

PHYSICS & SOCIETY

A Publication of The Forum on Physics and Society A Forum of The American Physical Society

From the Editor

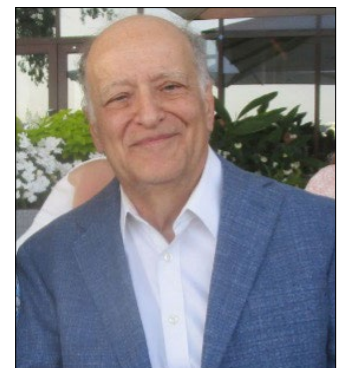
Welcome to the April issue of the FPS newsletter. Besides one letter to the Editor, we have two articles in this issue. One is by our latest Burton Award winner, Paul Woaf, about several aspects of being a physicist in sub-Saharan Africa. It is based on the invited talk he just gave as our most recent Burton award winner, at the APS global meeting in March. The other article, by Goetze and Hashimoto, describes a joint undertaking by the German and Japanese physical societies on the peaceful applications of Physics.

We have also one book review, of a book on Artificial Intelligence in the context of teaching Physics. The book was reviewed by a member of our own Board of Editors, at the request of our Book Reviews Editor. AI is a topic that I hope to return soon.

I have not had yet any response to the Editorial on "Democracy at APS " in the last (January) issue. This is disappointing. Does it mean, perhaps, that the root cause of the problem discussed there is simply apathy?

The contents of this newsletter are very largely reader driven. All topics related to Physics and Society are welcome, excluding only completely undiluted politics. I am not afraid of controversial topics or controversial language, excluding only invective, particularly of the *ad hominem* or *ad feminam* variety. Manuscripts should be sent to me, in.docx format, except Book Reviews which should be sent directly to book reviews editor Quinn Campagna qcampagn@go.olemiss.edu.

The contents are **not peer reviewed** (I do read submissions before acceptance) **and opinions given are the author's only, not necessarily mine, nor the Forum's nor, a fortiori, the APS's either.** But subject to the mild restrictions mentioned in the previous paragraph no **pertinent subject needs to be avoided on the grounds that it might be objectionable. On the contrary, controversy is welcome.**



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Reusing Books and Journals

DEAR EDITOR,

Some universities have bookcases where people can leave textbooks, reference books, research books, conference proceedings, journals, general interest books, and magazines that they no longer want for other people to take. I suggest that each university physics department, each other university department, and each research lab outside universities adopt this practice.

Retiring physics professors could leave their physics books and journals for other professors and students to take. Families of deceased physics professors could leave the professors' old books and journals for other professors and students to take instead of throwing them in the garbage. Retiring physicists in government research labs could leave their physics books and journals for colleagues to take.

Suggest this idea to your university department or research and development lab. The free libraries that some people have in their front yards usually have books that appeal to the general public rather than books and journals that appeal to physicists.

Another possibility for allowing books and journals to be reused is to donate them to organizations that ship them to poor countries.

Reusing books and journals saves money and allows products to be used to their fullest extent. Also, reusing books and journals decreases greenhouse gas emissions, natural resource consumption, energy consumption, pollution, waste, landfill size, logging, etc. Logging for paper products causes loss of carbon storage, reduced carbon sequestration potential, habitat simplification, habitat fragmentation, soil nutrient depletion, soil erosion, soil compaction, increased runoff and sedimentation, reduced groundwater recharge, and altered stream dynamics.

Most importantly, reusing books and journals as suggested is a way to fight climate change. Fighting climate change anywhere on the planet helps the climate everywhere on the planet. Ignoring climate change anywhere on the planet hurts the climate everywhere on the planet.

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German and Japanese Physical Societies jointly advocate for the peaceful application of physics

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We are physicists from opposite parts of our planet, and we have a shared concern: a concern for the survival of humanity. In January, the famous Doomsday Clock of the Bulletin of the Atomic Scientists has been set to 85 seconds to midnight, which is the closest we have ever been to representing global catastrophe. The risk of nuclear war is larger than it has ever been. In light of the nuclear threats, the German Physical Society and the Physical Society of Japan have issued a joint declaration, the [Declaration for the Future](#). Taken together, the societies comprise 65,000 members. We were part of the drafting team. The declaration serves as a powerful reminder of the responsibilities that science entails.

While the world commemorated the dropping of the atomic bombs on Japan last year, all nuclear weapon states increase the nuclear threat by modernizing their arsenals. Some states and their leaders engage in dangerous nuclear rhetoric. The New START Treaty just expired, leaving behind a world without agreed limits on nuclear weapons – for the first time in decades.

Many politicians, officials and pundits speak of nuclear deterrence as if it was an umbrella that can be spanned to be safe. Often, the discussions fail to address the humanitarian suffering that are the unavoidable consequence of nuclear explosions, the limitations of nuclear deterrence, and its risks of failure.

Physicists must engage in the debate. As our Declaration notes, “physicists’ knowledge can help to understand the consequences of the use of nuclear weapons. Multiple scientific studies showed the short- and long-term consequences of high radiation doses, fallout and injection of soot into the stratosphere, which can lead to the devastation of regions, the extinction of species and the destruction of ecosystems. Physicists can contribute to avert such a disastrous future by developing necessary verification technologies for nuclear disarmament, and by raising public awareness about the consequences.”

It adds to manifestos of scientists such as the Russell-Einstein Manifesto (1955) and the recent declarations by Nobel Laureates in Lindau and Chicago (2024, 2025) and is deliberately forward-looking. It was signed in the context of the United Nations’ International Year of Quantum Science

and Technology. With regard to the unparalleled benefits and innovations that the quantum revolution has brought and the expected contribution to human society over the next century, it urges us to “examine the principles guiding scientific endeavor, and deliberate on the responsibilities that science entails.” The Declaration of the Future is especially directed to the younger generations “who create the future, urging them to engage with the global existential challenges of humanity, such as climate change or nuclear warfare, and to strive for human progress.”

Our physical societies pledge to contribute to humanity’s survival and advancement by advocating for the peaceful application of physics. They “call to strengthen the current international commitments to abstain from participating in the development, production, testing, deployment, or use of weapons of mass destruction, especially nuclear weapons,” as well as “for the resolution of international conflicts through peaceful and diplomatic means, without recourse to armed force.”

The Declaration for the Future includes an invitation to physical societies and academic organizations worldwide to join in these commitments. In the U.S., the Physicists Coalition for Nuclear Threat Reduction was established with the support of the American Physical Society (it is now independent). The Forum on Physics and Society is also a place where such discussions take place.

As nuclear weapons have global consequences, our conversations also need to be international. Together, let us strengthen this dialogue!

Let us add that dialogue is indispensable to strengthen global security and strive towards a vision of world peace. Even within the drafting committee of the Declaration for the Future, an extended and sustained dialogue was required among the three German members and the three Japanese members. Differences in the circumstances faced by countries and regions around the world, differences in culture and history, differences in the perspectives and functions of our respective physical societies, and, in addition, differences in individual views concerning the technological applications and potential misuse of physics—these were all present. Through long and careful dialogue, these differences were gradually understood, and we arrived at a declaration that all members of the drafting committee and our societies as a whole could genuinely endorse. We believe that this declaration may serve as an

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expression of many physicists around the world. Having read it, how did it resonate with you?

At the same time, during a panel discussion held in Münster, the city where the declaration was signed, it was also argued that for this declaration to be read and carried beyond the community of physicists, it will require not only continued advocacy of its importance but also many new and creative initiatives. In Münster, a “Quantum Festival” was organized in conjunction with the International Year of Quantum Science and Technology, and a symphony based on concepts from particle physics was performed. In the final chorus, physicists sang together with two thousand citizens a song whose lyrics were inspired by the words of the Declaration for the Future. It was a joyful moment in which heartfelt wishes for peace were connected across nations and regions. In this way, carrying the Declaration for the Future forward may gather many creative efforts into a powerful force, so long as the shared human longing for peace—present in every heart—is brought together and shared. The signing ceremony in Münster and



the Quantum Festival demonstrated precisely this possibility. Rather than succumbing to despair in isolation, we can seek world peace grounded in the hope that is truly felt through dialogue and the mutual exchange of understanding.

Strengths and positive trends of physics in intertropical Africa and necessity of mutually beneficial international collaboration

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Intertropical Africa is the region between the tropic of cancer in the North and that of Capricorn in the South. It is constituted of several countries which had in the past suffered most from the European colonialism, slave trade from European and Arabic. Almost all the population are with black skin. Today, they have almost the highest population increase rate. This part of Africa is very rich in terms of minerals and other natural resources even if it does not benefit sufficiently on their exploitation.

Although those countries have been engaged in two different education systems, one from United Kingdom and one from France, the education in those countries has almost the same strengths and weaknesses, from the primary to the university levels (even if there are some very rare exceptions where the political will has engaged the education and research system in a good orientated move).

The education and research in a large number of countries in that region is increasing positively. Indeed, the population growth rate has also an impact on the number of students who are interested in doing physics. For instance, in a country like Cameroon, the number of students involved in physics education attains every year more than 2500 entering into the university system for the Bachelor program in physics. At the entrance to the Master level and PhD level, one can easily attain more than 50 students for each level for a single department. For instance, at the University of Yaoundé in Cameroon, 122 PhD students were admitted for the academic year 2022/2023 while 217 Master students were admitted. This is the case for one of the 10 universities offering Master and PhD programs in Physics. Even if Cameroon has a special high figure, an increasing tendency is observed in other countries. This increase of young people interested in doing Physics is an interesting strength which needs to be exploited.

Another important strength for physics in intertropical Africa is the increase in the number of scientific contributions in good refereed physics and engineering journals. This positive trend has had a good impact on the World ranking of intertropical African countries. Some of those countries are among the top-100 in physics outputs out of 243 countries in the World. From the Scimago journals and country ranks three years ago, there were the ranks occupied by some African countries in different fields of physics (the rank in the parenthesis).

- **Atomic and Molecular Physics, and Optics:** Nigeria (70), Cameroon (73), Ethiopia (87), Sudan (95)

- **Condensed matter physics:** Nigeria (69), Cameroon (82), Ethiopia (91), Sudan (95), Senegal (97)
- **Statistical and Nonlinear Physics:** Cameroon (54), Nigeria (65), Benin (78), Ethiopia (95), Bostwana (99), Senegal (100)

Twenty years ago, they were almost all after the top-100. Although in terms of the number of articles published yearly, the number for a country can be smaller to those of some individual research institutes in developed countries, a comparison considering the amount of funding will lead to the conclusion that African physicists are more performant.

The performance appearing in the ranking is the results of the existence of some isolated strong research teams whose research outputs are comparable to those of some research groups classified as good in developed countries. This is also an interesting strength which needs to be reinforced.

However, despite the positive attitude of the author of this article, there are many weaknesses that need to be mentioned and which hampered the development of physics and mostly its applications in that part of the continent. There are: (i) the limited practical training, (ii) the lack of industries to recruit physicists, (iii) the lack of official and national or continental research programmes in Physics (this limits the number of physicists recruited for universities and research institutes), (iv) the fact that more than 90 % of research activities are theoretical or not related to local problems, (v) the critical mass of physicists is not yet attained in most parts of those countries, (vi) the international collaboration between African physicists themselves and between African physicists and their colleagues in extra African countries is very limited.

One of the main consequences of the weaknesses is the brain drain. From a World Bank report in 2014, about 40 000 Africans with PhD degrees are out of Africa among which the 2/3 trained in developed countries do not go back to their country of origin. A good proportion of some of those trained in Africa also move to foreign continents. Among these PhD holders, one counts various physicists. Another important consequence is that many holders of degree in Physics (Bachelor, Master and even PhD) are jobless in some countries.

So the strengths mentioned above need to be sustained or reinforced. And the weaknesses need to be managed. A very big issue.

In that direction, some rare physicists in Africa work hard to improve the situation by tirelessly contributing to the supervision of PhD thesis or to developing research topics for young physicists. This is the case of the author of this article who was able to supervise 75 PhD thesis in his group in Camer-

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oon. Most of his former PhD students are lecturers, professors and researchers in Universities and research institutes in his country, in other African countries and in developed countries such as the United States of America. And some of them are very performant scientifically. Other actions undertaken by the author are the creation of a private centre to mitigate the lack of the practical training. The private centre Sci-Tech Services (www.sci-tech-services.com), created in 2013 has been the place for the promotion of experimental physics training high schools and university students in conducting experiments for their education, but also for their research projects. Moreover, the author has been behind several outreach activities for the promotion of physics such the Cameroon Physical Society, the students chapters club for the Optical Society of America (Optica), for the Institute for Electronic and electrical engineers, for the Society for Optics and Photonics (SPIE) which have served in the reinforcement of practical training. He was also one the founders of the African Physical Society.

But, these individual actions are not sufficient to efficiently enhance physics, specifically physics research in intertropical Africa. Parallel to individual countries efforts, more international actions are required to complement those already existing such as the important and long lasting support from the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy), the World Academy of Sciences (TWAS) and different scientific organizations. What we are proposing can be inserted in three actions.

Action 1: Development of international research programmes in Physics involving physicists in Africa and their colleagues in countries with more facilities. We have no doubt

that with the eagerness of African youth for physics education and research, an international physics research programme involving physicists in Africa (working there) will highly enhance the programme results.

Action 2: Creation of more international physics centres in Africa (public) not only for fundamental physics, but also for applied physics, capable of targeting development involving raw materials (minerals) exploited or to be exploited in Africa, and offering services to industries, not only in Africa, but also out of Africa. Those centres can stand alone, can support other initiatives in place in Africa such as the ICTP-East African Institute for Fundamental Research in Kigali, Rwanda or collaborate/support the existing research groups in Africa, or also initiatives such as that of a synchrotron infrastructure in Africa (africanlightsource.org).

Action 3: Parallel to the reinforcement through public centres, a more flexible action is the creation of private International Research Centres in Physics in Africa with the participation of physicists or physics research groups all over the World. Such centres will be beneficial for all. They can be founded by public institutions or by private donors. This action will be put in place with little constraints either through private research centres in Africa or through private higher education institutions in Africa. This action should be highly encouraged since it could attract private donors from abroad, but also from African countries.

No doubt that all those actions will enhance the development of Physics in Africa, but also contribute to the development of physics and applications throughout the World.

Teaching with AI: A Practical Guide to a New Era of Human Learning

José Antonio Bowen and C. Edward Watson. *Johns Hopkins University Press*, 2024. ISBN 978-1-4214-4922-7. \$26.

AI can spit out answers to physics problems in seconds. Students can edit responses and get credit on problem sets with minimal effort. Behavioral economics all but guarantees many will trade understanding for ease.

What's a professor to do now that *AI is ubiquitous*? In *Teaching with AI: A Practical Guide to a New Era of Human Learning*, José Antonio Bowen and C. Edward Watson argue that AI should be embraced; when used well it can substantially enhance rather than diminish learning. Though not tailored to the sciences, it has many insights and suggestions that are valuable for teaching physics.

It's only 50 years since the slide rule became obsolete and 40 since the Mac's introduction. AI assistance promises an even larger impact on workflow than the intervening early epoch of digital innovation. *Teaching with AI* already risks feeling dated, given how rapidly AI tools are evolving, but it's still a good reference and will save physics professors time as they think about how to use AI. The guide has many examples of iterative prompts and responses, which provide takeaways for improving prompts, a fundamental skill for faculty and students, and it is filled with useful activities that professors can try with students. There's a spirit of exploration that is both a fun and productive way to approach AI.

Teaching with AI is organized into three parts:

Thinking with AI. The chapter on creativity is compelling. Bowen and Watson encourage professors to take advantage of AI's prolific idea generation without inhibitions about what constitutes a good idea. It's possible to brainstorm with AI to find ideas that haven't been worn into the carpet. It's easy to discuss and explore with new twists that wouldn't emerge from talking with a colleague. With appropriate prompts, which can be improved by suggestions from the guide coupled with trial and error, AI can come up with lots of ideas and consider them in depth. It's useful to have discussions with multiple AIs such as ChatGPT, Google Gemini, and Claude, since each have different strengths and weaknesses. That's a good approach to all the suggested activities throughout the book, some of which include comparing AIs.

Beyond brainstorming, many physicists are already well versed in using machine learning and AI-driven data analysis. A challenge with these tools, which researchers need to impart to students, is to use them thoughtfully rather than blindly to gain deeper understanding of physical phenomena. Bowen and Watson make it clear that in this new era, it now falls to faculty

to teach students how to think with AI on multiple levels from initial brainstorming to highly sophisticated research.

Teaching with AI. One of the main messages in Bowen and Watson's guide is that AI can make teaching easier by answering emails, summarizing documents, grading tests, creating assignments, finding trends in student evaluations, and so on. The more faculty learn how to use AI, the more effective they will be teaching students to learn with AI, and the more fun teaching will be by handing off menial tasks to AI.

Bowen and Watson acknowledge that teaching students to write with AI assistance is a catch-22. AI can help draft, outline, and rewrite passages if one knows what a good result looks like. If not, without that foundation, the results can be worse than writing unaided. One tip for those who have some skill at writing, including faculty, is to provide AI with examples you've written and ask AI to write in your voice. Throughout the process of teaching students to write, it's important to bear in mind that professional norms regarding the use of AI, especially in the context of writing grant proposals or peer-reviewed papers, are evolving. Researchers will need to keep up with what's acceptable for their own and their students' work.

One example of making teaching easier that Bowen and Watson discuss in detail is using AI for course design. Give it a course description and learning outcomes and a template and then ask for a syllabus. Develop assignments and tests with AI. Iterate on assessments. Explore pedagogical methods. Every aspect of course development has the potential to be improved with AI assistance.

Hanging over all considerations of teaching with AI is the issue of cheating. Bowen and Watson discuss an array of sobering studies that predate AI and indicate most college students cheat at least sometimes and cheating is driven by opportunity. AI provides opportunities. Instead of paying someone to write a paper or copying a friend's problem set, it's cheaper and easier to ask Google Gemini to do the work. AI detectors can check for cheating, particularly for writing assignments, but the authors discuss how their accuracy varies considerably, and how students can use strategies to avoid detection.

Bowen and Watson offer multiple valuable approaches to reduce cheating. Examples of low-effort interventions include discussing academic integrity, giving an integrity quiz, allowing students to withdraw submissions, demonstrating AI detection tools, and normalizing appropriate ways to use AI. Changing pedagogy is more involved but ultimately more likely to have a larger effect. Bowen and Watson advocate in-class,

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active learning and point to physics education pioneer Eric Mazur's work as an example. Using flipped classrooms and active learning diminishes opportunities to cheat and leads to strong learning outcomes and deeper conceptual understanding, as demonstrated by decades of Physics Education Research.

Learning with AI. Bowen and Watson discuss myriad ways in which AI can be incredibly useful to the learning process, including providing feedback, serving as a tutor, and acting as a debate partner or a group discussion leader. They don't discuss specific physics software learning packages, but good ones exist such as Pearson Mastering Physics with built-in AI tools, developed by David Pritchard, another physics education pioneer. The authors argue, "AI's interactivity and patience can be an excellent way to practice and encourage mastery." You can give AI the specific information you want students to learn, allow it to track every student, and then design individual assessments. Very usefully the authors consider in depth how AI can personalize learning in ways that simply weren't practical for large classrooms prior to AI.

College students are using AI, for better or worse. Whether AI enhances or undermines learning will depend largely on how professors respond. Bowen and Watson provide a solid foundation to respond well.

This book review was improved by feedback from Google Gemini and Claude.

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