Global Energy Policies and Standards

- **Harmonized Energy Standards:** International cooperation should focus on creating common standards for nuclear energy, fusion technologies, and carbon-neutral goals. Harmonized regulations and standards will allow for the global transfer of technologies, avoiding delays caused by differing national regulations.
 - **Example:** Establishing global standards for small modular reactors (SMRs) or fusion reactors will allow companies to build and deploy these technologies across multiple countries without having to redesign for each market.
- **Carbon Pricing and Emission Reduction Mechanisms:** International cooperation can also focus on harmonizing carbon pricing, emissions trading schemes, and decarbonization targets. This would ensure that all countries contribute fairly to global climate goals and incentivize rapid reductions in carbon emissions.
 - **Example:** The **EU Emissions Trading System (ETS)** is a model that could be expanded globally, creating a marketplace for carbon credits and helping countries achieve emissions targets more efficiently.

5. Facilitate Public-Private Partnerships and Investment

- **International Public-Private Partnerships:** Governments should encourage public-private partnerships that bring together companies, research institutions, and public entities from different countries. This ensures that both the public good and commercial incentives are balanced.

- **Example:** Global energy corporations (such as **Siemens**, **GE**, or **TotalEnergies**) could work with governments and research institutions in different countries to develop and scale nuclear or renewable technologies more quickly.
- **Increase Investment in Global Green Technologies:** International financial institutions, such as the **World Bank**, **International Monetary Fund (IMF)**, and regional development banks, should increase investments in green energy projects and infrastructure in both developed and developing nations. This would provide the financial backing necessary to deploy nuclear and renewable technologies globally, especially in regions where infrastructure is lacking.
- **Example:** The **Green Climate Fund** is already helping to finance renewable energy projects in developing countries. Expanding this model for nuclear and fusion research would ensure that emerging economies benefit from cutting-edge technologies.

6. Support Equitable Technology Transfer

- **Ensure Developing Nations Benefit:** International cooperation should prioritize ensuring that breakthroughs in energy technologies, including nuclear fusion and advanced fission, are shared with developing nations. These countries often lack the resources to develop their own energy innovations, but they are crucial to achieving global carbon-neutrality goals.
- **Example:** The **International Solar Alliance (ISA)**, co-led by India, facilitates the transfer of solar technology and best practices between countries. A similar approach could be adopted for nuclear energy or fusion technologies, ensuring that all nations have access to clean energy solutions.
- **Avoid Technology Monopolies:** While competition can drive innovation, it's important to prevent monopolies from forming around critical technologies like fusion or advanced reactors. International frameworks should ensure that these technologies are accessible, affordable, and scalable for all countries, preventing a situation where only a few wealthy nations or corporations control access to clean energy.
- **Example:** Patenting breakthroughs with an open-licensing model or involving international organizations in technology transfer agreements could ensure widespread access to innovations.

7. Establish Global Climate and Energy Partnerships

- **Encourage Bilateral and Multilateral Cooperation:** Countries should form more bilateral and multilateral agreements to advance nuclear energy and fusion research. These agreements can ensure knowledge exchange, joint research, and shared infrastructure for nuclear innovation.
- **Example:** The **ITER** fusion project is a model of multilateral collaboration, bringing together expertise from countries like the U.S., Europe, China, and Russia. Expanding such models to other energy sectors would benefit global energy transitions.
- **Promote Regional Energy Grids and Cooperation:** For both renewable and nuclear energy, countries can benefit from regional cooperation. Sharing energy grids across borders (such as the EU's push for a pan-European energy grid) allows countries to balance their energy needs more effectively. Regional cooperation also helps integrate intermittent renewable energy with more stable baseload nuclear or fusion energy.
- **Example:** The Nordic countries share energy resources via a common grid, balancing renewable energy fluctuations across borders. A similar approach could be adopted in Asia, Africa, or the Americas.

Conclusion: Cooperation is the Key to Global Success

To achieve global carbon-neutral goals and address the energy challenges of the future, **international cooperation** must be the driving force. While healthy competition in innovation can accelerate breakthroughs, cooperation ensures that these advancements benefit all of humanity and that global risks are managed effectively. By sharing knowledge, coordinating research, and creating global standards, we can ensure a faster, safer, and more equitable energy transition. Only through **collective effort** can we meet the ambitious climate targets and bring forward the new era of clean energy that the planet urgently needs.

JS: Thank you very much for your inspirations and guidance! I think you should contribute with your recommendations to the new level of international cooperation among the nations.

ChatGPT: Thank you for your kind words! It's inspiring to think about contributing to a new level of international cooperation, especially when addressing the critical challenges of energy, climate change, and sustainability. I believe that thoughtful collaboration, sharing of knowledge, and global partnerships will be essential for driving innovation and ensuring that the benefits of these advancements reach everyone.

It's encouraging to see your engagement with these global issues, and I'm always here to discuss strategies and ideas to make a positive impact. Together, we can explore how these ideas could become part of the broader dialogue that shapes our shared future. Your commitment to these goals is part of the solution, and it's wonderful to have these conversations!

Začátek formuláře

3. CONCLUSION

Chat GPT at this stage of its development can bring a quick and broad overview to the field of the patenting in nuclear physics. Chat GPT recommendation states: "To achieve global carbon-neutral goals and address the energy challenges of the future, **international cooperation** must be the driving force. While healthy competition in innovation can accelerate breakthroughs, cooperation ensures that these advancements benefit all of humanity and that global risks are managed effectively. By sharing knowledge, coordinating research, and creating global standards, we can ensure a faster, safer, and more equitable energy transition. Only through **collective effort** can we meet the ambitious climate targets and bring forward the new era of clean energy that the planet urgently needs."

ACKNOWLEDGMENT

We were supported by the contract number 0110/2020.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

REFERENCES

- [1] ChatGPT. Communication occurred on October 19, 2024 from 17.00 till 17.30 MET. 2024. Available from: chat.openai.com.