

Physics Comment – March 2024

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*Unraveling the Mysteries of the Cosmos:
Exploring the Frontiers of Astrophysics*

Credit: OzGrav, Swinburne University of Technology



p. 17



p. 5

Physics Comment (PC) is a magazine published by the South African Institute of Physics (SAIP) and appears quarterly. The vision of the SAIP is to be the voice of Physics in South Africa.



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President's Message

The academic year is in full swing across South Africa. This issue of the magazine showcases several examples of South Africans being productive in international collaborations and research projects on home soil. In addition to producing excellent research, there is a high degree of community involvement and outreach projects to make the work of physicists more relevant. Prof Roy Booth would strongly approve!

It is especially encouraging to note the launch of the International Science Partnership Fund to support UK-South Africa science and research collaboration. This funding will support much vital research and associated human capital development for the next few years.

Readers are specifically reminded that 2024 is an SAIP Gold Medal year and the call for nominations for this prestigious prize is currently open. Please read the section on this prize in the magazine and consider making a nomination. A medal can only be awarded if a person is nominated, so the participation of the SA Physics community in this process is essential.

After the text of this issue was finalised, a call went out for nominations of a new prize that is being awarded by the SAIP; it is the SAIP Physics Education Award. Please refer to the information that went out on the SAIP mailing list or contact the SAIP Office for further information. As with the Gold Medal above, participation of the SA Physics community in the nomination process is essential.

I hope to see many of our readers at the SAIP2024 conference hosted by Rhodes University in Grahamstown / Makhanda from 1 to 5 July 2024. The abstract submission deadline is very soon!!

I wish everyone a productive and prosperous autumn season.

With best regards
Rudolph Erasmus
President: SAIP

Obituary of Prof. Roy Booth

The South African Radio Astronomy community is saddened by the news of the recent passing of Professor Roy Booth in Sweden after a period of deteriorating health. Roy was a prominent figure in global radio astronomy, and he dedicated his later active years to the development of the discipline in South Africa and the rest of the African continent. Roy's social consciousness compelled him to contribute to the development of science in Africa.



Prof. Roy obtained his PhD from the University of Manchester under the direction of Professor Rod Davies at Jodrell Bank. After his time at Jodrell Bank, he moved to Sweden where he was Director of the Onsala Space Observatory and Professor at Chalmers University of Technology. In 2006 Roy and his wife Shirley moved to South Africa, and Roy joined the Hartebeesthoek Radio Astronomy Observatory as Science Director. He subsequently held the position of Professor of Radio Astronomy at the University of Pretoria before returning to Sweden when he finally retired from active research.

Prof. Roy leaves a massive legacy to the global radio astronomy community. His graduate students have themselves become leaders in the field, including Professor Phil Diamond, now Director General of the SKAO. He was a great proponent of international cooperation and collaboration and was a key figure in the expansion of the network of VLBI stations and the establishment of the ALMA observatory. While in South Africa he led the development of the science case for the MeerKAT radio telescope, and he engaged the global radio astronomy community in the project through an open call for large-scale projects that would define the scientific capabilities of the telescope. The unprecedented success of the MeerKAT was celebrated at the MeerKAT@5 conference in Stellenbosch recently. Roy would have been proud of what has been achieved in South Africa, facilitated by his experience and guidance.

Prof. Roy will be missed by radio astronomers worldwide as a colleague and friend, as well as a ferocious defender of his principles and values. We extend our condolences to Shirley and the rest of their family and will celebrate his legacy in the years to come in the manner in which he would have approved: reminiscing about his achievements and antics over one of his favourite beverages.

We acknowledge SARAo for contributing to the obituary.

Reported by SAIP office.

MeerKAT's Discovery: Unveiling the Mystery between Black Holes and Neutron Stars



An artist's impression of the system assumes that the massive companion star is a black hole. The brightest background star is its orbital companion, the radio pulsar PSR J0514-4002E. The two stars are separated by 8 million km and circle each other every 7 days. Credit: Daniëlle Futselaar (artsource.nl).

An international team of astronomers, led by researchers from the Max Planck Institute for Radio Astronomy, have used the MeerKAT radio telescope to discover an intriguing object of an unknown nature in the globular cluster NGC 1851. The massive object is heavier than the heaviest neutron stars known and yet simultaneously lighter than the lightest black holes known and is in orbit around a rapidly spinning millisecond pulsar. This could be the first discovery of the much-coveted radio pulsar – black hole binary; a stellar pairing that would allow new tests of Einstein's general relativity.

Neutron stars, the ultra-dense remains of a supernova explosion, can only be so heavy. Once they've acquired too much mass, perhaps by consuming another star or maybe by colliding with another of their kind, they will collapse. What exactly they become once they collapse is the cause of much speculation, with various wild and wonderful flavours of exotic stars being proposed. The prevailing opinion, however, is that neutron stars collapse to become black holes, objects so gravitationally attractive that even light cannot escape them. Theory, backed by observation, tells us that the lightest black holes that can be created by collapsing stars are about 5 times more massive than the Sun. This is considerably larger than the 2.2 times the mass of the sun required for neutron star collapse, giving rise to what is known as the black hole mass gap. The nature of compact objects in this mass gap is unknown and detailed study has thus far proved challenging due to only fleeting glimpses of such objects being caught in observations of gravitational wave merger events in the distant universe.

The discovery of an object in this mass gap in our galaxy by a team of astronomers from the international Transients

and Pulsars with MeerKAT (TRAPUM) collaboration may help finally understand these objects. Their work, published recently in the journal *Science*, reports on a massive pair of compact stars in the globular cluster NGC 1851 in the southern constellation Columba (the dove). By using the sensitive MeerKAT radio telescope in South Africa, in combination with powerful instrumentation built by engineers at the Max Planck Institute for Radio Astronomy (MPIfR) in Bonn, Germany, they were able to detect faint pulses from one of the stars, identifying it as a radio pulsar, a type of neutron star that spins rapidly and shines beams of radio light into the Universe like a cosmic lighthouse. This pulsar, designated PSR J0514-4002E, spins more than 170 times a second, with every rotation producing a rhythmic pulse, like the ticking of a clock. By observing small changes in this ticking over time, using a technique called pulsar timing, they were able to make extremely precise measurements of its orbital motion. *“Think of it like being able to drop an almost perfect stopwatch into orbit around a star almost 40,000 light years away and then being able to time those orbits with microsecond precision.”*, says Ewan Barr, who led the study together with MPIfR colleague and Ph.D. candidate Arunima Dutta.

The regular timing also allowed a very precise measurement of the system’s location, showing that the object in orbit with the pulsar was no regular star – it is invisible in Hubble Space Telescope images of NGC 1851 – it is therefore an extremely dense remnant of a collapsed star. Furthermore, the observed change with time of the closest point of approach between the two stars (the periastron) showed that the companion has a mass that was simultaneously bigger than that of any known neutron star and yet smaller than that of any known black hole, placing it squarely in the black-hole mass gap.

“Whatever this object is, it is exciting news” – says Paulo Freire, of the MPIfR. “If it is a black hole, it will be the first pulsar–black hole system known, which has been a Holy Grail of pulsar astronomy for decades! If it is a neutron star, this will have fundamental implications for our understanding of the unknown state of matter at these incredible densities!”

The team proposes that the formation of the massive object, and its subsequent pairing with the fast-spinning radio pulsar in a tight orbit, is the result of a rather exotic formation history only possible due to its particular local environment. The system is found in the globular cluster NGC 1851, a dense collection of old stars that are much more tightly packed than the stars in the rest of the Galaxy. Here, it is so crowded that the stars can interact with each other, disrupting orbits and in the most extreme cases colliding. It is one such collision between two neutron stars that is proposed to have created the massive object that now orbits the radio pulsar. However, before the present binary was created, the radio pulsar must have first acquired material from a donor star in a so-called low-mass X-ray binary. Such a “recycling” process is needed to spin up the pulsar to its current rotation rate. The team believes that this donor star was then replaced by the current massive object in a so-called exchange encounter. *“This is the most exotic binary pulsar discovered yet,”* says Thomas Tauris from Aalborg University, Denmark. *“It’s long and complex formation history pushes at the limits of our imagination”.*

While the team cannot conclusively say whether they have discovered the most massive neutron star known, the lightest black hole known, or even some new exotic star variant, what is certain is that they have uncovered a unique laboratory for probing the properties of matter under the most extreme conditions in the Universe.

“We’re not done with this system yet,” says Arunima Dutta. She concludes, *“Uncovering the true nature of the companion will be a turning point in our understanding of neutron stars, black holes, and whatever else might be lurking in the black hole mass gap!”*

<https://www.sarao.ac.za/news/lightest-black-hole-or-heaviest-neutron-star-meerkat-uncovers-a-mysterious-object-at-the-boundary-between-black-holes-and-neutron-stars/>

Source: NRF-SARAO website

Celebrating the International Day of Women and Girls in Science

The International Day of Women and Girls in Science, celebrated on 11 February, is implemented by UNESCO and UN-Women, in collaboration with institutions and civil society partners that aim to promote women and girls in science. This day is an opportunity to promote full and equal access to and participation in science for women and girls. Gender equality is a global priority for UNESCO, and the support of young girls, their education, and their full ability to make their ideas heard are levers for development and peace.

Celebrating International Women and Girls in Science is a fantastic way to recognize the incredible contributions women have made and continue to make in the field of science. Here are some of our very own extraordinary women who have made substantial contributions to the field of science and stand as influential role models for girls and women globally:

Professor Aletta Prinsloo graduated with a BSc(Ed) in Physics, Chemistry, Mathematics, and Education as a major from the Rand Afrikaans University (RAU) in 1991. She completed her honours and master's degrees in the following two years at the same institution, after which she started working as a teacher. She enrolled for a PhD at RAU in 1995 and completed her degree in 1998 under the guidance of Prof Herman Alberts and Prof Peet Smit. The research focused on the physical and magnetic properties of spin-density-wave Cr-Si and Cr-Ga single crystals. While working on her Ph.D. she lectured at Vista University (Soweto Campus) from 1996 to 1998. Upon completion of her Ph.D., she was appointed as a lecturer at the University of the Witwatersrand in 1999. In 2000, she was appointed at RAU as a senior lecturer, carving out her niche in the fields of magnetism and magnetic materials.



During her career, she has attracted several research grants including a UNESCO/ROSTE travel grant from IUPAP in 2002 to present work at a conference in the USA, a CNRS/NRF grant for travel to Université de Bretagne (UBO), France, and an APS International Travel Grant awarded for visiting University of California San Diego (UCSD) during 2010. In addition, she obtained various NRF research grants: an NRF travel grant for an extensive visit to Hitachi Almaden Research Center, USA, a Focus Area Grant: Unlocking the future (2007 – 2011), a travel grant for an extended visit to UCSD, USA (2010), Incentive Funding for Rated Researchers from (2010 – 2018), Protea funding for French/SA collaborative project (2013 – 2014), as well as CPRR NRF grants from 2015 to date, with co-applicant Prof Charles Sheppard. In addition, she and Prof Sheppard received a NEP/NNEP NRF Infrastructure funding instruments grant (2013/14 call) to purchase a Cryogenic Physical Properties Measurement System. During Prof Prinsloo's career, she worked as a visiting scientist at IBM Almaden Research Center, USA (2001/01 – 2001/02), UBO Laboratoire de Magnétisme de Bretagne, France (2005/05), Hitachi Almaden Research Center, USA (2006/03 – 2006/05), University of California San Diego Centre for Magnetic Recording, USA (2010/05 – 2010/06), as well as UBO Laboratoire de Magnétisme de Bretagne, France

(2014/11 – 2014/12). In addition, she participated in specialized measurements at Necsa (South Africa), Ansto (Australia) and Elettra (Italy). Prof Prinsloo has supervised and/or co-supervised many master's, PhD, and postdoctoral research candidates. Several of these students and fellows received awards for presentations made at conferences and workshops. She has co-authored a total of 90 peer-reviewed papers, most of these published in accredited journals with good impact factors; as well as 32 papers in peer review conference proceedings. Prof Prinsloo acted as Editor for the SAIP Proceedings from 2021 to 2023, serves on panels and referee applications for the NRF, frequently reviews papers for accredited journals, as well as evaluates projects for international measurement facilities. In addition, she regularly acts as an external examiner for masters' dissertations and doctoral theses.

Dr. Katekani Shingange comes from Gavaza village outside Tzaneen, Limpopo. She is a distinguished scientist within



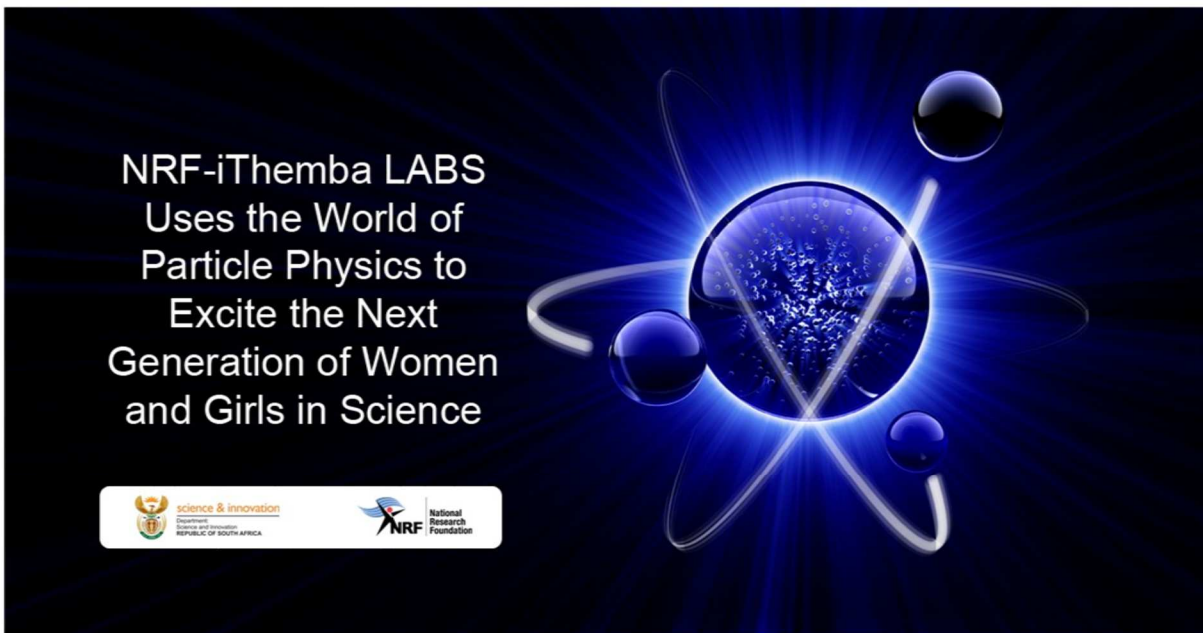
the Advanced Materials Division at Mintek in South Africa. She obtained a PhD in Physics from the University of the Free State in 2020. Her research interests are surface science and powders and thin films of optoelectronics semiconducting metal oxides applied to gas sensing technology for the selective and sensitive detection of gas molecules, particularly biomarkers in food safety, environmental monitoring, and disease diagnosis. Dr. Shingange is an emerging researcher with an exceptional research record, having published more than 20 peer-reviewed articles in prestigious journals of science, and an impressive H-index of 13. She actively engages in science communication workshops, mentoring, and supervision of postgraduate students and junior researchers, and she also participates in initiatives such as job shadowing for high school learners. Her passion for knowledge transfer and skill development has

positioned her as an impactful figure in her field. Recognition for Dr. Shingange's outstanding contributions has come in various forms. Notably, she received the South African Women in Science Award in 2019 from the Department of Science and Innovation for her remarkable contributions to the field of Physics. In 2020, she was honored with the CSIR Best Doctoral Award for excellence in her PhD studies. Additionally, she was acknowledged as an inspirational woman in STEM by #InspiringFiftySA in 2021, distinguishing her role as a motivator for young girls and women in STEM. Dr. Shingange serves as the chairperson of Women in Physics in South Africa (WiPiSA), championing the cause of women in physics and advocating for increased female participation in physics-related careers. Her commitment to empowering women in STEM is highlighted by her involvement in various activities aimed at attracting and nurturing female talent in the field. In 2023, Dr. Shingange was recognized as one of the 200 Mail&Guardian Young South Africans in the Technology and Innovation category, further solidifying her position as a trailblazer in her field. She also had the prestigious opportunity to attend the Lindau Laureates Meeting in 2019, dedicated to Physics, an event that brings together young scientists across the globe with Nobel laureates, showcasing her international standing and contributions to physics.

Reported by Letsoalo Rebecca

Nurturing Tomorrow's STEM Leaders: NRF-iThemba LABS Empowers High School Girls on International Day of Women and Girls in Science

In celebration of Women and Girls in Science, NRF-iThemba LABS hosted 38 girl learners from 19 high schools at its Cape Town facility on Friday, 09 February 2024. The young women engaged in several activities and attended lectures from experts in the STEM field.



The activities that the young scholars participated in were linked to the Strangeness Enhancement studies with CERN's A Large Ion Collider Experiment (ALICE). Introductory lectures were facilitated by Prof Zinhle Buthelezi and Dr. Siegfried Fortsch, who are part of the ALICE collaboration under the auspices of the SA-CERN program. The hands-on activities were facilitated with assistance from postgraduate students.

The introductory lectures created an opportunity for the learners to add questions to a "Huh-board" during short breaks. This was used to encourage participation as they broke through their confidence issues.

Some of the questions posed included:

- ✚ WHY can we NOT pull a quark out of a proton?
- ✚ WHY do scientists want to pull quarks out of protons/neutrons?
- ✚ Do scientists KNOW what the STRANGE quark looks like?
- ✚ If the "bonds" didn't break, would we still be able to produce a QGP?
- ✚ After the decay has been observed inside the detector, what happens to the particles?
- ✚ How does the conservation of invariant mass relate to the concept of mass-energy-equivalence?
- ✚ Can you explain the concept of color screening and its role in the presence of the QGP?
- ✚ You said the protons become heavier as they are moving faster. Is this needed to produce MORE particles, or is there something that I am missing?

NRF-iThemba LABS used the unifying force of science to create a space of deep learning and to forge new friendships. *"In celebrating this day, we had to make sure that we not only acknowledge our remarkable researchers and scientists but that we also use this opportunity to reach out to the younger generation of women teaching them the importance of STEM in society,"* said NRF-iThemba LABS Communications and Stakeholder Relations Manager, Dr Gillian Arendse. *"There has been tremendous progress made towards increasing the participation of women in STEM, but they are still under-represented in these fields, and we need to do more."*

In addition, NRF-iThemba LABS used this day to raise awareness of some of their female researchers while also engaging future female STEM players. They also invited the news channel, eNCA, to speak to some of their researchers about their work at the facility. The insert, which aired on Saturday 10 February, can be watched here:

<https://www.youtube.com/watch?v=d2serH1ergA>.

Source: NRF Facebook page

UK-South Africa Launch International Science Partnership Fund: Fostering Collaboration for Innovation and Development

Launch of International Science Partnership Fund to support UK-South Africa science and research collaboration.

The Minister of Higher Education, Science, and Innovation, Prof. Blade Nzimande, welcomed the announcement that the United Kingdom would make an investment of up to R1 billion over the next two years in a new International Science Partnerships Fund for science and technology collaboration between South Africa and the UK. The announcement was made at a reception hosted by the UK High Commissioner on 22 January for the Duke of Edinburgh's visit to South Africa

Addressing the reception, Minister Nzimande said that the fund would support the building of institutional and human capacity development in South Africa, enabling the country to fulfil its potential.

"It puts research and innovation at the heart of our international relationships, supporting UK researchers and innovators to work with peers around the world on the major themes of our time – the planet, health, technology and talent," said the Minister.

The Minister said that the cooperation planned under the fund was strategically aligned with the priorities of South Africa's Science, Technology, and Innovation Decadal Plan and its National Plan for Post-School Education and Training. *"I am especially excited about the plans for a new joint research chair in the field of digital humanities, as the use of digital resources in the social sciences will be critical for the success of our response to societal challenges such as understanding the future of society within the context of technology disruption,"* said Nzimande.

He also expressed his appreciation that the fund would help to support the Square Kilometre Array Observatory global partnership by developing skills for radio astronomy in Africa. The fund is managed by the UK's Department for Science, Innovation and Technology and implemented by a consortium of the UK's leading research and innovation bodies, which includes UK Research and Innovation (comprising the UK's seven research councils, Innovate UK and Research England), the UK Academies, the British Council, the Meteorological Office, the National Physical Laboratory, the UK Atomic Energy Authority, and Universities UK International. The UK High Commissioner to South



UK-South African collaborators

Africa, Antony Phillipson, said that partnerships were important in tackling global challenges.

"Rapid, equitable progress against global challenges such as climate change or towards the Sustainable Development Goals cannot be achieved without collaboration on science, research, technology and innovation. We need to come together to share expertise and experience, which is why we are grateful for the close partnership we have with the Department of Science and Innovation Minister Nzimande himself, and all the partners here tonight. We look forward to continuing to work together, to amplify the impacts of our science partnerships together over the months and years ahead," said Phillipson.

South Africa will make similar investments in the fund, and its Department of Science and Innovation and Department of Higher Education and Training will both work with their counterparts in the UK to co-design and co-fund programs to be implemented with the support of the fund.

Source: DSI

2024 Past Conferences and Workshops

The field of physics is constantly evolving, driven by discoveries, breakthroughs, and the exchange of ideas among researchers worldwide. Since the start of 2024, numerous conferences and workshops have been held, covering a wide array of topics ranging from fundamental theories to cutting-edge technologies. Let's delve into some of the noteworthy conferences and workshops in physics that have taken place, highlighting the diverse themes and advancements shaping the landscape of modern physics.

MeerKAT@5 Conference

The Minister of Higher Education, Science, and Innovation, Prof. Blade Nzimande, delivered a keynote address at the MeerKAT@5 conference on Tuesday, February 20th, at the Stellenbosch Institute for Advanced Study (STIAS). The conference, spanning from February 20th to 24th, 2024, serving as a gathering of key stakeholders who have played instrumental roles in the development of the MeerKAT telescope.

Under the theme **"Celebrating transformational science, engineering, and human capacity development,"** the four-day event served to highlight and commemorate the accomplishments, milestones, and contributions of the MeerKAT telescope to the fields of astronomy, science, technology, and international collaboration.

Drawing over 200 participants, including astronomers, scientists, engineers, government officials, and international students, the conference marked a significant milestone as 2024 marks five years since the publication of the first MeerKAT science paper. Its overarching goal was to celebrate the telescope's achievements across scientific, engineering, and human capacity development spheres.

The conference agenda encompassed a series of invited and contributed presentations, focusing on high-impact MeerKAT science outcomes, as well as discussions on various pertinent topics such as:



Engagement with the Minister

✚ The innovative engineering endeavors integral to the successful delivery of the instrument.

- ✚ The historical journey of the MeerKAT project and its broader societal impact.
- ✚ The future outlook of radio astronomy on the African continent, exploring potential advancements and collaborations.



Minister addressing the delegates.

In his keynote address the Minister touched on **MeerKAT's Milestone Anniversary, the Pioneering Role of South Africa in Radio Astronomy, MeerKAT's Scientific Contributions, International Collaboration, Human Capital Development (HCD), Socio-economic Impact, Future Prospects, Global Recognition, Hosting International Events and Vision for the Future.**

These points encapsulate the key messages and highlights of the speech, showcasing the significance of MeerKAT and South Africa's contributions to radio as-

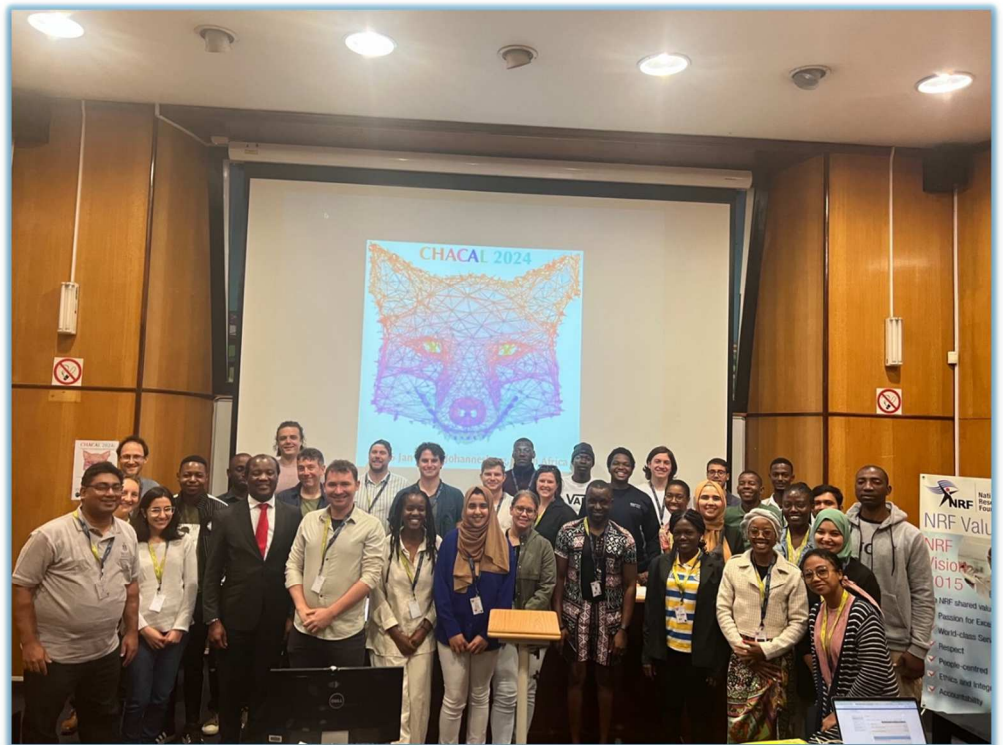
tronomy and scientific progress. A full message can be found on this link:

<https://www.dst.gov.za/index.php/media-room/media-room-speeches/minister/4182>

Source: DSI

Particle Physics Computing School Brings Together International Students and Speakers

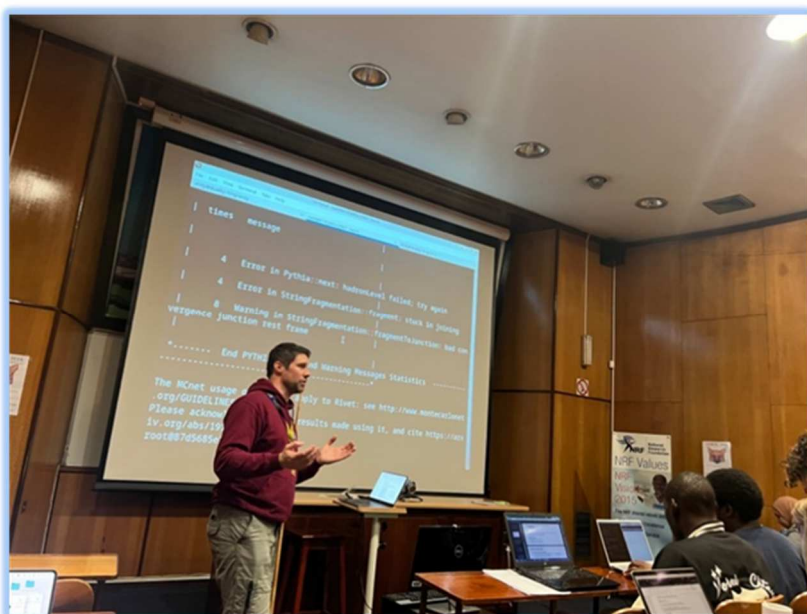
This January, a new residential research school, co-organised by Université Clermont Auvergne, took place at the University of Witwatersrand in Johannesburg, South Africa. The school, dubbed "CHACAL" (Computing in High Energy Physics and Applications CNRS-Africa Lectures) focused on advanced computing techniques used to analyse data at CERN's Large Hadron Collider and beyond. Topics included particle physics basics, general software skills, Monte Carlo event generation, machine learning, and quantum computing. The head of the school of Physics Prof. Deena Naidoo, and Vice Chancellor Prof. Zebulon Vilakazi dropped by to greet and encourage the attendees.



The Vice Chancellor of the University of Witwatersrand Zebulon Vilakazi (1st row, third from left) visits the CHACAL lecturers and attendees, including co-organisers Deepak Kar (Wits, 1st row, 1st on left) and Louie Corpe (UCA, 1st row, 4th from left).

The international experts were from universities in France, South Africa, the United Kingdom, and the USA, including Andy Buckley from Glasgow, Jonathan Butterworth from UCL, Caterina Doglioni from Manchester, Benjamin Fuks from Sorbonne, David Rousseau from Université Paris-Saclay, Heather Gray from Berkeley, Ana Peixoto from Washington-Seattle. The local experts included James Keaveney from UCT and Francesco Petruccione, who as a director of NITheCS, sponsored a school dinner. About 30 students, ranging from master's students to recent Ph.D. graduates, attended CHACAL. They traveled from 10 African countries attended the school: Algeria, Botswana, Cameroon, the Democratic Republic of Congo, Egypt, Morocco, Madagascar, Namibia, Senegal, and South Africa. Around 45% of the students and 40% of the school staff were female. To facilitate engagement from a wide array of countries in Africa, the students' travel, accommodation, and meals were fully covered. The mornings were focused on lectures, while the hands-on tutorials were given in the afternoons. Louie Corpe, the organiser from Clermont-Ferrand, said "It has been wonderful to interact with the students at CHACAL: it's rare to come across such a dedicated group. Even though they come from diverse backgrounds and levels of experience, they were united in their desire to learn and exchange knowledge with the lecturers". Deepak Kar of Wits said: "It was a lot of effort to organise this school but getting the lecturers and students together has been very rewarding on both sides.

We hope this leads to many future collaborations and strengthening of ties between UCA and Wits". Malak Ait Tamlihat, a participating student from Morocco, commented: "The well-structured curriculum, engaging lectures, and



Delegate presenting.

tutorials provided a comprehensive understanding of computing in the context of High Energy Physics. The expertise shared by the lecturers not only deepened my understanding of the subject but also inspired a passion for further exploration in this field".

The school furthers the connection of the CNRS with African partners and has formed cohorts of students with expertise in core skills that are necessary for the future of particle physics. CHACAL was funded by the French CNRS's France-Africa international cooperation program, which permitted Louie Corpe (Chaire Professeur Junior at UCA) and Deepak Kar

(Professor of Physics at Wits) to organise the event together. Additional support was provided by iThemba Labs, South Africa's National Research Foundation, and the National Institute for Theoretical and Computational Sciences.

More information: <https://indico.cern.ch/event/1306120/>

Reported by Deepak Kar

20 Years of Excellence: NASSP Symposium Reflects on Milestones and Future in Astrophysics and Space Science

In celebration of its 20th anniversary, the National Astrophysics and Space Science Programme (NASSP) hosted a symposium at the University of Cape Town (UCT) from 25 – 26 January 2024. Supported by the Department of Science and Innovation (DSI); the National Research Foundation (NRF); the South African Space Agency (SANSA); and the NASSP node universities (UCT, North-West University the University of KZN), the symposium brought together NASSP students, alumni, supervisors, lecturers, and stakeholders to celebrate and reflect on the positive impact of NASSP. At-

tendees at the event included the DSI Deputy Director General Mr Imraan Patel; Mr Takalani Nemaungani, Chief Director of Astronomy at the DSI, Prof Daya Reddy, the UCT Vice Chancellor, and Prof Petri Vaisanen, MD of NRF-SAAO.

NASSP has been integral in the creation of the next generation of astronomers and space scientists. The program has touched countless students through world-class education and research opportunities. By the end of 2023, NASSP had produced 464 Honours graduates and 235 Master's degrees in astrophysics and space science. Its graduate community across the African continent and around the world is diverse, vibrant, and excellent, and includes more than 70 graduates



Conference Delegates

from 17 African countries. Many from elsewhere in Africa have returned to their home countries where they are growing postgraduate programmes and research communities, the symposium aimed to celebrate the success of NASSP through its graduates, with a program of talks from alumni who shared personal accounts of their career paths and highlights of their current roles.

A significant number of graduates now work in scientific fields, including many at the NRF, and contribute to South Africa through their work in education, finance, and tech industries. NASSP graduate, Pfesemani van Zyl, who works at NRF-SARAO's HartRAO facility, visited SALT during a NASSP student tour. Looking back, she said, "My time in the NASSP program proved to be a truly transformative experience that left an indelible mark on my perspective and aspirations. It afforded me the opportunity to witness a real telescope for the first time, which was nothing short of awe-inspiring; a pivotal moment that reshaped my understanding of what I could achieve. Now, as I live out my dreams, I owe a debt of gratitude to that extraordinary decision to join NASSP that expanded my horizons and showed me that I, too, could reach for the stars in the truest sense."

Some of the other unique and impactful journeys shared by 'NASSPies' working in the scientific and tech fields came from Moses Mogotsi (from NASSP to the Southern African Large Telescope); Miriam Nyamai (from NASSP to MeerKAT); Wendy Williams (from NASSP to the Square Kilometre Array Observatory); and Xola Ndaliso (from NASSP to Operating SALT). Stories of NASSP graduates who have branched into other fields included talks by Given Phaladi, entitled *The World of PHYnance*; Mellony Spark, entitled *From NASSP to Impact Investing in Africa*; and from Themba Gqaza, whose talk, entitled *Data Science for Health*, was inspired by a personal crisis which leads him to an organisation which aims to build a world where personal, uninterrupted healthcare is available to everyone, not just a chance few. The symposium highlighted how crucial it is to share stories like these to understand the real impact of human capital development programs on people's lives and our societies. Investments are amplified as the first generations become the teachers and supervisors of the next.

Source: NRF Facebook page

Changing lives through Science: One engagement at a time

NRF-iThemba LABS, in partnership with the Joint Institute for Nuclear Research (JINR), hosted a Postgraduate Summer School from 15 January – 2 February 2024 under the auspices of the SA-JINR collaboration. The school, which included lectures and practical activities, was attended by postgraduate students from three South African Universities. The lectures and practicals were presented by representatives from the Joint Institute for Nuclear Research (JINR), academics who are actively involved in projects at JINR, and research staff at NRF-iThemba LABS. The lectures included topics such as accelerator technology, artificial intelligence and machine learning, data analysis, nuclear medicine (specifically isotope production), and computing in high-energy physics. The partnership with JINR enabled the introduction of virtual laboratories on nuclear electronics, gamma spectroscopy, calibration of spectrometers, the analysis of energy spectra, and the identification of radioactive sources. In addition, the school allowed for physical experiments using portable detectors such as Geiger-Müller counters and NaI(Tl) scintillators, and introduced the participants to ROOT software that is used in data analysis.

Ms Xleyani Precious Mgwena, a postgraduate student at the University of Johannesburg (UJ), emphasized that the course provides students with the chance to explore other scientific fields, pushes them out of their comfort zones, and teaches important research skills to add to their research capabilities. One of the challenges in our education system is the fact that we are struggling to attract more students into the STEM disciplines. It is for this reason, that the science engagement team at NRF-iThemba LABS used the Summer School, and the strength of the existing partnership with JINR, to create an immersive experience for learners and education practitioners.



Summer School attendees

A total of 60 learners, 30 from primary school and 30 from high school, and representatives from the Western Cape Education Department were invited to attend part of the summer school. The visitors were treated to informative lectures on the history of the universe, the wonderworld of atoms, molecules, and nuclei, and an introduction to nuclear structure and astrophysics. The availability of interactive displays and virtual reality made for a fascinating learning experience that excited both the learners and the education practitioners. It was encouraging to see how we were able to expand their worldviews by allowing them to be immersed in the world of experimental science.

The development of digital education resources, which include virtual tours and laboratory simulations, interactive models, practical engineering, and motivational videos tailored for physics courses, will enhance the impact that research facilities have within the education space. It is hoped that a group of educators and representatives of the WCED will be able to visit JINR in June 2024.

Reported by Gillian John Arendse

Western Cape SAIP-Inkcubeko Physical Science / Maths Teacher Development Workshop



Virtual reality experience

The Western Cape SAIP-Inkcubeko Physical Science/Maths Teacher Development Workshop took place from the 22nd to the 24th of February 2024. This workshop aimed to enhance the skills and knowledge of physical science and mathematics teachers in the Western Cape region of South Africa. Organized jointly by the South African Institute of Physics (SAIP) and Inkucubeko, the workshop provided a platform for professional development and collaboration among educators.

South Africa faces significant challenges in mathematics and science education, leading to low pass rates in physical science at the high school level. Recognizing the importance of improving education in these critical subjects, the South African Institute of Physics (SAIP) has developed innovative initiatives to support both teachers and Grade 12 learners. This report outlines the objectives and impact of the SAIP-Inkcubeko Physical Science/Maths Teacher Development Workshop held in the Western Cape province from the 22nd to the 24th of February 2024.

Objectives:

- ✚ To address the skills gap and misconceptions identified in the Matric Diagnostics Report regarding physical science and mathematics education.
- ✚ To provide professional development opportunities for teachers in the Western Cape province.
- ✚ To enhance the quality of physics education and research in South Africa.
- ✚ To nurture the next generation of physicists and increase human capital in science, engineering, and technology disciplines.
- ✚ To support the Fourth Industrial Revolution (4IR) and Strategic Infrastructure Projects (SIPs) by improving science education and developing relevant skills.
- ✚ To contribute to the realization of Sustainable Development Goals (SDGs) by unlocking the potential of physics education to address socio-economic challenges in South Africa.



Interactive session

The SAIP-Inkcubeko Physical Science/Maths Teacher Development Workshop was a three-day in-person training session held at the Inkucubeko Youth and Science Centre in Thembaletu, Western Cape. The workshop focused on

providing educators with innovative teaching strategies, resources, and support to improve their effectiveness in teaching physical science and mathematics. Sessions were designed to address common challenges faced by teachers and to promote the development of critical thinking, problem-solving, and quantitative reasoning skills among learners.

The SAIP Physics Teacher Development program is accredited by the South African Council of Educators (SACE), the statutory professional body for educators in South Africa. As a result, participating teachers are eligible to accumulate Continuous Professional Development Points (CPD) by attending SAIP Teacher Development workshops. This accreditation underscores the commitment to ongoing professional growth and development among educators.

The workshop provided participating teachers with valuable insights, resources, and strategies to enhance their teaching practice in physical science and mathematics. By addressing skills gaps and misconceptions, educators are better equipped to support Grade 12 learners and improve pass rates in these subjects. Furthermore, by nurturing the next generation of physicists and increasing human capital in science and technology fields, the workshop contributes to the long-term socio-economic development of South Africa.

The SAIP-Inkcubeko Physical Science/Maths Teacher Development Workshop represents a crucial step towards improving mathematics and science education in South Africa. By providing professional development opportunities, supporting educators, and nurturing the next generation of scientists, the workshop aligns with the goals of enhancing education, fostering innovation, and addressing socio-economic challenges in the country.

Source: SAIP Facebook page

Calls

SAIP2024 Conference: Registration and Abstract Submission Now Open

The SAIP office is excited to announce the commencement of registration and the call for abstracts for the 68th Annual Conference of the South African Institute of Physics (SAIP2024). Themed "**To the next 100, South Africa's future in physics,**" the conference is scheduled to take place at Rhodes University in Grahamstown/Makhanda from July 1st to 5th, 2024. This significant event coincides with Rhodes University's 120th anniversary celebration, adding to the historical and academic significance of the occasion.

SAIP2024 aims to delve into contemporary physics, acknowledging its foundations while also exploring the potential for future advancements and shifts in knowledge boundaries. The theme, "To the next 100, South Africa's future in physics," boldly signals a vision of progression and innovation within the field. All interested participants, researchers, academics, students, and industry professionals are invited to register for the conference and submit abstracts for presentation. This conference offers a unique platform for sharing insights, exchanging ideas, and fostering collaboration among the physics community.

Registration and abstract submission can be completed conveniently through the conference website <https://saip2024.co.za/>. Please ensure to adhere to the submission guidelines provided on the website.

Source: SAIP website

The 5th Advanced Nuclear Science and Technology Techniques (ANSTT5) Workshop

The forthcoming ANSTT5 workshop, slated for April 15-19, 2024, at NRF-iThemba LABS in Cape Town, promises a rich agenda covering diverse topics in advanced nuclear science and technology.

Topics to be discussed include:

- ✚ Metrology and applications
- ✚ Environmental measurements
- ✚ Neutron physics and applications
- ✚ Nuclear structure studies
- ✚ Future experimental programmes at iThemba LABS
- ✚ Nuclear Safety and Security

The workshop will be structured for presentations, discussions, and networking. Collaborations and networking will again be at the forefront of the workshop, including memoranda of understanding. The workshop offers a comprehensive program of invited talks, accepted talks, poster presentations by students, and round-table discussions. Participation (presentation and poster) is subject to abstracts being accepted by an advisory panel. Registration is now open: <https://indico.tlabs.ac.za/event/124/>. Please also note that the submission deadline for abstracts has been extended to 22 March.

Co-organisers: Pete & Alison

Reported by Gillian John Arendse

NRF-SARAO Public Open Day

Have you ever desired to visit the MeerKAT telescope in person? NRF-SARAO is organizing a public open day on March 27, 2024. The South African Radio Astronomy Observatory (NRF-SARAO) Public Open Days allow members of the public to visit the MeerKAT radio telescope and other instruments that are hosted on the Square Kilometre Array (SKA) site.

The MeerKAT radio telescope, an array of 64 interlinked receptors, is situated 90 km outside the Northern Cape Town of Carnarvon. The MeerKAT is a precursor to the SKA telescope and will be integrated into the mid-frequency component of SKA Phase 1.

Details of the Open Day are as follows:

- ✚ Date: Wednesday, 27 March 2024
- ✚ Meeting point: Carnarvon, address TBC
- ✚ Duration of Tour: 08h00-16h00
- ✚ Total capacity: 100 people (Maximum 5 people per group)
- ✚ Price: R350 per person (includes return transport to site, welcome refreshments, branded gift, and bottled water)

If you're interested in attending, you can register or find out more information by following this link: <https://www.sarao.ac.za/open-days/>

Source: NRF-SARAO website

SAIP 2024 Gold Medal Nominations

The nominations for the SAIP Gold Medal 2024 are open and will close at 23H59 on Friday, 10th May 2024. Nominations must be sent to the SAIP secretary at secretary@saip.org.za. Please take note of the following regarding the nominations as outlined in the Bylaws of the SAIP:

- ✚ The award is made for outstanding achievements in any of the following facets of any branch of Physics: research, education, technology, and industrial development. As the highest standards are applied, the award is intended to be the greatest distinction that is conferred in South Africa for achievements in Physics.
- ✚ The award or, in exceptional cases, two awards or no award shall be conferred every second year. The award cannot be divided and only one award shall be made to any one person.
- ✚ All members shall be invited to nominate physicists for the award. The submission shall consist of a full Curriculum Vitae of the nominee, accompanied by a substantial motivation that must describe the fields of activity in Physics in which the nominee has excelled, what his/her actual contributions are, and the standards by which these contributions have been measured. Nominees must have been normally resident in South Africa up to the closing date set by the Council for the receipt of nominations. Only work done by a South African citizen or South African resident shall be considered for this award. The work must have been done in South Africa or during a temporary visit abroad. Please also note that previously unsuccessful nominees for the SAIP Gold Medal may be re-nominated.

Source: SAIP office

SAIP Projects

During the course of every year, SAIP implements several projects aimed at improving physics education and research, developing, and nurturing an inclusive next generation of physicists for South Africa. These projects include:

Teacher development

The goal and impact are to improve the competence of physical science teachers in South Africa (content, pedagogy, confidence, and enthusiasm attracting and keeping learners in physics) through the Workshop on Teacher Development, which in turn. Improve the interest and competence of high school learners to enjoy physical science and pass with better grades, ultimately resulting in Increasing the pool of Human Capital with skills in Science, Engineering, and Technology.

Women in physics

The goal is to encourage women and physics to study physics. To encourage and support women to work in physics-related careers. To assist in removing or overcoming obstacles and barriers for girls and women.

Physics in my village

The development, change, and improvement that physics has brought to our education, opening windows to SET careers and necessities that physics has brought to villages, townships, and everyday lives.

100 years in physics in Africa – ‘Past, Present and Future.’

This initiative is prompted by the 100th year of the International Union of Pure and Applied Physics (IUPAP), Whether your country is a member of IUPAP or not, this is an excellent time to look back and look forward. One hundred years from now, perhaps Physicists will understand the vision we had for physics contribution to the Sustainable Development of Africa. For example, how can Physics contribute to the 4th Industrial Revolution, gender and equity, food security, science education, health, energy, and clean water, among other sustainable development challenges facing Africa?

CAPS-aligned virtual experiments

The SAIP, through a partnership with Johnson Matthey Science & Me project, has compiled virtual experiment resources that teachers can use to teach physical science and make learners enjoy science and understand physical science better. It is often said, “When I see, I forget! but when I do, I remember”. Experiments are essential to teachers’ and learners’ understanding and enjoying science. These virtual experiments empower teachers with resources to perform experiments required by the CAPS curriculum despite some schools lacking lab facilities.

Detailed information on these projects and contributions can be found on the following link: <https://www.saip.org.za/> under projects.

SAIP Membership

Physics is a basic science that is a basis for all science and technology disciplines. This results in physics graduates working in every sector imaginable. Therefore, SAIP caters to a wide range of industries and economic sectors.

SAIP membership includes any physicists who graduated with at least physics physics-related degree working in either; industry, commerce, government, academia, research, theoretical physics, or experimental physics, and uses physics skills and thought processes in their job/career.

Why Professional Membership is Important

Academic qualifications are only the beginning of a career in physics and its applications. The need for continuing professional development is widely recognised to be the mechanism by which professionals maintain their knowledge after the formal education process has been completed. By becoming a member of a professional society, one demonstrates their commitment to maintaining competence in their field through continuing their professional development from activities such as conferences, schools, and workshops and abiding by an acceptable code of conduct. Membership in a professional society is an important addition to a physicist’s credentials for example when competing for a job membership in a professional society will distinguish one from other applicants with similar qualifications but no professional affiliation.

1. **Stay informed** - News flashes and alerts are sent directly to your email. A quarterly magazine, Physics Comment, will keep you briefed on physics news, government policy, and jobs in industry and academia.
2. **Specialist Groups and Networking - Through** the various activities of SAIP, networks have been established with the African and International Physics communities, to benefit all our members. You’ll make important new contacts and forge lifelong professional relationships by getting involved in a specialist group.
3. **Save Money** - You’ll receive discounted rates for SIAP conferences and have the benefit of paying affiliate membership fees for IOP membership.
4. **Employment opportunity information** -Job advertisements will be displayed on our new website and mailed to members from time to time.
5. **Access to current information on sources of funding grants and scholarships** - Exclusive service provided to our members via a direct email system.
6. **Scientific meetings** - The annual conferences and workshops provide learning opportunities for different specialisation areas and varying degrees of experience.
7. **Especially for the global physics community - You’ll** have the opportunity to partake in events organised by the SAIP for the Physics community in South Africa as well as Africa: developmental workshops, schools, and conferences.
8. **Additional resources** - Your membership privileges also include information and guidance when [applying for](#)

[and acquiring visas to study and participate in scientific meetings and research](#) opportunities in South Africa and abroad. There is also an exclusive member-only area on our website.

9. **Career guidance and resources**- Career assistance is provided to all members to find their career path in industry or academia.
10. **Opportunities to win excellence awards** - SAIP recognizes contributions to physics in SA by awarding two different medals and various student prizes at the annual conference.
11. **Teaching and Learning Resources for schools** - As part of our growing outreach programme we provide teachers and learners with the tools and opportunities to allow and motivate more learners to follow careers with physics as a background.

JOIN SAIP TODAY CLICK THE LINK BELOW FOR MORE INFORMATION ON HOW TO APPLY:

<http://www.saip.org.za/index.php/members/membership-info>

Source: SAIP Website

Physics Comment Editorial Policy

Physics Comment is an electronic magazine for the Physics community of South Africa, providing objective coverage of the activities of people and associations active in the physics arena. It also covers physics-related ideas, issues, developments, and controversies, serving as a forum for discussion. It is not a peer-reviewed journal.

Physics Comment publishes innovative reports, features, news, reviews, and other material, that explore and promote the many facets of physics. Physics Comment endeavors to:

- ✚ support and inform the physics community.
- ✚ promote membership of the South African Institute of Physics
- ✚ promote the understanding of physics to interested parties and the general public represent the readers' point of view
- ✚ focus on issues and topics of importance and of interest to the physics community.

We accept submissions on any physics-related subject, that endeavors to inform readers and encourage writers in their research. We aim to be politically, socially, and geographically inclusive in the articles, which we commission and receive. Therefore, we shall not discriminate according to political or religious views. Physics Comment does not support or endorse any individual politician or political party. However, contributions, that are being published, may contain personal opinions of the authors. We desire to present unfettered the opinions and research of our readers and contributors. All articles submitted for publication are subject to editorial revision. Such revisions, if necessary, will be made in cooperation with the author.

The views expressed in published articles are those of the authors and are not attributed to the Editorial the Editor will make the final determination of the suitability of the articles for publication.

Declaration by Author

When an author submits material for publication, this means:

1. The author(s) assures the material is original, his/her own work, and is not under any legal restriction for publication online (e.g., previous copyright ownership).
2. The author allows PC to edit the work for clarity, and presentation, including making appropriate hypermedia

links within the work.

3. The author gives PC permission to publish the work and make it accessible in the Magazine's archives indefinitely after publication.

The author may retain all other rights by requesting a copyright statement be placed on the work.

Authors should respect intellectual integrity by accrediting the author of any published work, which is being quoted.

Publication Deadlines

Physics Comment is published four times a year.

Issue	Closing Date	Publication Date
Issue 1	28 February	15 March
Issue 2	31 May	15 June
Issue 3	31 August	15 September
Issue 4	30 November	15 December

Specification and Submission of Content

Editorial Tone. As the voice of the physics community, the magazine will create a provocative, stimulating, and thoughtful dialogue with the readers; and provide a variety of perspectives that reflect the dynamism of the physics community.

Article types. The magazine is devoted to articles, reports, interesting facts, announcements, and recent developments in several areas related to physics:

Manuscripts. Solicited manuscripts will be judged first for reader interest, accuracy, and writing quality. The editor reserves the right to request a rewrite, reject, and/or edit for length, organization, sense, grammar, and punctuation.

Re-use. The publisher reserves the right to reuse the printed piece in full or in part in other publications.

Submission and Format. Manuscripts must be submitted to the editor on or before the designated due date Manuscripts must be submitted electronically, on the prescribed Microsoft Word template available for download from <http://www.saip.org.za/PhysicsComment/>. Manuscripts are to be submitted directly to the editor: PhysicsComment@saip.org.za.

Style. AP style is followed for punctuation, capitalization, italics, and quotations.

Photography and Illustration. All solicited photography and illustrations should be part of an article and will be judged first for technical quality and editorial appropriateness. The editor and art director reserve the right to request revision or reject any material that does not meet their criteria. The publisher reserves full rights to all solicited photography and illustration, including the right to reprint or reuse graphic material in other publications.

Categories of Content Contributions

Technical articles and reports: These are generic articles of about 1,500 words plus diagrams and pictures. A technical article covers a relevant feature topic. Articles are authored by the writer and publishing a 40-word resume of the author could enhance its credibility. By submitting an article that has been previously published the author confirms that he/she has the right to do so and that all the necessary permissions have been received. The acknowledgment

must be made within the article.

News: These are short editorial items usually not more than 250 words. Full-colour pictures must be referenced on the editorial submission and the picture or picture file.

Advertorials: Advertorials could be published when supplied by the client. We recommend a maximum of 500 words plus one or two pictures for maximum impact. A PDF file of the laid-out advertorial should be emailed to the client along with an MS Word file of the text and separate image files of the pictures. It is the client's responsibility to ensure that the advertorial is correct as it is, in fact, a paid-for advert page.

Letters to the Editor: Letters to the Editor are encouraged. The Editor reserves the right to edit for length and format. The Editor will not change the political position of the initial letter. Physics Comment does not publish anonymous letters.

Advertising Policy: The Editorial Board will determine advertising prices for Physics Comment, subject to approval by the SAIP Council. The objective will be to obtain revenue to maintain and develop the magazine. Physics Comment offers classified advertising to subscribers of the magazine for free. The advertisements must be a maximum of 60 words including the telephone number, and there is a limit of three free classifieds per subscriber, per issue. Advertisements may include a photo, which may be reduced in size or resolution by the editor to optimize loading time. All items or opportunities, that are being advertised for free, should be physics-related. The Editor reserves the right to refuse any advertising, which does not conform to the objectives of the magazine.

Submission of Articles

All articles must be submitted on the prescribed template available for download from <http://www.saip.org.za/PhysicsComment/>.

Source: PC Magazine Website