What's New in this Issue of the Newsletter?

In this issue, we bring you the latest developments in the physical sciences within Africa and the Diaspora. The news is marked by major capacity-building and networking events, honors for development actors, and breakthroughs in cutting-edge fields. This issue is a tribune of opportunity, visions, and scientific strategies for sustainable development grounded in physics, with the aim of inspiring research and exemplary leadership.

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We encourage you to forward this newsletter to colleagues you think may be interested in hearing about the latest developments in physics in Africa. Subscriptions to the newsletter are free and open to both Africans and non-Africans. To subscribe go to https://go.aps.org/africanphysics.

Do you have a meeting, conference, school, award, etc. you would like posted? Do you have any other news or articles you would like to share with your colleagues? Click here for more information on how to submit this information to the newsletter and share it with colleagues across the African continent.

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JANUARY 2024

THE AFRICAN PHYSICS NEWSLETTER

An Inspiring Journey with Belgium's Royal Academy for Overseas Sciences (RAOS): A Vision for the Future of Science in Africa

This article traces my personal journey toward membership in RAOS, a flagship institution in African and global scientific research. My election as the first Congolese woman Corresponding Member of the Technical Sciences Class marks a historic milestone, reflecting a deep commitment to emancipating and inspiring future generations of African scientists.

ROAS 2023-2024 Opening Ceremony

(Photo Credits: Raïssa Malu)

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Introduction
In the global panorama of science, academies of science play a crucial role. These institutions, true forums of knowledge, not only offer support and recognition to scientists but also actively contribute to global scientific progress. Among these prestigious bodies, Belgium's Royal Academy for Overseas Sciences (RAOS), stands out for its commitment to research concerning overseas countries, with a particular emphasis on those in Africa.

The History and Mission of RAOS
Founded in 1928 and known under its present name since 1959, RAOS has established itself as a vital nexus for the exchange of expertise, the publication of academic work, and the organization of significant events such as conferences and seminars. Home to numerous experts in fields such as anthropology, economics, geography, history, and agronomy, RAOS transcends disciplinary boundaries while remaining conscious of its historical heritage.

Current RAOS Structure

Today, RAOS has 335 members and is led by Professor Christine Cocquyt of Ghent University, Belgium, and the University of Kisangani, DRC, and Perpetual Secretary Professor Philippe De Maeyer, also of Ghent University. The institution strives to be inclusive and to adapt to contemporary developments. I particularly appreciate the benevolence and open-mindedness of its members.

An Historic Moment

A notably significant aspect of my experience at RAOS was becoming the first woman from the DRC to serve as a Corresponding Member in the Technical Sciences Class, a distinction shared by only 10 women. This achievement, far from trivial, marks a historic turning point. It symbolizes a call to African youth – especially to girls and women – to embrace science with boldness and passion.

Conclusion

My integration into RAOS is not only a personal achievement but also a symbol of hope and inspiration for the next generation of scientists in Africa. At a time when equity and inclusion are becoming essential in science, stories like mine underline the importance of pursuing ambitious dreams and actively contributing to the global scientific dialogue.

References:

[1] Royal Academy of Overseas Sciences (s. d.). Classe des Sciences Techniques - List of members. https://www.kaowarsom.be/fr/membres_sciences_techniques

[2] Malu, R. (2023, October 27). A Dream Come True. LinkedIn. https://www.linkedin.com/pulse/un-r%C3%AAve-concr%C3%A9tis%C3%A9-ra%C3%AFssa-malu-1yttf

THE AFRICAN PHYSICS NEWSLETTER

The Role of Physicists in Politics: An African Perspective

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JANUARY 2024

Since 2014, the Science and Technology Week, which I initiated in the Democratic Republic of Congo, bears witness to my conviction that scientists, particularly physicists, can play a fundamental role in society beyond laboratories and lecture halls. This initiative aims to facilitate a space where different sectors can meet and exchange ideas, thus fostering innovation and new opportunities, especially for young graduates and researchers.

(Photo Credits: Raïssa Malu)

Scientists in Politics: A Dilemma

In light of the December 2023 elections in the DRC, the question of scientists' involvement in politics becomes relevant. As it is well known, the dilemma is complex, as outlined in existing literature [1], balancing the preservation of scientific integrity with active participation in politics. Our physics training, which inculcates critical thinking, an ethical approach, and an ability to solve complex problems, can nevertheless offer a unique perspective in the political arena, where such qualities are crucial yet often absent.

From Physics to Politics

The transition of physicists into the world of politics, while less common than their move into industry, holds enormous potential. The skills acquired in physics, such as critical thinking, data analysis, complex problem solving, and effective communication, represent invaluable assets in politics. Physics training equips individuals to navigate complex situations, seek practical solutions to societal challenges, and adopt an ethical approach. These abilities, combined with abstract modeling skills and rigorous quantification of phenomena, can substantially enrich politics, particularly in African contexts where data-driven decisions and long-term vision are crucial. Elsewhere, figures such as Angela Merkel, the former German Chancellor (2005-2021), a physicist by training with a PhD in quantum chemistry, have proved that this transition can be successful.

Post-political Concerns and Prospects

As physicists, we acknowledge that the fear of losing our integrity and reputation in the political arena is real. Politics is often seen as a temporary commitment, especially for those who do not strive to be career politicians. Yet, the impact we can achieve in politics, particularly in the African context, is significant. Our role is not limited to understanding the universe – it also encompasses improving the living conditions in our continent.

Different Approaches to Political Commitment for Physicists

Physicists can adopt a variety of strategies to influence politics. Some may choose to run for office, bringing their scientific expertise directly into decision-making processes. Others might serve as technical advisors, informing policy on issues such as artificial intelligence, energy, and climate change. They can also apply their expertise to advocate for evidence-based policies, working with nongovernmental organizations and other groups to influence legislation. Additionally, they can play a role in educating the public and policy-makers on significant scientific issues through conferences, articles, or social networks. As engaged citizens, physicists can also actively participate in political life through voting, demonstrations, and other democratic means. Finally, their research, particularly in subjects that accelerate development and sustainability, can have direct political implications and influence policy.

A Call to Action

I always emphasize that we should not leave the development of science and technology to developed countries and men alone. This pursuit is far too much fun and strategic not to get involved. In the same way, as physicists, we hold a crucial role in the development of our societies by going beyond the boundaries of science and actively participating in politics. It is essential that we bring our unique perspective, skills, and ethics into the political sphere, contributing to the good of Africa and beyond. This serves as a call to action for all physicists to actively engage in fostering change for a society where science and politics work hand in hand for a better future.

References:

[1] Gabriel Popkin (2016). Science Meets Politics: A Complicated Relationship. APS News. https://www.aps.org/publications/apsnews/201605/politics.cfm

THE AFRICAN PHYSICS NEWSLETTER

Fostering the Battery Value Chain in Africa: Insights from the DRC and Zambia

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Supported by a Zambia-DRC cooperation, the DRC-Africa Business Forum's focus on developing a comprehensive battery value chain in Africa signifies a pivotal moment.

Raïssa Malu, Director, Investing In People ASBL

(Photo Credits: Raïssa Malu)

Introduction

The DRC-Africa Business Forum [1], a pivotal initiative for Africa, aims to create an industrial value chain and market for batteries, electric vehicles, and renewable energies. This initiative, coupled with an emphasis on secondary education and the anticipated contributions from the African physics community, will underscore Africa's commitment to fostering a sustainable and efficient battery industry, vital for its long-term economic and social development. Launched in November 2021 in Kinshasa, Democratic Republic of Congo (DRC), the forum seeks to unify high-level stakeholders to discuss, identify opportunities, and facilitate investments, thereby enhancing Africa's role in the global battery value chain. Scheduled for late 2023 in Kinshasa, the second edition of the DRC-Africa Business Forum will continue to emphasize the development of the battery value chain, electric vehicles, and renewable energies in Africa.

"The initiatives and collaborations in the DRC and Zambia, along with the involvement of the broader African physics community and the strategic focus on secondary education, will highlight the continent's commitment to developing a sustainable and efficient battery value chain."

Historic Cooperation Between Zambia and the DRC

A landmark cooperation agreement between Zambia and the DRC aims to facilitate the development of the battery and clean energy sector value chain. Both nations face similar challenges, including establishing an efficient supply chain for raw materials necessary for battery production, governance, environmental challenges, and greenhouse gas emissions related to battery production. This collaboration promises to pool resources and expertise, potentially leading to a more efficient and sustainable battery value chain.

Diverse Battery Value Chain Careers

The battery value chain offers a variety of careers, including battery design engineers, chemists, battery production engineers, supply chain managers, battery recycling specialists, and marketing and sales professionals. Geologists and mining engineers play a crucial role in extracting raw materials like lithium, cobalt, and nickel, vital for battery production.

Global Lithium, Cobalt, and Nickel Producers

Australia, Chile, and China are leading lithium producers, while the DRC, Russia, and Australia top the list for cobalt production [2]. Indonesia, the Philippines, and Russia are the main nickel producers. These countries dominate the global production of lithium, cobalt, and nickel, essential for battery manufacturing.

DRC's Potential in Battery Precursor Cathode Production

BloombergNEF's study [3] highlights the DRC's potential to leverage its abundant cobalt resources and hydroelectric power to become a low-cost, low-emission producer of lithium-ion battery cathode precursors. Building a 10,000 metric ton cathode precursor plant in the DRC could cost USD 39 million, significantly cheaper than a similar facility in the U.S. The study also found that cathode precursors produced in the DRC could compete in cost with those from China and Poland, but with a smaller environmental footprint. The DRC is identified as a favorable destination for sustainable battery material manufacturing, especially for high-nickel-content batteries.

The Role of Secondary Education in Battery Value Chain Development

Both the DRC and Zambia face the challenge of training a skilled workforce to support the battery value chain development. However, the focus should not only be on higher education. Secondary general, technical, and vocational education also play vital roles in providing the necessary technical and professional skills. Secondary education forms a strong foundation in STEM that is essential for understanding and innovating within the battery domain. Technical and practical skill development, adaptability, ecological and sustainability awareness, talent base creation for future innovation, long-term economic and social impact, and reducing educational inequalities are key aspects where secondary education can contribute significantly to the battery industry's growth.

African Physicists' Interest in Battery Value Chain Development

The African physics community might find the development of the battery value chain in the DRC and Zambia intriguing. Batteries are complex devices requiring a deep understanding of electronics, chemistry, physics, and material engineering. Physicists can offer unique insights into the physical and electronic aspects of batteries, like electrical conductivity, energy density, and lifespan. Potential areas of interest for African physicists include research and development of new battery materials, international collaboration opportunities, and skills development in the battery field.

Conclusion

The initiatives and collaborations in the DRC and Zambia, along with the involvement of the broader African physics community and the strategic focus on secondary education, will highlight the continent's commitment to developing a sustainable and efficient battery value chain. This commitment is not only crucial for the industrial sector, but also pivotal for the long-term economic and social development of the region.

References:
[1] United Nations Economic Commission for Africa. (n.d.). DRC-Africa Business Forum. United Nations Economic Commission for Africa. Retrieved from DRC-Africa Business Forum | Nations Unies Commission économique pour l'Afrique (uneca.org).
[2] Statista. (2023). Cobalt: production minière par pays principaux [Graph]. In Statista. Retrieved November 19, 2023, from Cobalt produit par pays du monde 2022 | Statista
[3] BloombergNEF. (2021). The Potential Competitive Advantage of the DRC in Lithium-ion Battery Precursor Manufacturing. BloombergNEF. Retrieved from Producing Battery Materials in the DRC Could Lower Supply-Chain Emissions and Add Value to the Country's Cobalt | BloombergNEF (bnef.com)

THE AFRICAN PHYSICS NEWSLETTER

The First African Light Source Project Roundtable Discussion at the African Conference of Physics (ACP2023)

Led by accelerator physics experts, a collaborative roundtable unveiled the African Light Source Project (AfLS), attracting a global audience.

AfLS discussion at the ACP2023 in George, South Africa.

(Photo Credits: The Authors)

The 3rd biennial African Conference on Fundamental Physics and Applications (ACP)[1], covered a broad spectrum of topics, ranging from particle and nuclear physics to renewable energies, thereby fostering collaboration and innovation. The conference exemplified the spirit of innovation and collaboration. From delving into the depths of particle physics to venturing into the cosmic mysteries of astrophysics, this unique event offered a platform for experts to discuss subjects as diverse as artificial intelligence, quantum physics, earth science, and accelerator physics. Committed to inclusivity, ACP2023 also championed the voices of young physicists and women in physics, acknowledging the importance of diversity in scientific pursuits.

Within this rich scientific tapestry, the spotlight shone on the African Light Source Project (AfLS). This interactive platform provided an opportunity to gather and listen to diverse ideas and propositions, enriching the ACP experience with thoughtful insights and collaborative discussions.

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"In the grand tapestry of scientific development, the ACP serves as a beacon, illuminating a promising trajectory for physics on the continent."

A collaborative roundtable led by Dr. Luca Serafini, Professor Simon Connell, and myself (Figure 1), proved to be a dynamic and globally inclusive event. The discussion was attended not only by all conference participants, including Dr. Makondelele Victor Tshivhase, Director of iThemba LABS (Laboratory for Accelerator-Based Sciences), but it also attracted a diverse international audience of over 45 individuals, connecting various countries via Zoom. This discussion fostered a rich exchange of insights. Simon Connell set the stage by providing the audience with the latest developments regarding the AfLS [2,3], thereby shedding light on recent workshops conducted within this framework.

Luca Serafini introduced the STAR project, a pioneering research infrastructure centered around Inverse Compton Scattering (ICS) technology, currently in the commissioning phase within Calabria, Italy [4]. ICS sources are renowned for their distinct advantages, chiefly their capacity to produce high-performance X-ray beams in the hard X-ray energy range (100-500 keV) using relatively compact and cost-effective machinery, typically in the realm of 10 M$. This cost-efficiency represents a considerable reduction compared to traditional synchrotron light sources. This last point was discussed as well during the LS session with Dr. Simone Di Mitri from Elettra Synchrotron.

One of the standout features of ICS, exemplified by STAR, lies in its remarkable versatility. This technology offers a spectrum of properties, including tunability, monochromaticity, polarization, precise collimation, and a time structure characterized by short pulses, as well as dual-color X-ray beams. These features collectively empower ICS sources like STAR to excel in advanced X-ray imaging applications. Notably, this includes micro-tomography of thick metallic objects, such as those encountered in the study of archaeological artifacts.

Nonetheless, operating an ICS source with electron beam energies ranging from 50-200 MeV requires the cultivation of a specialized accelerator team well-versed in a multitude of critical technologies. These encompass

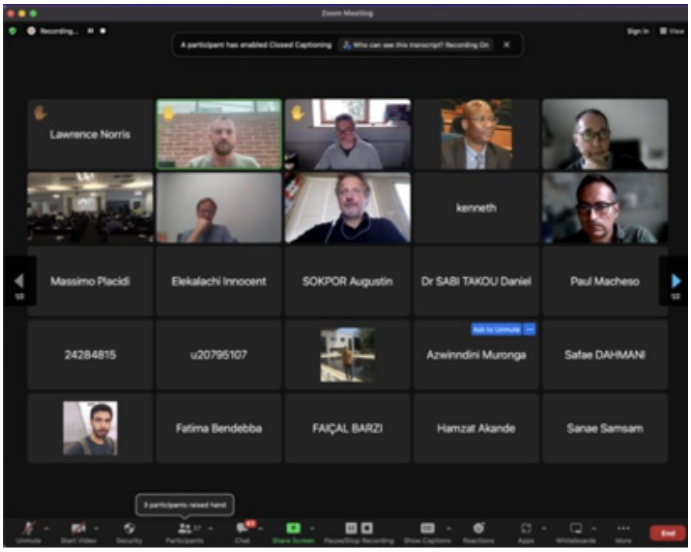

Figure 2: AfLS Zoom discussion at the ACP2023 in George, South Africa. (Photo Credits: The Authors)

radiofrequency (RF) systems, electronics, lasers, vacuum technology, diagnostics, control systems, alignment procedures, beamlines, X-ray detectors, radiation safety measures, auxiliary equipment, and beam dynamics/X-ray spectra simulations. Notably, these proficiencies are also fundamental for the operation of large-scale accelerators like GeV-class electron storage rings.
Consequently, the development of an ICS source within an African university campus or an equivalent laboratory as an African regional facility represents a significant milestone on the roadmap toward the ambitious aspiration of constructing the AfLS in Africa. This endeavor gains further significance considering that South Africa boasts one of the continent's most extensive facilities of its kind and is home to several particle accelerators situated in Cape Town and Johannesburg, notably the iThemba. The AfLS transcends being merely a scientific project; it envisions itself as a nucleus and welcoming haven for diverse African researchers. It also has the potential to catalyze broader changes, spurring the African science diplomacy that facilitates intra-continental travel through new direct flights and train lines, resulting in streamlined visa processes for African researchers.

In the grand tapestry of scientific development, the ACP serves as a beacon, illuminating a promising trajectory for physics on the continent. We need to recognize this event not only as a platform for the exchange of groundbreaking ideas, but also as a fertile ground where the seeds of curiosity and ambition can be sown in the hearts of our emerging scientists, particularly emphasizing the advancement of women in science.

ACP2023 provided an opportunity to share pioneering research and forge collaborations that hold the potential to elevate African physics to new heights. Together, we can overcome the challenges that lie ahead and guarantee that Africa continues to make a substantial and lasting contribution to the global scientific physics community.

References:

[1] https://indico.cern.ch/event/1229551/overview
[2] https://www.africanlightsource.org/
[3] Newton, MC; Connell, SH; Mitchell, EP; Mtingwa, SK; Ngabonziza, P; Norris, L; Ntsoane, T; Traore, DAK, Nature Reviews Physics, Building a brighter future for Africa with the African Light Source, 5/2 (2023) 74-75
[4] https://star.unical.it/

THE AFRICAN PHYSICS NEWSLETTER

Nurturing Brilliance: Insights from Early Career African Physicists

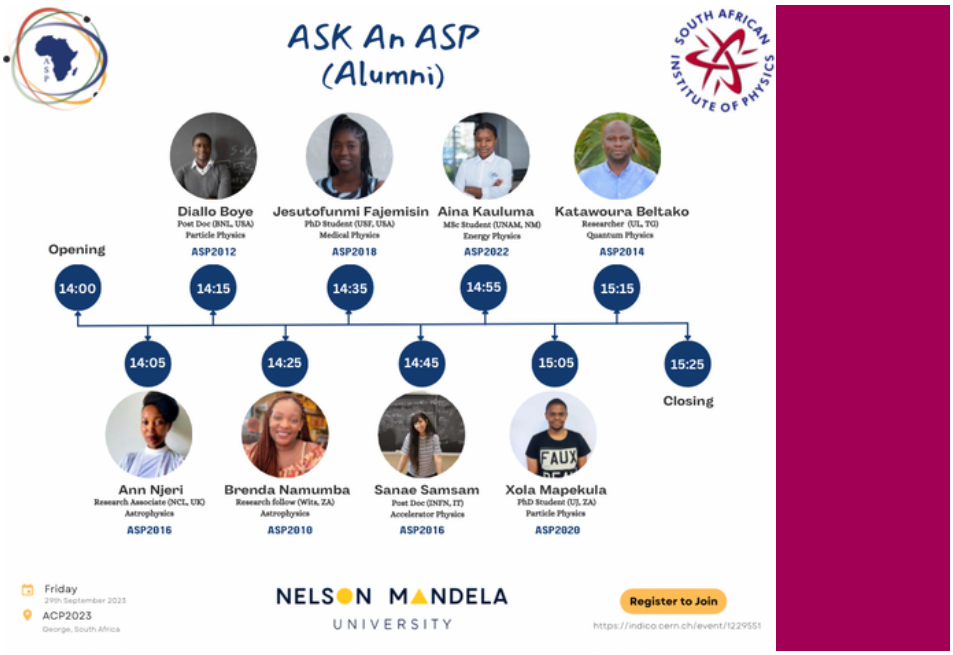

Figure 1: Ask an ASP (Alumni) session flyer. (Photo Credits: Mounia)

The African School of Physics (ASP) serves as a hub for aspiring physicists, offering a unique blend of theoretical knowledge and practical skills. The African Conference on Fundamental and Applied Physics (ACP) is an activity led by ASP, aiming to support the academic growth of its alumni and broaden participation internationally.

The 3rd edition of the forum, ACP2023 [1], took place at Nelson Mandela University's George Campus in George, South Africa from September 25 to 29, 2023. During ACP2023, I organized a special session titled "Ask an ASP (Alumni)" (flier shown in Figure 1). In this session, I invited eight distinguished alumni of ASP to share their experiences and insights, while shedding light on their journeys since attending ASP.

The eight alumni were asked to address two fundamental questions that shaped the narrative of their professional journeys –Where are you now? What happened to you after you attended ASP?

The "Ask an ASP (Alumni)" session delved into the impact of ASP on the lives and careers of its delegates. The session enlightened and inspired the conference participants through the shared experiences, excerpts of which are presented here.

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Ann Njeri (ASP2016 Alumna), "Trailblazing: From ASP (MSc Student) to PDRA in Extragalactic Astrophysics"

Ann Njeri, a research associate at Newcastle University, UK, conducts groundbreaking research in Newcastle, focusing on the formation and evolution of galaxies through cosmic time. Utilizing high-angular-resolution radio observations, including radio interferometry and Very Long Baseline Interferometry (VLBI) techniques, she investigates the interplay between star formation and accretion onto supermassive black holes in high-redshift galaxies. Njeri's current focus is on the Quasar Feedback Survey, utilizing radio observations from eMERLIN, VLA, and LOFAR to understand how quasars impact their host galaxies. Beyond her research, Njeri is dedicated to education and mentorship, founding the program, "Elimisha Msichana Elimisha Jamii" (Swahili for 'Educate a Girl, Educate the Entire Community'). This initiative addresses the existing gender disparity in education through astronomy outreach, mentorship, STEM workshops, and scholarships, ensuring a complete primary-secondary education transition for young schoolgirls in rural areas of Kenya and Uganda.

Diallo Boye (ASP2012 Alumnus), "From Quantum Curiosity to Particle Physics Passion: A Journey of Inspiration and Motivation"

Diallo Boye is a postdoc at Brookhaven National Laboratory, USA. Since his undergraduate studies, he has wholeheartedly immersed himself in the captivating realm of quantum mechanics and particle physics. With an insatiable curiosity, Boye delved deeply into the intricate theories of quantum fields, meticulously examining the behavior of particles at the smallest scales known to science. It was during this intellectual exploration that his trajectory as a particle physicist took a profound turn, transforming into an enriched and exhilarating adventure. A pivotal moment in this transformative journey occurred in 2012 when he actively participated in the 2nd edition of ASP in Kumasi, Ghana (ASP2012). This experience not only sharpened his focus on High Energy Physics (HEP), but also kindled a fervent desire to contribute to capacity development in Africa. Boye recognizes the critical role education and collaborative platforms like the ASP play in shaping the future of particle physics throughout the continent. Recently, he has been awarded the prestigious BNL Goldhaber Fellowship, further validating his dedication and contributions to the field [2].

Brenda Namumba (ASP2010 Alumna), "Bridging Africa and Inspiring the Future Through Science"

Brenda Namumba, a research fellow at the University of the Witwatersrand in South Africa, has journeyed from earning her bachelor's degree in physics from the University of Zambia to becoming a distinguished astrophysicist, showcasing resilience and accomplishment. Her prolific research – acclaimed at international conferences – has earned her prestigious fellowships such as the Women by Science's "Mujeres por Africa" and L'Oréal-UNESCO's Women for Science awards. Beyond academia, Namumba actively motivates and mentors young African girls through the Kuongoza Mentors program, demonstrating her commitment to education and community impact. The transformative experience at the 1st edition of ASP in Stellenbosch, South Africa (ASP2010) played a pivotal role in shaping Namumba's academic trajectory, acting as a catalyst for her passion in astrophysics. The exposure to high-quality education, collaboration with fellow physicists, and insights gained during the ASP not only equipped her with essential skills, but also provided a supportive network and inspiration, propelling Namumba toward impactful research and community engagement, thereby emphasizing the lasting influence of the ASP on her professional path.

Jesutofunmi Ayo Fajemisin (ASP2018 Alumna), "Bridging Continents: Jesutofunmi's Journey from Ilesa to the Forefront of Medical Physics"

Jesutofunmi Ayo Fajemisin, PhD student at the University of South Florida in Tampa, USA, has come a long way from Ilesa, Osun state, Nigeria. Armed with a bachelor's degree in physics from the University of Ibadan and a master's degree from the African University of Science and Technology in Abuja, Fajemisin broadened her horizons at the 5th edition of ASP in Windhoek, Namibia (ASP2018). Following this, she interned at the Medical Isotope Research and Production Department at Brookhaven National Laboratory, USA. Currently, she is pursuing a PhD in medical physics and her research at Moffitt Cancer Center focuses on utilizing machine learning algorithms for cancer treatment outcome predictions, showcasing her commitment to advancing healthcare through innovative applications of physics.

Sanae Samsam (ASP2016 Alumna), "From ASP to Illuminating Africa's Future in Light Sources"
Sanae Samsam, postdoc at INFN in Milano, Italy, is an ambitious researcher deeply passionate about the realm of accelerator physics and light sources. Her unwavering curiosity is dedicated to exploring how light sources can propel humanity's progress through the lens of physics. With a special focus on Africa, a continent currently devoid of a dedicated light source facility, she is committed to pioneering transformative advancements. Her journey from the 4th edition of ASP in Kigali, Rwanda (ASP2016) has ignited a dream to illuminate Africa's scientific future through the development of indigenous light sources, a dream Samsam is relentlessly pursuing.

Aina Kauluma (ASP2022 Alumna), "Escaping the Prism"
Aina Kauluma, an energy analyst for the Daures Project and a master's student at the University of Namibia, Windhoek, explains, "a prism is a geometric object that refracts light, causing it to separate into different colors. Metaphorically, it can represent a confined or limited viewpoint, a rigid system, or a set of societal norms that restrict individuality. 'Escaping the prism' suggests liberating oneself from those constrictions, embracing a broader perspective, and pursuing personal growth, freedom, or self-expression. It implies transcending boundaries, exploring new possibilities, and challenging existing paradigms to achieve a more expansive and authentic existence." This is a testament to Kauluma's journey through physics, a traditionally male-dominated field.

Xola Gugulethu Mapekula (ASP2020 Alumnus), "High Energy Physics: The Edge of Possibility"
Xola Gugulethu Mapekula is a PhD student at the University of Johannesburg, South Africa. Mapekula's journey into high-energy physics started with an unconventional twist. Completing his master's unleashed a wild imagination questioning the existence of a periodic table beyond known elements. Now, developing fiber optic sensors, he confronts the challenge of radiation-exposed detectors at collision points. Seeking a solution, Mapekula delved into the world of radiation-hard sensors, studying their viability for monitoring temperature and humidity within the detector for dark matter experiments. His commitment extends beyond the lab. Dedicating his academic life to dark matter, Mapekula aims to apply technology from high-energy physics collaborations to address societal issues. With hope, he envisions a future where dark matter illuminates the path to solving our energy problems.

Katawoura Beltako (ASP2014 Alumnus), "A Passion for Physics at the Nanoscale"
Katawoura Beltako, a researcher and the principal investigator of the "Quantum Simulations and Energy Materials" research project at the University of Lome, Togo, stated "attending the 3rd edition of ASP in Dakar, Senegal (ASP2014), was eye-opening because, despite being a graduate student, I had no prior knowledge of fundamental particles such as hadrons, or the standard model." As a result, Beltako strongly supports initiatives such as ASP, ACP, and any other programs that strive to assist young and talented students on the African continent in gaining access to the same eye-opening opportunities in science. Beltako's long-term aspiration is to implement and support the emergence of cutting-edge quantum research in Africa for energy and nanoelectronics applications. He aims to advance a research niche on energy materials discovery and low-power consumption nanoelectronics, train young African scientists, and conduct research informing policy decisions to improve the delivery of energy dependent basic services such as health and education.
The "Ask an ASP (Alumni)" session at the African Conference of Physics was a captivating exploration of the journeys of early career African physicists. Through this unique platform, the eight ASP alumni shared their stories, imparted valuable insights, and inspired the next generation of physicists across the continent. As the scientific community came together in George, South Africa, these stories echoed the resilience, brilliance, and potential that exist within Africa's scientific landscape.

References:
[1] The African School of Fundamental Physics and Applications: ACP2023
[2] African School of Physics Alumnus Diallo Boye Awarded the Goldhaber Fellowship

THE AFRICAN PHYSICS NEWSLETTER

Unveiling the Beauty of Physics: A Night of Inspiration and Insight

Figure 1: Early career panel discussion, "Beauty of Physics" at the ACP2023. (Photo Credits: Mounia Laassiri)

On the evening of September 25, 2023, early career physicists organized a captivating event centered on the "Beauty of Physics" (Figure 1). The event, held during the 3rd edition of the African Conference on Fundamental and Applied Physics (ACP), ACP2023, was a beacon of intellectual exchange aimed at revitalizing interest in physics amidst the widely discussed decline.

The panel featured outstanding physicists, including Professor Azwinndini Muronga, Executive Dean of Natural Science at Nelson Mandela University; Professor Mmantsae Moche Diale, faculty at the University of Pretoria; and Professor Mohamed Chabab, Director of the High Energy and Astrophysics Laboratory at Cadi Ayyad University.

Under the stewardship of the event's conveners, Dr. Mounia Laassiri from the University of Helsinki and Dr. Diallo Boye from Brookhaven National Laboratory, the session unfolded with a carefully orchestrated structure where panelists offered their views on the beauty of physics.

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"It takes a village to raise a child," is a well-known African proverb. But how do we get the buy-in, especially when it comes to the teaching and learning of physics?

In the heart of a "Black homeland" in South Africa, Professor Azwinndini Muronga's journey is a testament to resilience, resourcefulness, and an unexpected twist of fate. His mother, who never had the opportunity to attend school, was instrumental in his schooling as she sold homemade beer to fund her children's education. His mother's work was a labor-intensive process that took about a week. Professor Muronga recalled the meticulous steps his mother took to ensure each batch was "really perfect for drinking," while she relied on her senses to craft a beverage that sustained their educational pursuits.

Intriguingly, it was this home-brewing process that initially captivated Professor Muronga's attention, long before he knew about the branch of science called chemistry. The alchemy of creating the perfect brew unfolded within the walls of his home and laid the foundation for a scientific curiosity that shaped his future.

Professor Muronga loved mathematics in primary school, and the discovery of physics and its related fields came at a slower pace. In the absence of the educational resources prevalent in developed nations where knowledge is disseminated through various mediums, the villages of Professor Muronga's youth relied on the light of the moon for directions.

The pivotal turn toward physics occurred when Professor Muronga was faced with a crucial decision between mathematics and physics for higher education. Confronted by economic realities, he had to follow the path where funds and grants were available. The choice was not merely academic, but a pragmatic response to the financial reality that dictated the trajectory of his educational journey.

Africa grapples with an annual expenditure of US $4 billion on recruiting skilled expatriates, prompting a crucial question — how can early career researchers lead a transformative science renaissance? Professor Muronga advocates for harnessing the influence of senior African researchers to shape policies that create an environment conducive to early career growth. "We are not politicians, we are scientists," said Professor Muronga, "our focus should be on mentorship rather than political engagement." This approach ensures a continuous cycle of growth and contribution among the early generation of researchers.

Empowering Futures: Early Investment in High School Sparks a Scientific Journey for Young Women

In the realm of physics where innovation and discovery thrive, women scientists are making groundbreaking contributions globally. However, despite their remarkable achievements, women still represent just 33.3% of researchers worldwide and their work often goes unrecognized. Professor Mmantsae Moche Diale, an eminent physicist from Africa, stands as a beacon of inspiration, challenging historical underrepresentation and paving the way for a new era of inclusion and mentorship.

For Professor Diale, the journey into physics was a conscious choice made in order to defy the historical underrepresentation of women in the field. Despite the challenges posed by a predominantly male-dominated discipline, her dedication to science has made her a role model for aspiring women scientists across Africa. The question of what inspired her to pursue a career in physics opens a window into the determination that fuels her journey.

Crucial to Professor Diale's trajectory were the experiences and individuals who provided mentorship and support during her journey. She emphasizes the need for dedicated mentorship programs, especially for young women aspiring to enter the field of physics. By sharing her experiences and insights, Professor Diale becomes a guide, offering a roadmap for the next generation of women scientists.

In her pursuit of fostering inclusivity, Professor Diale recognizes the need to address the stark gender disparity that exists within the scientific landscape of Africa. She believes that attracting young women to science begins early, advocating for investment in time and resources at the high school level. Professor Diale envisions a future where more women – particularly black women – play a significant role in research and innovation, thereby challenging the status quo and enriching the scientific community.

African Innovation Unleashed: A Strategic Vision for Physics Advancement and Scientific Empowerment

Great minds across disciplines have long grappled with the intertwined concepts of beauty and truth. Hermann Weyl, a luminary in mathematics, physics, and philosophy, once remarked, "In my work, I have always tried to unite the true with the beautiful; but when I had to choose one or the other, I usually chose the beautiful." This statement invites us to explore the profound connection between beauty and truth.

Physics, according to Prof. Mohamed Chabab, is the art of problem-solving, and the beauty lies in the seamless interplay between mathematics and the natural order. The forces that govern our universe—electromagnetism, weak and strong nuclear forces, and gravity—are elegantly encapsulated in mathematical expressions.

Yet, this pursuit of beauty is not divorced from reality. In the words of Prof. Chabab, the beauty of a theory finds its true value in its consistency with experimental observations. "It doesn't matter how beautiful your theory is; it doesn't matter how smart you are if it is not consistent with the experiment," emphasizes Prof. Chabab. Here, beauty and truth emerge as inseparable companions.

In the midst of these scientific endeavors, Prof. Chabab also serves as a convener of the particle physics working group of the African Strategy of Fundamental and Applied Physics [1] that is exciting and challenging. "Indeed, beyond my personal satisfaction, it is also one of my responsibilities as an African physicist to contribute to such initiatives aiming for the improvement of the scientific research system in Africa and the reform of higher education," said Prof. Chabab. These initiatives are among the essential keys to unlocking minds, boosting economic growth, and ensuring sustainability.

The "Beauty of Physics" Early Career Panel Discussion not only unveiled the personal narratives of these esteemed physicists but also ignited a spark of inspiration for early career physicists.

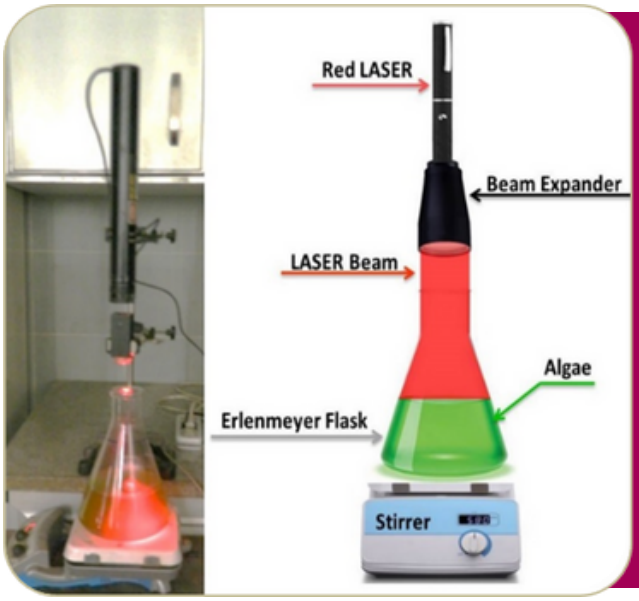
Figure 2: Event flyer. (Photo Credit: Mounia Laassiri)

References:

[1] African Strategy for Fundamental and Applied Physics, https://africanphysicsstrategy.org/

THE AFRICAN PHYSICS NEWSLETTER

Exploring the Effects of Laser Irradiation on Lipid Accumulation and Growth of Microalgae for Biodiesel Production at Cairo University



Irradiation of microalgae using a laser source

(Photo Credits: NA)

This study hypothesizes that exposing algae to laser irradiation enhances lipid production and promotes microalgae growth, particularly Chlorella sorokiniana, for biofuel production and wastewater treatment applications. The effects of laser irradiation on microalgae involve photo-biostimulation, where the energy from the laser can be absorbed by pigments within the microalgae cells, therefore triggering biochemical reactions. Laser irradiation could enhance lipid accumulation by stimulating lipid biosynthesis and altering metabolic pathways, leading to increased production of triacylglycerols (TAGs), the main storage lipids in microalgae. Additionally, laser irradiation promotes growth by stimulating photosynthesis respiratory activities, upregulating key enzymes, and activating signaling pathways involved in cell division and growth.

Laser irradiation can also influence various physiological and biochemical parameters in microalgae, including the modulation of antioxidants and reactive oxygen species production. These changes contribute to cellular defense mechanisms, stress responses, and improved overall health and viability of microalgae cultures. The specific effects of laser irradiation on Chlorella sorokiniana depend on factors that need to be carefully optimized, including wavelength, intensity, and exposure duration.

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In a specific 2022 study [1], the effects of monochromatic light, such as red light-emitting diodes (LEDs) and He-Ne red laser, on the growth and lipid accumulation of Chlorella sorokiniana (Figure 1) were investigated. The study demonstrated that red light within the photosynthetically active radiation range stimulates photosynthetic activity, increasing biomass growth and lipid accumulation. The study also highlighted the modulation of metabolic pathways and reactive oxygen species signaling as essential mechanisms underlying the photo-biostimulation effects. The study was carried out using an array of photobioreactors for biodiesel production of cultivated algae exposed to white light after being irradiated with a monochromatic light source (Figure 2). The results showed that the oil content and biodiesel yield from algal cells irradiated with He-Ne red laser were 3.1 times those of the control, while the oil content and biodiesel yield from algal cells irradiated with red LEDs were only 0.82 times those of the control.

The mechanisms of photo-biostimulation involve enhanced photosynthetic activity through the absorption of light by pigments, stimulation of metabolic pathways involved in lipid biosynthesis, modulation of ROS signaling and antioxidant responses, and optimization of laser parameters for desired effects. The growth enhancement and increased biomass productivity of Chlorella sorokiniana have implications for applications such as biofuel production. Laser irradiation can also influence the lipid content and composition of the microalgae, therefore impacting the quality and suitability of the lipids for downstream applications.

However, further research is needed in order to determine the practicality of scaling up laser irradiation techniques using lasers for microalgae cultivation. Factors such as light penetration, energy efficiency, and cost-effectiveness should be considered for practical applications in larger cultivation systems.

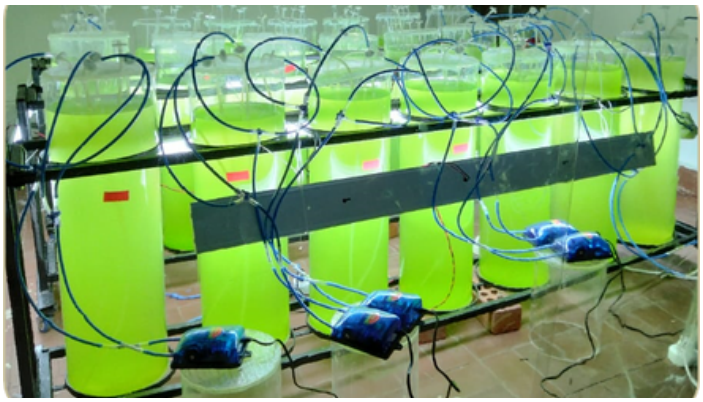

Figure 2: A photograph presenting an array of photobioreactors for biodiesel production of cultivated algae exposed to white light after being irradiated with a laser source. (Photo Credits: NA)

References:
[1] Faried, Maryam et. al., "Photobiostimulation of green microalga Chlorella sorokiniana using He-Ne red laser radiation for increasing biodiesel production," February 2022, https://doi.org/10.1007/s13399-021-02220-3.

THE AFRICAN PHYSICS NEWSLETTER

Citizens and Travelers II: A Collection of African Scientists' Stories

"There's always room for a story that can transport people to another place." J.K. Rowling

(Photo Credits: The Author)

Citizens and Travelers II is a project aimed at collecting and publishing the stories of African scientists. We strongly believe that everyone has a story to share, whether it has a happy ending or not. When shared, these stories can motivate, guide, correct, and educate others. We have read many stories regarding how the Western world has made an impact in science, but we believe it is time to showcase the contributions of African scientists in science and technology through detailed accounts of their life journeys. With this project, our goal is to provide a unique collection of stories particular to the African community, with the aim of motivating, guiding, and protecting the next generation.

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"...It is time to showcase the contributions of African scientists in science and technology through detailed accounts of their life journeys."

The motivation for this project can be traced back to a book authored by Dr. Kétévi Assamagan titled "Citizen and Traveler" [1]. This book tells the true-life story of Dr. Kétévi Assamagan and has served as a source of inspiration for students across Africa. We strongly believe that offering stories from diverse perspectives will be of a great advantage to the next generation. The perspectives covered in this project range from financial backgrounds to missed opportunities, geographical diversity, struggles to secure permanent positions, scientists in business, and beyond.

We would also like to highlight some of the benefits of participating in this project and its impact on the African scientific community. These benefits include increased international exposure, networking and mentorship opportunities, access to materials for learning and research, the creation of a human capacity database, and more. The impact is that students will have access to detailed information about the scientists around them, exposure to research opportunities, the ability to learn from others about handling life's challenges, gain motivation and direction, as well as insights into both failed and successful opportunities.

In this project, we have had the privilege of featuring the stories of the first batch of remarkable African scientists, including Dr. Azote Somiealo, Dr. Betrand Tchanche, Professor Claudio Paulo, Dr. Mounia Laassiri, Dr. Marie Clémentine Nibamureke, Professor Wole Soboyejo, and Professor Mirjana Povic. Each of these scientists hold a unique connection to Africa, either through their birth, upbringing, or migration, and they have generously shared their inspiring life journeys as part of this project.

The heart of this project lies in the compelling stories of these remarkable individuals – Dr. Azote Somiealo, born and raised in Togo; Dr. Bertrand Tchanche from Cameroon; Professor Claudio Paulo, a native of Mozambique; Dr. Mounia Laassiri, born in Morocco; Dr. Marie Clémentine Nibamureke from Rwanda; Professor Wole Soboyejo, with roots in Nigeria but born in California; and Professor Mirjana Povic, originally from Serbia but having called several African nations home for the past two decades.
All of these extraordinary people have made significant contributions as faculties and scientists in their respective fields. In our upcoming newsletters, we will delve deeper into their life stories and share full interviews, giving you an opportunity to learn from their experiences and the valuable insights they have shared. We invite you to stay tuned and be inspired by the journeys of these exceptional African scientists.

Citizens and Travelers II: A Collection of African Scientists' Stories Project Team

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References:
[1] Kétévi Assamagan, "Citizen and Traveler," 2017.

THE AFRICAN PHYSICS NEWSLETTER

The 3rd African Conference on Fundamental and Applied Physics (ACP2023)

Some of the female participants at ACP2023

(Photo Credit: The Authors)

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JANUARY 2024

The African School of Physics (ASP) encompassesa a series of activities designed to support the academic growth of African students and research faculties. One noteworthy activity is the African Conference on Fundamental and Applied Physics (ACP). Established in 2010, ASP conducts an intensive three-week student summer school organized biennially. Over time, ASP was augmented to include a workshop to train African high school teachers in the planning and delivery of physics instructions, an outreach program to motivate high school learners to develop and maintain interest in physics, a structured mentorship program for ASP alumni, a forum engaging policymakers in physics education and research, online workshops, a short-term research program placing selected ASP alumni in US-based research groups for three to six months, and the ACP. ASP activities for students, teachers, and learners draw a limited number of international lecturers and students selected based on the availability of funds and logistical constraints at the venues. To cater to the growing interest in ASP and broaden participation beyond the limited numbers of selected school participants, the ACP series was integrated, thus increasing networking and enriching scientific discourse at ASP. The inaugural ACP (ACP2018) took place in Namibia [1-10].

The 2nd edition of ACP was organized as an online event in March 2022, featuring the African Strategy of Fundamental and Applied Physics as its central theme [11]. In November-December 2022, South Africa hosted the 7th African School of Physics, ASP2022, at the Nelson Mandela University in Gqeberha. The 3rd edition of ACP, ACP2023, served as the continuation of ASP2022 and was held at the George Campus of Nelson Mandela University from September 25 to 29, 2023 [1]. The ACP scientific program is designed to include the major physics and societal engagement areas of interest in Africa, including particles and related applications such as nuclear physics, particle physics, medical physics, (particle) astrophysics, and cosmology, as well as fluid and plasma physics, and complex systems. Additionally, the program covers light sources and their applications, condensed matter and materials physics, atomic and molecular physics, optics and photonics, earth science, accelerator physics, computing, instrumentation, detectors, physics education, community engagement, women in physics and early career physicists [9].

Approximately six hundred individuals expressed interest in ACP2023, as shown in Figure 1. Among these participants, four hundred and seventy-five hailed from thirty African countries, while one hundred and twenty-six represented twenty-eight non-African institutes [12].

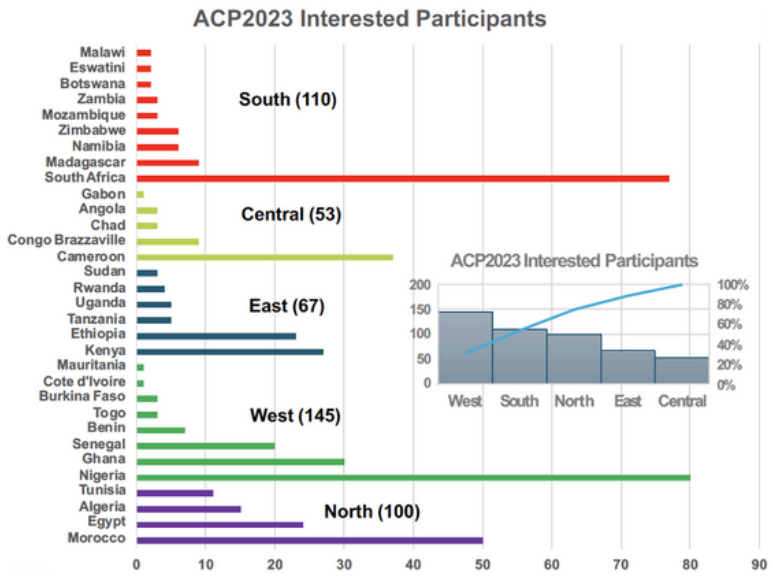

Figure 2: The community interest in ACP2023, with 475 individuals from African institutes and an additional 126 from non-African institutes. (Photo Credits: The Authors)

The program for ACP2023 was designed around invited plenary presentations, supplemented by selected contributed abstracts and poster sessions across the aforementioned fields. Additionally, dedicated panel discussions and topical sessions covered themes such as the "beauty of physics" organised by ASP alumni, "small detector labs and the Internet of Things," "big detectors and large research infrastructures in Africa," "African countries joining and thriving in large international collaborations," "career trajectories of selected ASP alumni," and "inverse Compton Scattering and light source research infrastructure for Africa."

Approximately sixty participants attended in-person, with the number constrained by travel coverage, while the plenary sessions witnessed over fifty online connections. ACP2023 drew a greater participation of ASP alumni in both event organization and scientific engagements [12]. Notably, ACP2023 included a significant female participation across all aspects of the events [13]. Figure 2 highlights some of the female participants, with a registration ratio of 4:10 (female to male) and an in-person attendance ratio of 1:2.

Prior to the COVID-19 pandemic, ASP events occurred biennially, limiting the number of African countries eligible to host ASP due to a competitive bidding process. To increase the frequency of ASP events and broaden the reach to more African countries, a new approach has been implemented since 2023. The ASP schools and conferences are now organized in alternating years in different countries. For instance, Morocco is set to host the eighth edition of the school, ASP2024, in July 2024 [1], while Togo is slated to host the fourth edition of the conference, ACP2025, in September or October 2025 [13].

References:
[1] The African School of Fundamental Physics and Applications, https://www.africanschoolofphysics.org/
[2] Acharya et. al, "Biennial African School of Fundamental Physics and its Applications 2010 Report," ASP, 2010, https://africanschoolofphysics.web.cern.ch/2010/asp2010.pdf
[3] Acharya et. al, "Biennial African School of Fundamental Physics and its Applications 2012 Report," ASP, 2012, https://africanschoolofphysics.web.cern.ch/asp2012/asp2012_final.pdf
[4] Acharya et. al, "The Third Biennial African School of Fundamental Physics and its Applications," ASP, 2014, https://www.africanschoolofphysics.org/wp-content/uploads/2014/11/asp2014.pdf
[5] Acharya et. al, "Activity Report of the Fourth Edition in Rwanda," ASP, 2016, https://www.africanschoolofphysics.org/wp-content/uploads/2019/08/ASP2016-FinalReport.pdf
[6] Acharya et. al, "Activity Report on the Fifth Biennial African School of Fundamental Physics and Applications," ASP, 2018, https://www.africanschoolofphysics.org/wp-content/uploads/2019/08/ASP2018.pdf
[7] Assamagan, K. & Lassiri, M., "The African School of Fundamental Physics and Applications (ASP)," ASP, 2019, https://doi.org/10.48550/arXiv.1909.06309
[8] Koropsak, Jane, "Alumni from African School of Physics Come to Brookhaven Lab for Hands-on Work Experience," 2019, https://www.bnl.gov/newsroom/news.php?a=216732
[9] Assamagan, K. et. al., "Activity Report of the Second African Conference on Fundamental and Applied Physics, ACP2021," 2022, https://doi.org/10.48550/arXiv.2204.01882
[10] Assamagan, K. et. al., "Activity Report on the Seventh African School of Fundamental Physics and Applications (ASP2022)," 2023, https://doi.org/10.48550/arXiv.2302.13940
[11] The African Strategy of Fundamental and Applied Physics, https://africanphysicsstrategy.org/
[12] "Physics Conference | Africa's top scientists convene in George," https://www.youtube.com/watch?v=zCxMFTx8Ym4
[13] The 3rd African Conference on Fundamental and Applied Physics (ACP2023), https://indico.cern.ch/event/1229551/

THE AFRICAN PHYSICS NEWSLETTER

Nuclear Energy for African Development

Germain Hubert Ben-Bolie

(Photo Credit: The Author)

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JANUARY 2024

The Energy Context in Africa

With a population of approximately 1.3 billion inhabitants, Africa holds an enormous potential for economic growth through its abundant natural and human resources. However, for the continent to advance and rise to the forefront of the world economy, it must resolve its pressing issues, including population management, healthcare, education, housing, food security, and access to clean water. Additionally, challenges such as inadequate infrastructure, limited industrialization, insufficient transport, education gaps, and employment require urgent attention.

Among these issues, energy is a critical priority for the implementation of a real development policy. Indeed, Africa is experiencing exponential demographic growth, resulting in a predominantly young population – a source of creativity and innovation. However, the continent struggles to harness this potential that our youth constitutes because it is incapable of providing them with housing, food (despite vast arable land), access to education, quality health care, and job opportunities.

On the other hand, Africa is plagued by various epidemics and pandemics, including cholera, malaria, AIDS, Ebola, and COVID-19. Additionally, the continent grapples with the consequences of climate change, including drought and starvation, which further hinder its demographic growth from serving as a driver of development rather than a hindrance.

The African industrialization policy, which integrates technology acquisition, faces difficulties in supplying sustainable, reliable, affordable, and competitive energy. Despite being naturally endowed with numerous energy resources such as oil, natural gas, coal, and uranium, the African continent faces difficulties due to the imperative of transitioning to green energies. We need to reduce the global carbon footprint of emissions from the combustion of petrochemicals in order to reduce the effects of global climate change.

Correlation Between Energy and Economic Growth

The International Energy Agency (IEA) states clearly that energy holds a significant role in economic, social, political, and environmental contexts. According to the Energy Review spanning from 2011 to 2019, global energy provision increased by an average of 3.7% annually, while energy consumption grew at a lower rate of 2.6% per year during the same period. There is a strong correlation between energy consumption and the level of economic growth and development. Notably, China accounted for 90% of net global energy demand growth in 2019, with a 3.4% increase, while advanced economies, including the European Union (2% decline) and the United States (0.8% decline), experienced decreased energy demand [1].

Energy has a very large impact on the economic growth and development of a country. Indeed, there is no human activity that does not consume energy, whether direct or indirect, as energy and work are therefore hardly substitutable. An increased supply of energy has the potential to boost economic growth within a country. Supporting this idea, a 2016 study demonstrated that energy consumption is linked to GDP growth in the countries of the West African Economic and Monetary Union (UEMOA) [2].

Nevertheless, by improving energy efficiency, countries can reduce their energy consumption while maintaining sustained economic growth. The International Energy Agency emphasizes that energy efficiency has become the primary energy source in high-income countries, enabling the repurposing of saved energy elsewhere.

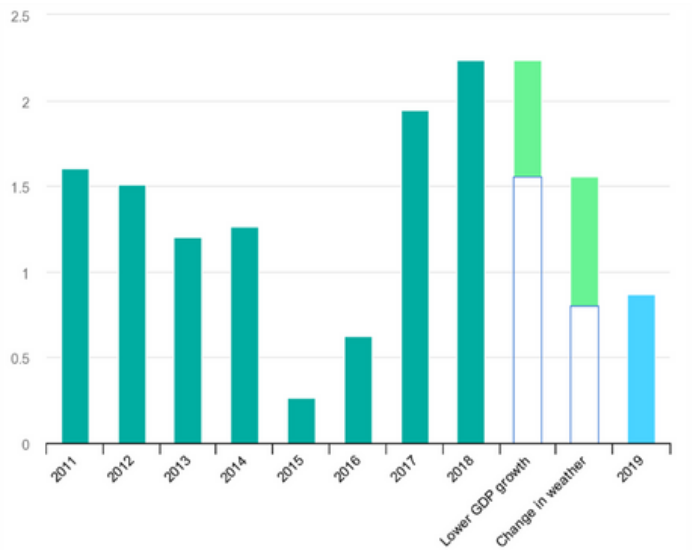

Figure 2: World energy demand growth rate 2011-2019 [1]. (Photo Credits: Reference [1] CC BY 4.0)

Nuclear Energy for the Accelerated Development of Africa

African countries have experienced unprecedented economic growth over the past two decades; however, energy remains a critical challenge for their economic, political, and social development. Indeed, the majority of African countries face a lack of access to energy. Over the years, we have observed that greenhouse gasses are responsible for the degradation of our environment, evident in the increase in air pollution and the advancement of climate change. It is important to remember that the greenhouse effect results from human activities, particularly the use of fossil fuels.

Renewable energies designate a set of means of producing energy from theoretically unlimited sources, reconstituted more quickly than they are consumed. Despite their potential, several challenges linked to financing, regulations, and public policies still hinder increased investments in these technologies. Addressing these challenges becomes essential for African countries to harness their abundant renewable resources and successfully undergo an energy transition. The technologies of these green energies are not completely mastered yet and, having an untimely nature, remain too expensive for local industries. Faced with problems that still undermine Africa today, including its galloping demographics, the infancy of renewable energy technology, and the high demand for energy for the construction of large infrastructures and industries, we are right to ask ourselves whether renewable energies can meet Africa's development

challenges. The use of renewable energies appears to be one of the preferred solutions for effectively reducing these emissions. However, strong and sustainable growth in Africa will require high energy intensity that does not harm the environment.

According to the French Academy of Sciences, industrial installations powered by fuels like nuclear reactors and thermal power plants can reach a power of GWe, whereas those operating without fuel, such as solar panels and wind turbines, range from kWe to a few MWe. Multiplying these, particularly on farms, makes it possible to reach several dozen MWe. Additionally, on a global scale, the IEA notes that nuclear power annually avoids emissions of around 600 million tons of carbon (MtC), approximately equivalent to hydroelectric power. These 600 MtC represent 8% of current global greenhouse gas emissions. The choice of technologies supporting a country's sustainable development is a sovereign decision, and each country must adopt the mix of technologies that meet its situation and needs. Considering the advantages of nuclear power in achieving sustainable development goals, it should play an important role in the energy mix of many countries. Therefore, it would be more prudent for African public policies to highlight energy resources with a low carbon footprint, such as nuclear power, as a clean energy source capable of supporting industrial growth and reducing harmful greenhouse gas emissions.

Nuclear energy is viewed as the ideal alternative solution to provide African countries with sufficient, high-quality energy for their harmonious development. Faced with the high cost of energy investments, particularly in the field of nuclear power, and the requisite technical, technological, and human resources for their implementation, it would be wise for African nations to adopt a collaborative approach. Indeed, to achieve this objective, African countries should organize themselves at regional and sub-regional levels to consolidate their resources and expertise and establish a human resources development plan.

References:
[1] The International Energy Agency, "World Energy Review 2019," www.iea.org/reports/global-energy-review-2019
[2] Palakiyèm Kpemoua et.al., "Electric energy consumption and economic growth in Togo," 2016 https://mpra.ub.uni-muenchen.de/69113/.

THE AFRICAN PHYSICS NEWSLETTER

What Can Physicists Do in Our Planetary Crisis?

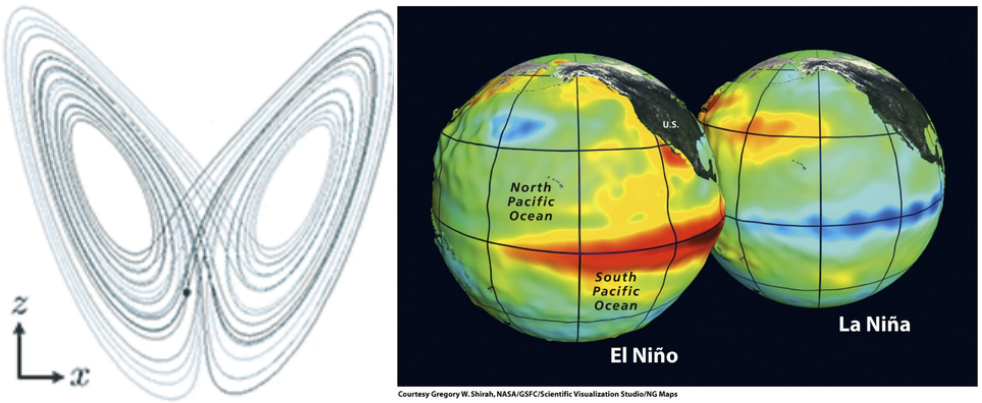

Figure 1a (left): The Lorentz attractor in phase space. Figure 1b (right): Sea surface temperatures - El Niño and La Niña currents. (Photo Credit: 1a, Dan Quinn - Own work, CC BY-SA 3.0; 1b, Courtesy Gregory P. Shirah NASA/GSFC/Scientific Visualization StudioNG Maps)

There's no doubt that the African climate is changing. We ourselves see knock-on effects in agriculture and pastoralism, health and heatstroke, extended droughts, and storm severity.

What can physicists do to engage with this crisis? Many are already deeply involved.

In physics, we are well-acquainted with solar power-generation systems, from innovative perovskites to the control systems that manage supply. Advanced materials research has reduced the cost of solar electricity 100-fold in the last two decades, and curiously, this has been furthered by the efforts of astronomers in their quest to collect more photons at a lower cost.

Windmills will continue to be useful in local pump power provision, and composite wind turbines are being deployed, particularly across the South African landscape. Physicists and engineers are active in finding novel storage solutions, from batteries to pumped storage and heat storage systems. Naturally, Africa has groups working in all these areas. Renewable energy is a research focus that makes an impact, both in journals and in everyday life.

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The additional stress of a changing climate leads us to the construction of buildings with natural ventilation for cooling and insulation for heating. Frequently, these designs refer back to ancient practices, such as wind-towers and latticed windows. The trend towards larger airports and urban buildings has hastened the ability to design with natural light [1].

In many countries, reliable provision of electricity is a major problem. The consumption of electricity without due consideration for the future is a luxury that few people can entertain. Moreover, the additional stress placed on transmission systems by the transients of switching off and on constitutes a significant factor contributing to system failures [2].

What suits diverse communities in Africa best? Our urbanisation is rapid and our rural areas need solutions that work for them. All communities wish to make choices and decisions about their own future – we know that "solutions" can't be "thrown over the wall" to a community from a university as an academic project. Technologies truly become usable when they are moved into the lost-cost scope and open opportunities for local employment. Physicists excel in this area as we are always thinking of low-cost demonstrations that beautifully illustrate basic principles. To quote a call to action in physics, "in the green economy, efforts to reduce energy consumption, diminish pollution, and develop more efficient processes are currently being researched and developed by teams of physicists and colleagues."

Climate physics offers profound opportunities. Three Nobel Prizes in the field were awarded in 2021 to professors Syukuro Manabe and Klaus Hasselmann for the physical modeling of Earth's climate, quantifying variability and reliably predicting global warming. Additionally, Giorgio Parisi received recognition for the discovery of the interplay of disorder and fluctuations in physical systems, from atomic to planetary scales. The science of non-linear dynamics and chaos evolved, in part, from efforts to model and understand our planet's atmospheric circulation [3]. At the Centennial Symposium of the International Union of Pure and Applied Physics (IUPAP), Timothy Palmer explained basic bistable non-linear systems, drawing the potential analogy with the El Niño-La Niña Southern Oscillation, a phenomenon of atmospheric-ocean circulation causing droughts and storms from Cape Town to Chile.

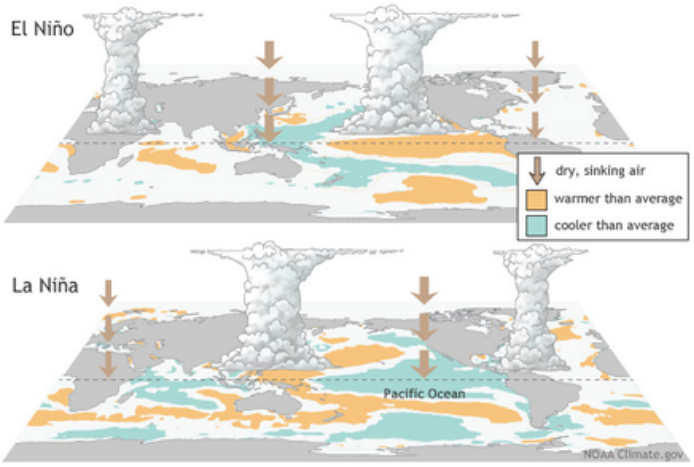

Figure 2: The two global dominant states of El Niño and La Niña. (Photo Credits: https://www.climate.gov/enso)

Physicists can contribute in diverse ways to climate modeling. Carolina Vera, affiliated with the IPCC, underscores the challenges faced in climate assessments, stating, "Spatial and temporal gaps in both historical and current observing networks, and the limited extent of paleoclimatic archives, have posed a challenge for assessments…Limited climate monitoring in some regions impedes the full understanding of the relevant climate processes, an appropriate validation of model simulations, and the formulation of trustworthy regional climate information" [4]. This issue is deeply true for Africa.

The difference between weather and climate has been made very clear. While weather refers to short-term changes in the atmosphere, climate refers to atmospheric changes over longer periods of time, usually defined as 30 years or more. Weather forecasting is essential for Early Warning Systems, which we desperately need in Africa, as demonstrated in the Mozambique floods of 2019 [5].

IUPAP has therefore formed Working Group 21 on Climate Change Action and Sustainable Development. The Working Group has been tasked to identify, promote, engage, and discuss the unique role that physics plays and should play in this area. The aim is to entrench an evidence-based approach to responses to climate change studies and the energy transition process in close collaboration with experts from other disciplines. The Working Group will establish a strong bridge with the broad international public on these topics. Very importantly, it will suggest and encourage ways of incorporating green economy and sustainability thinking in university curricula and research training.

IUPAP is not a research organization but relies on making a space in which deeply important issues can be addressed by physicists globally. The Working Group will organize at least one major conference within the next three years. This initiative fits extremely well with the anticipated activities related to the International Decade of Sciences for Sustainable Development proclaimed by the United Nations General Assembly in August 2023. Furthermore, the Working Group will liaise with regional and national physics societies, as well as with other Unions.

The way in which we approach science policy as scientists is critical. The terrain is fraught with political influences and it is essential that we must carefully differentiate between academic discourse and political discourse, as well as between climate action and climate activism. We come to the advisory table as providers of evidence-based reasoning. The experience gained, particularly in dealing with challenges like COVID-19, has shown that this approach builds trust between the stakeholders at the table.

IUPAP operates without individual members, relying instead on national physical societies that are territorial members. Useful ways for physicists to contribute to the climate-related effort include finding opportunities for teaching climate physics, engaging in research related to green energy provision, promoting evidence-based reasoning, contributing to research, and fostering evidence-based decision-making in science policy.

The African Physics Newsletter is eager to continue to receive articles from groups working in these areas. The more information we exchange, the better.

References:
[1] J.-L. Scartezzini, Advances in daylighting and artificial lighting, CRC Press, 2003
[2] e.g. Gorjão and Maritz, African Physics Newsletter, June 2023
[3] James Gleik, Chaos, Abacus, 1987
[4] Carolina Vera, priv. comm., 30 October 2023
[5] Engelbrecht and Vogel, One Earth, 4, August 2021 https://doi.org/10.1016/j.oneear.2021.07.016
[6] Dan Quinn CC BY-SA 3.0
https://en.wikipedia.org/wiki/Lorenz_system#/media/File:A_Trajectory_Through_Phase_Space_in_a_Lorenz_Attractor.gif

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Price Accessibility for the APS March, April, and DAMOP Meetings

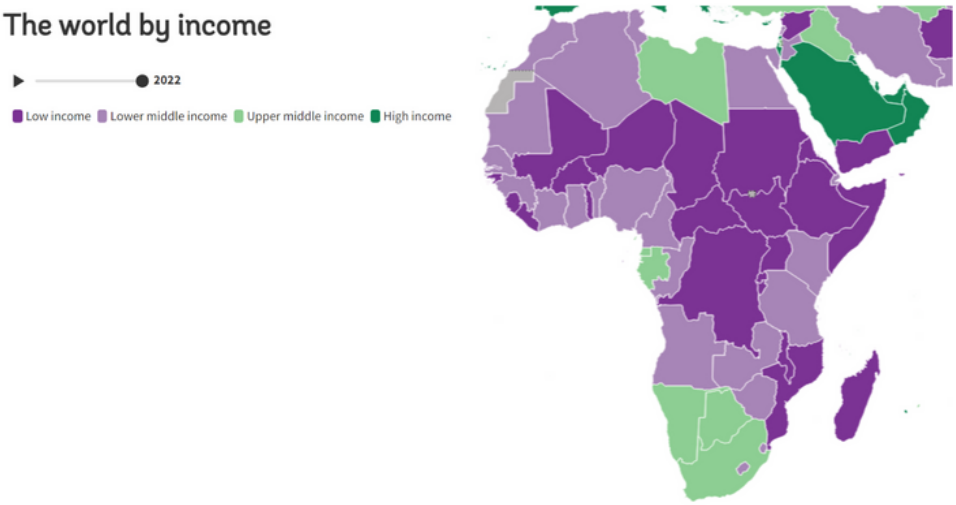

Figure 1: Eligibility: The world by GDP per capita 2022. (Photo Credits: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html)

The American Physical Society's (APS) major meetings offer reduced fees for attendees from developing countries. The March and April Meetings, along with the annual meeting of the Division of Atomic, Molecular and Optical Physics (DAMOP), have agreed to extend a nearly 90 discount to physicists from Low-Income countries, and a more than 70% discount to those from Lower-Middle-Income and Upper-Middle-Income countries, as per World Bank rankings.

APS developed these tiers using a ratio between the registration fees and the average GDP per capita. The equitable registration pricing structure for in-person and virtual attendance is part of the APS move to serve as an inclusive welcoming global hub for the worldwide physics community.

The March Meeting takes place in Minneapolis (UTC -6) from March 3-8, 2024, and attracts approximately 13,000 physicists from around the globe. The conference will also feature a special session featuring Nobel Laureates on Sunday, March 3. If you wish to submit a paper for the 2025 meeting, please keep an eye on the site in autumn 2024.

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References:

If you wish to consider hosting a Satellite Meeting, where physicists gather in their home country to participate virtually, please contact international@aps.org. Explore Price Accessibility for Less-Resourced Countries at https://aps.org/meetings/policies/price-access.cfm.

Read about previous March Meeting satellite events organized in Africa in the July 2022 issue of the APN: https://us19.campaign-archive.com/?u=63e42c583930d9f7a8b637982&id=c5a6350f56

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An Interview with Dr. Tolulope M. Ajayi, Contributor to a Recent Breakthrough in Single Atom X-Ray Imaging

Dr. Tolulope M. Ajayi

Photo Credit: Dr. Tolulope M. Ajayi)

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At the heart of your work as a scientist, could you explain your field of research to a non-expert?
In this field of research, we study materials' chemical and physical properties at the most fundamental level – on an individual atom basis using cutting-edge X-ray probing methods. For decades, scientists and engineers have sought and developed novel X-ray-based techniques to study and characterize materials in the nanoscale regime. Studying materials from the nanoscale reveals characteristic information and property-defining details that are unavailable when investigating bulk materials.

What drives you to be such a dedicated researcher?
My commitment to research is fueled by a diverse mix of personal enthusiasm, intellectual inquisitiveness, the desire for meaningful impact, and a dedication to advancing knowledge and society. I am motivated by the prospect of contributing to the collective pool of human knowledge. The potential to create solutions for pressing issues, make medical breakthroughs to improve lives, advance technology, and address global challenges provides a profound sense of purpose. I am also driven by the opportunity for continuous learning and staying intellectually engaged.

You recently contributed to a work that led to the first characterization of a single atom using X-rays – a breakthrough 128 years after the discovery of X-rays by Roentgen! What does such an achievement mean to you?
This accomplishment holds immense significance for me on multiple levels. Firstly, it stands as the most impactful and influential publication in my career as a researcher, pushing the boundaries of what can be explored through X-ray studies. Equally crucial, it represents the culmination of a decade-long research journey for my group, a pursuit that often felt like an ambitious dream. Although the initiative to measure the X-ray signature on a single atom was underway before I joined the group, I feel fortunate and blessed to have been one of the individuals who made it a reality.

What was your main contribution to this work and what are the potential applications?
As you can imagine, undertaking research of this magnitude is not a solitary endeavor. It involved a collaborative effort across various disciplines, including physicists, chemists, X-ray beamline scientists, and others. The concept of exploring the intrinsic properties of individual atoms using synchrotron X-rays at the Advanced Photon Source, Argonne National Laboratory, was conceived more than a decade ago by my Ph.D. advisor, Professor Saw-Wai Hla, and his colleague Dr. Volker Rose. However, the project leading to this breakthrough discovery was an integral part of my Ph.D. thesis and I was responsible for conducting the measurements.

In terms of potential applications, this discovery opens up a new realm of research with limitless possibilities. It showcases the feasibility of characterizing molecular materials at the level of individual atoms. I firmly believe that this could expedite the development of engineered molecular materials with applications in crucial areas such as medicine, including the use of nanobots for organ-targeted drug delivery, and in information technology, such as the utilization of qubits in quantum computing and molecular electronics for storage or memory units.

You recently joined industry. What motivated your choice?
I have always sensed my fit within the realm of applied research and development in the industrial sector, where projects are driven by clear goals and concentrate on resolving practical issues or pioneering new technologies. Despite a relatively brief but exhilarating stint in basic and fundamental research within the public sector, delving into the depths of our understanding of the natural world and pushing the frontiers of science, my experience in industry has been illuminating. Steering projects with a direct influence on individuals, businesses, and society has been transformative for me. At this juncture in my career, I believe this is precisely where I want to be.

What is the difference between working in industry and working at a university?
Public sector research work is about studying and answering fundamental questions about the natural world with meticulous and exhaustive methods. Project timelines tend to be more relaxed, often spanning years or even decades before they manifest and impact practical applications. Conversely, industry operates with a more goal-oriented approach, focusing on resolving practical issues, enhancing existing processes, or innovating technologies with immediate real-world applications.

Moreover, unlike the university or public sector setting, where researchers often work in isolation, industry projects frequently necessitate collaboration among experts from diverse disciplines. This collaborative approach ensures the resilience and robustness of solutions as professionals from different backgrounds contribute their insights to the development process.

Is the US the right place for you to be at the moment? What do you think are the reasons?
I see the United States as ideal for me or any early-career scientist for two reasons. Firstly, there is substantial capital investment in Research and Development (R&D) from both the government and the private sector. This abundance of resources provides early-career scientists ample opportunities for accelerated career growth. Additionally, the thriving public-private partnerships in the US play a pivotal role in promoting innovation, facilitating the commercialization of new technologies, and fostering their widespread adoption—all of which contribute significantly to driving economic growth.

What are you doing to bring science expertise to Africa?
I have contributed to enhancing scientific expertise in Africa by facilitating access to capacity-building initiatives designed to train and empower young scientists, researchers, and educators on the continent.

These initiatives encompass a range of activities such as graduate programs, international workshops, seminars, and training sessions led by experts from around the globe. They offer advanced instruction in cutting-edge scientific techniques, technologies, and methodologies.

Furthermore, numerous scholarship opportunities, fellowships, and exchange programs are available specifically for young African talents. While I have personally benefited from some of these opportunities, it's important to note that many others remain untapped. Those who have participated in these programs and seized these opportunities have gone on to make positive impacts in their respective research fields.

What are your wishes regarding physics in Africa?
African physicists are actively engaged in research, and there is a growing number of publications from researchers on the continent from top universities and research institutions in Africa that have impacted various fields of physics. However, inadequate funding is the leading inhibitor of the development of physics research in Africa. Many researchers and institutions struggle to secure sufficient funding for their projects, limiting the scope and scale of their work. Therefore, my greatest wish regarding physics in Africa is for our scientists to have more access to research grants, both locally from within Africa and internationally. Additionally, I hope for greater visibility of research emanating from Africa on the global stage. Recognition and acclaim for innovative works within the continent at an international level would not only inspire the next generation of scientists but also catalyze the accelerated growth of physics in Africa.

The topic of Blacks in science is important. Black physicists are still underrepresented. How do you contribute to the promotion of young African scientists?
I actively contribute to the advancement of young African scientists, primarily through networking and mentorship. Navigating the research landscape can be challenging, particularly for early-career researchers emerging from Africa with aspirations of establishing their presence. I concertedly connect with and support individuals in need, providing guidance, sharing valuable insights, resources, and opportunities, and engaging in collaborative research when feasible.

Additionally, I make it a practice to acknowledge, celebrate, and publicize the accomplishments of young African scientists. I firmly believe that heightened visibility can serve as inspiration and challenge stereotypes, ultimately addressing the underrepresentation of black physicists in the field.

About the interviewee
Dr. Tolulope M. Ajayi, an accomplished physicist from Nigeria, has earned accolades for his contributions to the field. In 2011, he graduated with first-class honors in physics from the Federal University of Technology in Akure, where he consistently ranked at the top of his class. His research journey commenced in 2012 as an assistant in the Condensed Matter Physics Lab at the same institution.

In 2014, Dr. Ajayi was awarded the prestigious British Government's Commonwealth Scholarship, enabling him to pursue a master's degree in renewable energy systems at Durham University in the United Kingdom. Subsequently, he furthered his academic pursuits in the United States, obtaining a second master's degree in physics before successfully earning his Ph.D. in 2022 from Ohio University. Following this achievement, he joined the Argonne National Laboratory as a post-doctoral researcher before transitioning to the private sector.

Dr. Ajayi's diverse research interests encompass molecular machines and nanoscale molecular systems, scanning tunneling microscopy, and X-ray spectro-microscopy. His journey underscores a commitment to excellence and a passion for advancing scientific understanding across multiple domains.

References:
[1] Ajayi, T. et al. (2023). Characterization of just one atom using synchrotron X-rays. Nature. 618. 69-73. https://doi.org/10.1038/s41586-023-06011-w

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Upcoming Events and Activities

- Second U.S.-Africa Frontiers of Science, Engineering, and Medicine Symposium
  January 16-18, 2024
  Hassan II Academy of Science and Technology, Rabat, Morocco

- International Workshop on Air Quality and IoT-based Air Sensors
  March 14-15, 2024
  Alioune Diop University, Senegal

- The 1st Edition of the Central African Conference on Physics and Applications (CACPA)
  March 18-24, 2024
  Brazzaville, Republic of Congo

- The 8th African School of Fundamental and Applied Physics, ASP2024
  July 7-21, 2024
  Cadi Ayyad University, Marrakesh, Morocco

- The 33rd/35th International Colloquium on Group Theory Methods in Physics GroupJuly 15-19, 2024
  Cotonou, Benin

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Your Online Resources

- GRE Policies/Application Fees for Physics Graduate Programs in the US and Canada
  Compiled by Prof. James Guillochon, this comprehensive table details the GRE requirement policies and application fees for astronomy and physics graduate/PhD programs in the US and Canada.

- Physics World Webinars
  Physics World Webinars from the Institute of Physics

- APS Webinars
  APS Webinars connect you with the expertise of individuals who can offer insight into physics careers, educational programs, and professional development for students, working physicists, and educators.

- APS Career Guidance Webinar Archive
  Career Guidance Webinars Archive of APS

- Opportunities Available Through APS

- Opportunities at the National Institute of Theoretical and Computational Sciences, South Africa

- APS Physics Career Exploration Webinar Series Archive
  Features many of the common career paths available to those with physics degrees, as well as many that are "off the beaten path."

- SPS Career Webinars
  Society of Physics Students Archived Career Webinars

- ICTP Virtual Seminars
  ICTP is expanding its free, online, interactive streaming options for its seminars and colloquia to mitigate some of the effects of isolation during the COVID-19 emergency and beyond.

- NITheCS Webinars and Mini-schools
  The South African National Institute for Theoretical and Computational Sciences offers colloquia, webinars, and mini-schools.
  Upcoming events | Recordings of past events | Mini-schools

- The World Academy of Sciences (TWAS)
  The TWAS site lists deadlines for fellowships, prizes and awards, research grants, visiting scientists, and scientific meetings.

Physicists in the Spotlight

Every three months, the American Physical Society (APS) spotlights a physicist from the global community.

Physicists worldwide contribute their time and thought to the global community and generate new knowledge, yet sometimes remain unknown except in their own communities. The African Physics Newsletter actively seeks out stories of physicists on the continent, aiming to broaden awareness. However, as in particle physics, we must confirm our presence through other channels, too. APS members are encouraged to participate by submitting recommendations!

Access the Global Spotlight initiative at
https://www.aps.org/programs/international/spotlight.cfm.