



Physics Comment

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ABOUT SANSA**

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7 Tips on how to excel in
physics

PHYSICS & SPACE
SOUTH AFRICAN INSTITUTE OF PHYSICS
QUARTERLY MAGAZINE

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If you would like to submit articles, news, achievements, calls or adverts to be featured in the magazine please email physicscomment@saip.org.za

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MESSAGE FROM THE PRESIDENT

I am writing this statement a few days after various Covid19-related restrictions were lifted. The symbolism of this is not lost on us. Hopefully the only Zoom we will be doing from now is to try and suss out elusive details in the kinks of our plots. Proceedings of the 65th Annual Conference of the South African Institute of Physics (SAIP2021), which were managed by North-West University, have just been published. The volume has interesting work on experimental, computational and theoretical physics papers drawn from the various subjects' divisions of the SAIP. I extend my gratitude to the editorial board who worked tirelessly against the odds to get this volume out within a year of the conference itself.

I would like to single out a topical matter in the current issue of Physics Comment. The SAIP is running a project on the outlook and precedence of physics in Africa, 100 years of Physics in Africa – 'Past, Present and Future.' The project is tied to the centenary of the International Union of Pure and Applied Physics (IUPAP) in 2022. We are therefore soliciting stories about physics and physicists in Africa. The magazine has more details on how you can contribute your pieces. The development of physics in Africa has been staid and steady to such an extent that we have a good number of internationally competitive research programmes. We need to tell these stories. Sometimes the lion has to tell its own account of the hunt. I hope you enjoy reading the magazine and can find the time and motivation to assist with the many initiatives that the SAIP is running this year.

Prof Makaiko Chithambo
President

SHORT ANNOUNCEMENTS

IUPAP 100 Photo Contest

A contest to celebrate the beauty of physics and the fun that can be encountered in its practice.

The contest is aimed at professional and amateur photographers and at science students and researchers. The images must be related to physics research and/or education, the impact of physics on everyday lives or an event or process in which physics plays a role. In the case of research, it can reflect the object of study of the scientific activity, the people who carry it out, its instrumentation and facilities or the technologies resulting from physics research.

The IUPAP 100 Photo Contest accepts entries beginning 08:00 EST, 14 February 2022, and ends at 23:59 EST on 14 April 2022. More details on how to register and submit your entries are described [here](#).

SAIP Weekly Webinar Invitation to Speakers

You are invited to participate in the SAIP weekly webinar series. More details are available here:

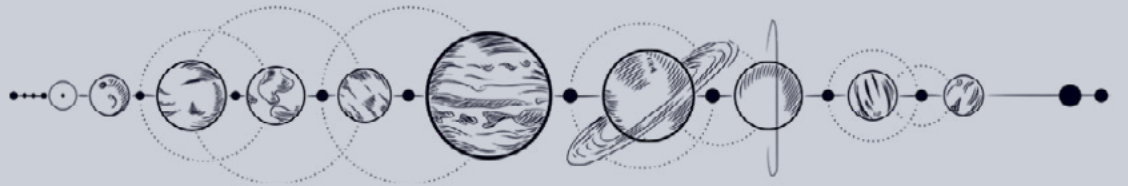
<https://www.saip.org.za/saip-weekly-webinars/>

100 Years of Physics in Africa- "Past Present and the Future"

The SAIP would like to invite you to contribute to an exciting project: 100 years of Physics in Africa – ‘Past, Present and Future.’ This initiative is prompted by the Centenary Celebrations of the International Union of Pure and Applied Physics (IUPAP) in 2022.

This is a story about a story: about Physics and Physicists in Africa.

For more details and to participate in the project, please visit the project



Call for WiPiSA Departmental Lunches 2022/2023

Dear SAIP Members

The WiPiSA Executive Committee would like to invite female academics, postgraduate students and non-academic female SAIP members to apply for the 2022 Hybrid (virtual/physical) WiPiSA Lunches to be held at their respective Physics Departments or virtually. WiPiSA will provide funding of R4000 only for your institution to organize the virtual lunch.

We therefore request you to help us accomplish this goal by sending an email expressing interest, with information (name and contact details) of the representative from your department that will facilitate this activity. Please include a detailed plan of the event and breakdown of the budget. Organisers are expected to submit the following, after the lunch:

- 1) A short report about the event (venue, number of attendees, activities, etc).
- 2) Receipts of expenditure
- 3) The outcomes of the event (students were motivated, links established, etc).
- 4) Few events pictures
- 5) Article to be published in Physics Comment Magazine.

**For further correspondence, kindly contact:
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SPACE-RELATED fields in Physics

Space Physics

Space physics is the study of the natural phenomena that occur in the Earth's upper atmosphere (aeronomy) and from the sun to the edge of the solar system

Topics included:

solar physics
heliophysics
solar wind
planetary physics
space weather
cosmic rays

Astrophysics

Astrophysics is a branch of space science that applies the laws of physics to seek to understand the universe and our place in it.

Topics included:

birth, life, & death of stars
galaxy formation & evolution
nebulae
black holes
dark matter

Cosmology

Cosmology is the study of the origin and evolution the universe, with a focus on the large-scale structure and properties of the universe as a whole.

Topics included:

origin and evolution of the universe
string theory
dark matter
dark energy

There are many space-related fields in physics; this is a summary of the three main domains. There is some degree of overlap between the domains but they have different focal points. Space physics deals with phenomena within our solar system, while astrophysics looks beyond our solar system.

HOW TO EXCEL AT PHYSICS...

- Master the fundamentals/basics: Learning to distinguish basic physics concepts by understanding their meanings will make learning Physics much easier.
- Strengthen your Math skills: This is useful in derivations involving differentiation, integration, and trigonometric concepts.
- Use drawings: Using a graphical representation of an idea allows the brain to understand the concept more quickly than simply reading.
- To study, use notecards: Making a note of units, formulas, equations, and general definitions and principles is one way to remember the entire subject.
- Understand, don't cram: You won't get very far if you try to cram. However, if you can grasp the logic, subsequent studies will be a lot more enjoyable.
- Practise problem solving: apply the relevant equations to solve actual problems. Also, make sure to use the correct measurement units.
- Simplify: This is done by analysing the problem and understanding the parameters that are already given in the problem and what is to be found. This becomes easy only when the basic formulas and equations are known which takes us back to the first point i.e.; master the basics.



WHERE CAN I STUDY ASTROPHYSICS ??

Several universities in South Africa offer degrees in astronomy and astrophysics and related subjects. This includes University of Cape Town, North-West University, University of Western Cape, University of KwaZulu-Natal, Rhodes University, University of the Free State, University of Johannesburg, University of Pretoria, University of South Africa and the University of the Witwatersrand.

At some universities astronomy-related research is situated in the Mathematics or Applied Mathematics departments. The University of Cape Town is the only university with a department dedicated to astronomy. Its Department of Astronomy was formally established in 1970. Their staff and students work with the South African Astronomical Observatory (www.saa.ac.za) to use telescopes like the Southern African Large Telescope (SALT) in Sutherland. Due to its substantial involvement (and lead) in four of the ten MeerKAT big survey projects, the radio astronomy group has built similarly strong relations with the South African SKA Office in recent years. The department is also a component of the Astrophysics, Cosmology, and Gravitation Research Centre (www.acgc.uct.ac.za) established in 2009. NASSP, the National Astrophysics and Space Science Programme (www.star.ac.za), is a multi-institutional initiative hosted at 3 'nodes': the University of Cape Town (original node), the University of KwaZulu-Natal and North-West University.

Where can I study Space physics ?

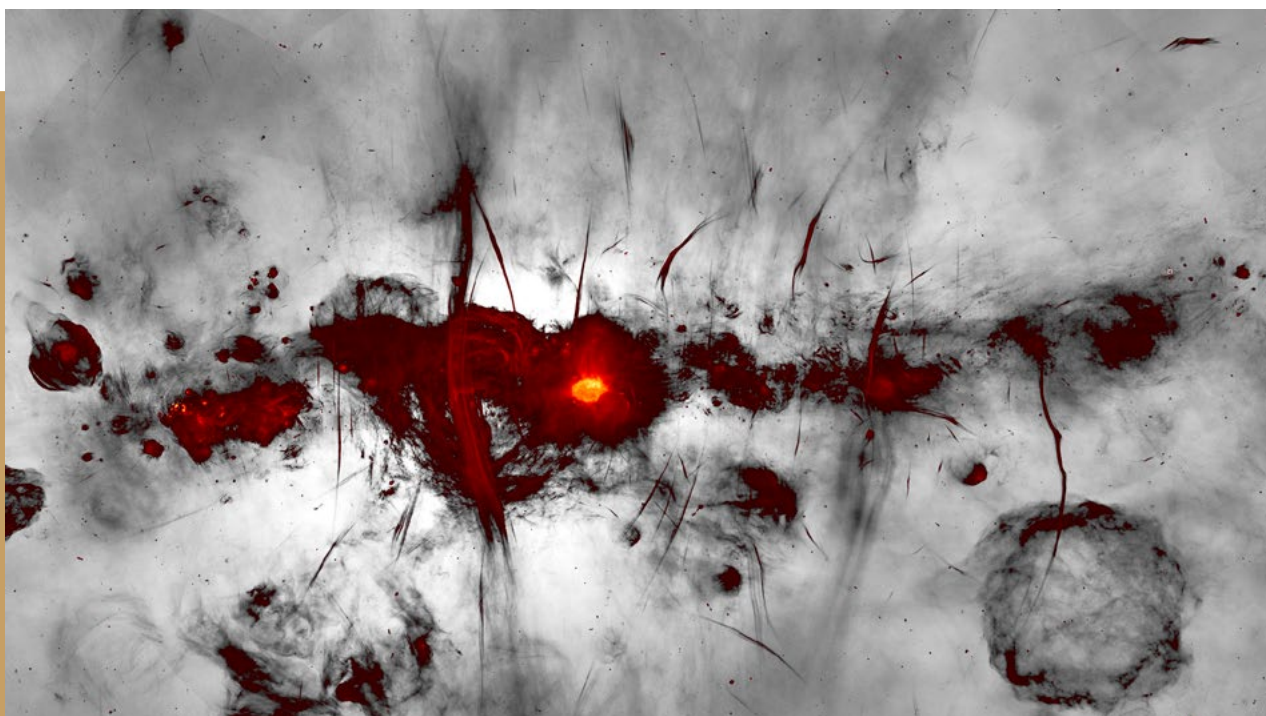
Space physics encompasses all scientific disciplines that involve space exploration and the study of natural phenomena and physical bodies occurring in our solar system. This includes the study of the natural phenomena that occur in the Earth's upper atmosphere (aeronomy).

The NASSP programme consists of contact teaching through coursework components as well as research, and contributes to national programmes such as the Square Kilometre Array (SKA) and the South African National Space Agency (SANSA) through its capacity-building skills development (please see the separate article on SANSA in this issue of PC Magazine for more information).

The University of KwaZulu-Natal, North-West University, the University of Cape Town and the University of the Western Cape are some of the universities that offer space science in SA. For many years, UKZN physicists have worked on Space Physics as part of the South African National Antarctic Programme (<http://scp.ukzn.ac.za>). Due to the Earth's magnetic field arrangement, Antarctica provides a "window into geospace." Understanding "space weather" has commercial and strategic implications. As an example of the latter, humanity increasingly relies on the growing number of satellites in orbit above the Earth for our society to function. The electronic components on these satellites are susceptible to damage from high-energy particles from the Sun and this is one of the many aspects of space weather that is monitored on a daily basis.

Where can I study Cosmology ?

Cosmology is the study of the origin and evolution the universe, with a focus on the large-scale structure and properties of the universe as a whole. There is often strong overlap between studies in cosmology and theoretical physics. With developments in instrumentation and space-borne observatories, it is increasingly becoming possible to test some of the predictions of cosmology with observational data. The main universities that offer courses in Cosmology participate in the research programmes of the National Institute for Theoretical and Computational Sciences (NiTheCS) (<https://nithecs.ac.za/>).



The new MeerKAT image of the Galactic centre region is shown with the Galactic plane running horizontally across the image.

LINKS TO THE LATEST SPACE-RELATED NEWS

<https://www.sarao.ac.za/media-releases/new-meerkat-radio-image-reveals-complex-heart-of-the-milky-way/>

(image on pg 8)

[nytimes.com/2022/01/31/science/milky-way.html](https://www.nytimes.com/2022/01/31/science/milky-way.html)

<https://skyandtelescope.org/astronomy-news/astonishing-radio-view-of-the-milky-ways-heart/>

<https://apod.nasa.gov/apod/ap220202.html>

2022 has been declared the International Year of Basic Sciences for Sustainable Development (IYBSSD2022) (<https://www.iybssd2022.org/en/home/>). The IYBSSD 2022 will spotlight the links between the basic sciences and the UN's Sustainable Development Goals (SDGs). It will be a crucial opportunity for mobilization to convince economic and political leaders and the general public of the importance of basic sciences in contributing to sustainable development.

IYBSSD2022

INTERNATIONAL YEAR OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

While all 17 [Sustainable Development Goals](#) require some input from the science and technology community, here is a list of a few of the goals that are explicitly linked to the sciences:

- *SDG 3, good health and well-being;*
- *SDG 6, clean water and sanitation;*
- *SDG 7, affordable and clean energy;*
- *SDG 13, climate action;*
- *SDG 14, life below water and;*
- *SDG 15, life on land*

Physics is a core basic science at the center of innovation, science, engineering, and technology. For example, most people know how discoveries in radiation, nuclear and medical physics contribute to addressing the cancer burden, thereby addressing SDG 3. Another example is material science and nanotechnology used in photovoltaic cells contributing to SDG 7.

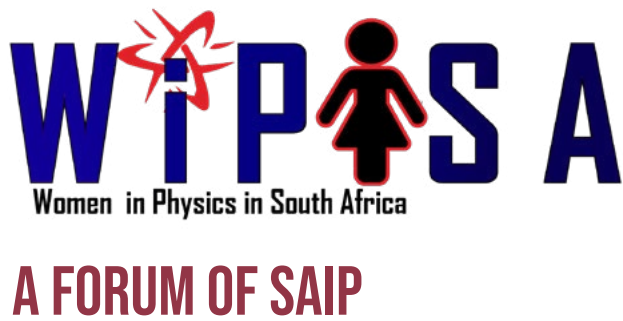
During the IYBSSD2022 commemorations, the SAIP, which is "The Voice of Physics in South Africa," has two goals:

Goal 1: To reach out to the general public and policymakers and inform them of the importance of Physics for sustainable development. Facilitate the understanding that "The Physics of Today is the Technology of Tomorrow".

Goal 2: Reach out to physicists and students at all levels, highlighting how their skills in physics contribute to sustainable development and what careers for the future are linked to physics skills.

The SAIP, in partnership with the South African physics community, developed a concise 30-minute documentary on how physics improves the quality of our everyday life. The documentary also looks at physics in South Africa and its role in sustainable development from a layman's point of view. This is the link to share this short and exciting documentary: <https://www.youtube.com/watch?v=BqNcTTGJNIM>

The SAIP also conducted a competition named "Physics in my Village," where high school learners described how physics discoveries improve the quality of life in the communities they live. To view these exciting submissions from the top six learners, visit the link <https://www.saip.org.za/Physicsinmyvillage/index.php/our-stories/>



**"INSPIRE, MOTIVATE, SUPPORT AND ENCOURAGE
GIRLS AND WOMEN TO PURSUE CAREERS IN PHYSICS",
THIS IS THE MISSION OF
WOMEN in PHYSICS in SOUTH AFRICA (WIPISA)**

Women account for about 30% of the STEM (Science, Technology, Engineering, and Mathematics) workforce in South Africa. This is lower than the world average, although it is still higher than other Sub-Saharan African countries. The labour market is continuously transitioning toward a more digital economy. Therefore, it is critical to educate and upskill girls and women in STEM careers. Providing skills will ensure job security, which is especially important given the current COVID-19 epidemic. Globally, there is a "leaky pipeline," resulting in only a few women pursuing STEM careers.

The South African Institute of Physics (SAIP) established a women's forum, WiPiSA, in 2005 (Women in Physics in South Africa). The forum's objective is to resolve women's under-representation in physics while developing a network for females in the field. Girls and women have systematically turned away from science and mathematics throughout their education. Possible reasons for this are social bias or socio-economic factors, and consequently, opportunities in physics and associated areas are restricted. WiPiSA's mission is to inspire and support girls and women who are interested in pursuing careers in physics.

Social and cultural beliefs about the role of women in society and the working world have had a powerful influence in determining the social and economic roles played by women in all societies, as well as determining the opportunities that women have access

to. It is possible to argue that the principal reasons for the low numbers of girls and women in science are the social presumptions about the role of women in society and excluding females in careers that are known to be particularly male dominant. Despite world progress in working towards equity for women and men in all spheres of human life, a gender imbalance in the science field is still a reality.

SAIP currently has 1135 physicist members of which 921 are men and 214 are women. While not all physicists in the country are registered with the organisation, these numbers reflect the level of slow transformation in the profession. It is for this reason that WiPiSA, which is a women's wing of the SAIP has been working to support and encourage women to study physics. This is in line with the overall global campaign to encourage more girls to study science, technology, engineering, and mathematics (STEM).

Through outreach programmes, seminars, mentorship programs, involvement in industry events, public relations, and stakeholder engagements, WiPiSA has led the way in sparking and developing interest in physics among girls and women.

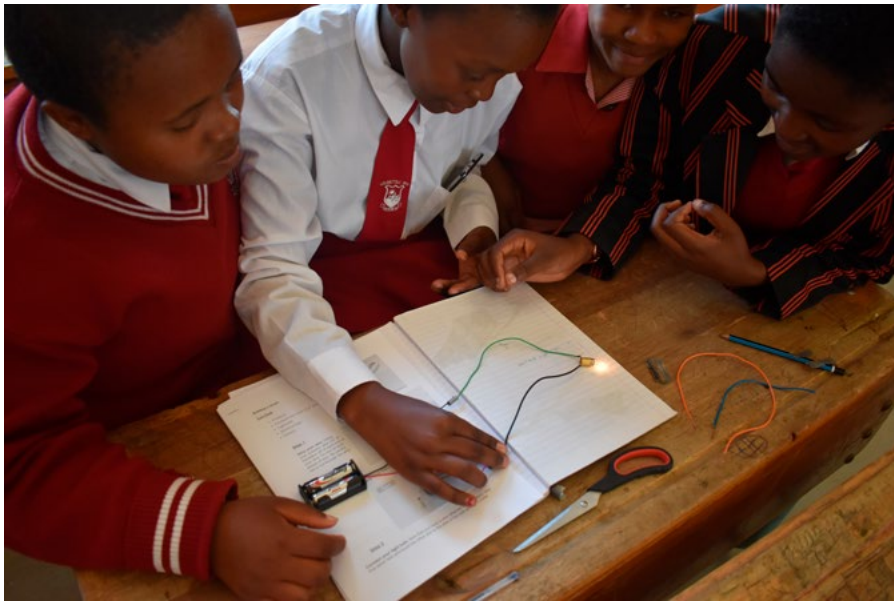
Experiments, lab tours, and media campaigns during Women's Month in 2020 and 2021 assisted WiPiSA in cementing its message while reaching a wider audience. WiPiSA is a firm believer that no one should be denied the opportunity to learn skills that would enable them to function in the 4IR environment in a constantly changing global economy.



From left to right:

Student Representative: Ms Onesimo Mtintsilana

Interim Chairperson: Dr Rosinah Modiba (CSIR)



OBJECTIVES

- To attract girls into physics
- To support women embarking on careers in physics
- To promote women in physics in leadership roles
- To break stereotypes that discourage women from studying physics and working in physics-related careers
- To support women in physics who need to balance family and career
- To promote the creation of flexible jobs (not only full-time) that will allow women in physics who have families to follow meaningful career paths
- To promote funding criteria that take into consideration women who have families (and may interrupt their career for a time)
- To improve institutional structures and climate for women in physics
- To challenge gender discrimination in selection procedures and the workplace

"Empower Her" was an outreach project that took place in the Eastern Cape. This program aimed to encourage rural girls to pursue studies in physics, computer science, and coding



ACTIVITIES

- Women Luncheons
- Call for project proposals
- Women's month outreach
- Teacher development programme
- Empower her
- Webinar series

MEMBERSHIP

Everyone affiliated with SAIP automatically forms part of WiPiSA. To become a member of SAIP, click [here](#).

For more information on WiPiSA visit our website, follow us on social media or contact us on:

wipisa@saip.org.za



The "Empower Her" project included physics experiments, software development, a virtual tour of the Large Hadron Collider at CERN, and career guidance. This effort benefited a high school and two elementary schools, impacting 63 students.

WiPiSA takes pride in establishing networks among junior and senior female physics students.

In partnership with the Allan Gray Foundation, SAIP implemented several programs through WiPiSA in 2020. Adhering to all of the lockdown protocols and regulations established by the "New Normal" necessitated the development of unique strategies to encourage female participation in physics. Some WiPiSA-funded programs included the trailblazer webinars hosted by Astronomy in Colour (AiC). This astronomy group provides a safe space to discuss issues facing astronomers at the intersection of race and gender and aims to inspire and empower black women to pursue careers in astronomy and support those who are already in the field by mentoring, expanding our networks, and raising their exposure.

The AiC hosted a speaker series featuring women that encouraged women and provided them with helpful advice and insights on navigating this journey at the intersection of race and gender.

International trailblazers such as Dame Prof Jocelyn Bell Burnell, Prof Chanda Prescod-Weinstein, and Prof Shobhana Narasimhan were among these women. South African female scientists and academics, Prof Mamokgethi Phakeng, Prof Mmaki Jantjies,

and Prof Mmantsae Diale, highlighted their career journeys on the digital platform. This event's Zoom sessions had between 70 and 100 individuals attending. The seminars were posted to the AiC YouTube page and have received over 700 views to date. This program has already benefited over 600 women.

Another initiative, the Gender-Friendly Physics Curriculum, targeted the CAPS curriculum's grade 7 to 12 cohort. Support materials were given to 28 schools around the country. The initiative aimed to increase learners' interest in physical sciences as one of their core subjects and make physics curricula more gender-friendly by having both female and male scientists conduct experiments. Quintiles one to three primary and high schools with low pass rates were explicitly targeted.

WiPiSA takes pride in establishing networks among junior and senior female physics students. Annual departmental lunches have been held at various institutions of higher learning. Undergraduate, postgraduate, and female faculty are encouraged to take on numerous roles in physics. WiPiSA has been pleased with the tremendous rise in the number of female physicists in South Africa since its inception. Women are pursuing postgraduate degrees in physics in more significant numbers than ever before. Furthermore, there has been an increase in the number of female physicists in senior positions in institutions of higher learning, as well as an increase in the number of females earning Ph.D. degrees.



Professor Irvy (Igle) Gledhill is a past president of SAIP and continues to promote women in physics. If you missed the previous issue, read Professor Igle's article on the Gender Gap there.

// USING PHYSICS TO UNDERSTAND THE COSMOS



INTERVIEW WITH
PROFESSOR YIN-ZHE MA
FROM THE UNIVERSITY OF
KWAZULU - NATAL.



Yin-Zhe Ma

is a professor in the Astrophysics Research Centre (ARC), which is part of the College of Agriculture, Engineering and Science at the University of Kwazulu-Natal (UKZN). His research is on the cutting-edge frontier of astrophysics and cosmology. He uses cosmic microwave background radiation and large-scale structure data to study the evolution of the Universe at different epochs and to understand the physical nature of dark energy and dark matter. Prof. Ma holds a Ph.D. in Astronomy, Master of Science, Bachelor of Science, and is a CITA National Research Fellow & Research Associate.

"My research is pure science. It is mainly curiosity-driven research, so it is not directly applicable to the industry. UKZN is a good place to do research. It provides the infrastructure to conduct our research, with reasonable teaching and administration load". - Prof. Ma

Prof. Ma's research group comprises two master's students, 2 Ph.D. students, and four postdoctoral fellows, two of whom have been his students throughout their postgraduate studies.

His research group focuses on Cosmology and radio astronomy. They use cosmological data mainly from radio antennae, cos-

mic microwave background radiation, and the MeerKAT telescope to understand the physical processes during the early Universe and the subsequent structure formation.

In addition to lecturing and supervising students at UKZN, he is also an adjunct Professor at two of the major observatories in China. One is the National Observatories of China, and the other is the Purple Mountain Observatory, also known as Zijinshan Astronomical Observatory. Prof. Ma also frequently collaborates with the SKA ([Square Kilometer Array](#)) office.

When asked to use a single sentence to describe what he does, Prof. Ma replied, "I use physics as a tool to understand the cosmos."

The rest of the interview has been kept in a Q & A format.

Q: Why did you choose to pursue a career in Physics?

A: My interest in physics started in high school, and as my studies progressed, my curiosity became greater. I found myself reading and enjoying more advanced books, which exceeded my high school content. I immersed myself in books which were a tool to understand physics. Subsequently, I enrolled as a physics major at Nanjing University of China. I listened to many seminars and talks from all fields of physics. When I came across astrophysics, I instantly knew that this was the field for me.

Q: Did you ever have any doubts about your chosen field or uncertainties about your career?

A: As I said, I knew instantly that I wanted to pursue astrophysics, and I specialized in the sub-field of Cosmology. In my mind, there were no other possibilities. I constantly worked towards becoming a researcher in this field. Throughout my journey, my choice was re-affirmed. I've never had any doubts.

Q: Once you achieved your goal of becoming a researcher, did the reality match your expectations?

Absolutely! I'm even more fascinated with the subject. When I started learning about cosmology, it was just the starting point in precision cosmology. When I began my postgraduate research, we could use much more precise data to measure cosmological parameters. As I progressed, the precision of my data increased. The information allows much physics to be tested with a higher level of accuracy and highlights some fascinating phenomena. I would say that astrophysics exceeded my expectations as I continue to enjoy it.

Q: Has Covid-19 impacted your research group in any way?

Yes, it has. There is a future threat from the lack of funding we receive. There has already been a decrease in funding for students, which can be attributed to the pandemic. To overcome this rough patch, we need to start thinking of solutions. In terms of my research group, we would meet every Monday to chat, talk about challenges and socialize. We had to change our face-to-face group meetings to be online since the pandemic.

On the lecturing side, I've found ways to overcome some of the challenges of virtual teaching. Since physics is a very hands-on subject, I use my iPad and Apple pencil to derive equations and work through problems step by step on screen. This simulates the classroom experience. Being passionate in class is as important as ever, so learners participate and follow

Q: Do you think that astrophysics and cosmology have enough exposure, or should we be doing more to raise awareness of this field among prospective students?

A: I feel that it is a bit underrepresented. Our position in the Universe is one of the main curiosities we should have as humans. This knowledge (cosmology) would be the common knowledge we share with other intelligent lifeforms. For example, there's an alien with a completely different physical appearance and language. However, their knowledge of physics or astronomy will still lead them back to the big bang as the origin of the Universe. So in that regard, astrophysics and cosmology is a universal knowledge that is not confined to any particular group of people but a common knowledge shared by all intelligent life forms in the cosmos. It's fascinating and much fun.

Q: Do you think that the concept of astrophysics is too complex for the public to grasp?

A: When it comes to the general public, they think that studying the cosmos is an abstract topic and lacks relevance in our everyday lives. One of the things I find in my life is that if you want to win a friend, you should tell them that you're an astronomer. Tell them you're a physicist if you want to lose a friend. That highlights the stereotype of physicists. People think that we are solitary scientists that don't involve ourselves in regular conversations. In comparison, an astronomer sounds fun and exciting. So I think it is something that we need to change and help people understand what we do and why we do it.

Q: Comparing South Africa's education system (with regards to physics) to China's, how does it fare, and what areas do you think need improvement?

A: Overall, South Africa's education system is sound, but it needs more skills training. At an honours level, students are generally good, but they need more training on how to go about solving real problems. Another area for improvement is communication. Students need to be able and comfortable communicating their knowledge, especially with collaborators that may be from other parts of the world. When you look at China, I think that students are over-trained and skilled to the point where they lack curiosity about phenomena. So a balance is essential. In South Africa, I believe greater skills training and more work needs to be done at the undergraduate and high school levels so that when they face (always unanticipated) problems, they are equipped with skills, tools and confidence to solve them.



ANNUAL CONFERENCE OF THE SOUTH AFRICAN INSTITUTE OF PHYSICS (SAIP 2022)



Date:
4-8 July 2022

100 years
of Physics in Africa
Past, Present and
Future



This year, in conjunction with international IUPAP 100 and IYBSSD celebrations, the SAIP is celebrating 100 Years of Physics in Africa: Past, Present and Future! As part of these celebrations, the SAIP annual conference (SAIP 2022), to be held virtually in July, will be dedicated to showcasing the work of physics graduates from across the continent as they make invaluable contributions to industry and towards achieving the sustainable development goals. The SAIP will also be honouring our past colleagues who laid the foundations for Physics in Africa.



SUBMIT AN ABSTRACT

Please visit the [conference website](#) for abstract submission deadlines and other conference-related information. Accepted abstracts will be allocated either an oral (facilitated via [Zoom](#)) or poster (facilitated via [Gather](#)) presentation slot. The conference tracks are as follows:

Track A - Physics of Condensed Matter and Materials

Track B - Nuclear, Particle and Radiation Physics

Track C - Photonics

Track D - Astrophysics and Space Science

Track E - Physics for Development, Education and Outreach

Track F - Applied Physics

Track G - Theoretical and Computational Physics

PHYSICS IN INDUSTRY DAY

Calling all Physics graduates! If you are a physics graduate working in industry please consider participating in the Physics in Industry Day forum which will form part of the SAIP 2022 conference in July. Physics graduates are an immense resource of experience and potential collaboration. The Industry Day forum aims to synergistically tap into this resource by providing a platform for stimulating knowledge transfer and collaboration between industry and academic partners. We invite Physics graduates active (or retired) in all areas of industry to share their working experience and projects, their technical achievements, their business start-ups and business goals, their experiences in workplace challenges, entrepreneurship, economic realities, and how their Physics background integrated with these aspects. The intention is to inspire and equip the physics community to use their skills in industry or to create a start-up company. The intention is also to connect industry graduates with potential academic collaborators who can support their R&D needs. If you are interested in participating in the Industry Day forum, please indicate your willingness by completing the "Expression of interest form" below. Participation will involve giving a live or pre-recorded presentation and participating in a live Q&A session. Participation is free for presenting speakers.

Expression of interest form (deadline: **4 March 2022**): [Click here](#)

For further enquiries, please email: Manny.Mathuthu@nwu.ac.za

WINTER SCHOOLS

Join us on Friday, 1 July 2022, for one of the SAIP 2022 online winter schools! Preliminary topics include:

- Biophysics in Confronting Health Challenges
- Sustainable Research: Bridging the Gap between Academia and Industry

More information to follow.

LIGHTS, CAMERA, ACTION!

SAIP 2022 Video Competition: Inviting all bright minds to celebrate the International Year of Basic Sciences for Sustainable Development (IYBSSD 2022). Groups consisting of a maximum of 4 individuals are invited to partake in the SAIP 2022 Video Competition focusing on the role of Physics in achieving the United Nations Sustainable Development Goals (SDGs). These goals include, but are not limited to: Zero Hunger; Quality Education; Gender Equality, Clean Water & Sanitation; Affordable & Clean Energy; Climate Action; Life on Land and Sea. To enter, submit a 3-5 minute video showcasing how Physics can contribute to solving any one of the SDGs.

Visit the [competition website](#) for more info on SDGs, video specifications, judging criteria, submission deadlines and prizes! For enquiries, please email: ettienne.minnaar@mandela.ac.za.

COUNCIL PROFILES

PART 2

Prof Du Toit Strauss is appointed as an associate professor in the School of Physical and Chemical Sciences within the Faculty of Natural and Agricultural Sciences of the North-West University. His research interests are in heliophysics, the physics of the Sun, and its interplanetary extension. In particular, he focussed on the propagation of energetic particles through the turbulent interplanetary plasma. He has published 56 papers in international journals and 35 conference proceedings. In 2019 he was awarded the SAIP Silver Jubilee Medal and in 2021 the American Geophysical Union's Africa Award for Research Excellence in Space Science.

As an ordinary member of the SAIP council, he aims to advance the SAIP's general mission of being the voice of physics in South Africa. He will do this by actively engaging with SAIP members, identifying their needs, suggestions, and concerns, and presenting these to the larger SAIP council. He will also work towards advancing the cooperation between different physics departments and research institutions in South Africa through, e.g., joint curriculum and module development



Council Portfolio:
Astronomy & Astrophysics
Liaison
Conferences & Conference proceedings.

Organization:
North-West University

Field:
Heliophysics



Council Portfolio:
Marketing & Outreach

Organization:
SANSA

Field:
Space physics

to enhance the quality of tertiary physics education and facilitate local research collaboration.

Dr Zama Katamzi-Joseph is a space physics researcher at the South African National Space Agency (SANSA) and research associate at Rhodes University. She completed her undergraduate training in Physics at the University of Cape Town in 2004. She then joined the National Astrophysics and Space Science Programme for BSc Hon and MSc. After completing her MSc with distinction at Rhodes University in 2007, she went on to do her Ph.D. at the University of Bath (UK) and graduated in 2011. Her research interests include thermosphere-ionosphere dynamics and the influence of gravity waves, tides, and geomagnetic storms on the ionosphere and thermosphere. She has won several awards, including the American Geophysical Union's Sunanda and Santi may Basu (International) Early Career Award in Sun-Earth Systems Science, the International Union of Radio Science's (URSI's) Young Scientist Award, and Ikusasa Awards – Youth Leadership: Science and Technology. She was also selected to participate in the Fulbright Visiting Research Scholar Program, hosted by the University of Illinois at Urbana-Champaign (USA). Dr. Katamzi-Joseph represents South Africa as the national representative for Commission G (Ionospheric Radio and Propagation) of URSI, COSPAR, and SCOSTEP.

SOUTH AFRICAN NATIONAL SPACE AGENCY

The South African National Space Agency is a public entity that was established in December 2010 (and started operations in April 2011) to promote the use of space and strengthen cooperation in space-related activities while fostering research in space science, advancing scientific engineering through developing human capital, and supporting industrial development in space technologies

SANSA's research and work focuses on space science, engineering and technology that can promote development, build human capital and provide important national services. Much of this work involves monitoring the Earth and our surrounding environment, and using the collected data to ensure that navigation, communication technology and weather forecasting services function as intended

Contributed by

Dr Lee-Anne McKinnell,
SANSA Managing Director.



What does SANSA study/do?

The South African National Space Agency (SANSA) contributes to global space research through high-impact collaborative research and development ensuring South Africa is recognised as a leader in space science and technology. The research areas covered by SANSA are diverse and are focused under four main Agency programmes: Earth Observation, Space Science, Solar physics, Space Operations and Space Engineering. These focus areas include opportunities in remote sensing, Earth system science, geospatial programming, Antarctic research, climate change, space weather and ionospheric physics, aerospace and electronic engineering, computer science, software and systems engineering. SANSA plays a key role in monitoring the near-Earth space environment and forms part of the worldwide network of space weather centres and magnetic observatories. The Agency is responsible for operating a distributed network of research infrastructure used for monitoring the near-Earth space environment over Southern Africa, Indian and Atlantic Ocean, and Antarctica.

SANSA contributes to international research through its knowledge based on its unique geographical area (access to information linked to our location) and our presence in Antarctica which is a window into geospace. SANSA owns 80% of the instruments at SANAE IV base in Antarctica which gives us a unique window to observe the impact of space weather on the Earth's magnetic

The SANSA Space Science
Research Group in the
Space Weather Centre



field and in the Earth's upper atmosphere (ionosphere). We contribute to global knowledge of space weather in terms research and data from the African continent. We also participate in international space weather and earth observation forums. Our designation as regional space weather provider positions South Africa to support global space weather centres and The Digital Earth Africa project will deliver Earth observation products and services to Africa.

What role does SANSa play in our economy?

SANSa contributes to the economy through the derivation of benefits of space for South Africans and in perusing and developing space applications to protect earth systems. Examples are the use of Earth observation satellite footage and data to create products and services that help government to make important policy decisions. SANSa's Earth Observation Programme monitors urban expansion (for sustainable development and city planning), water resources and agriculture. SANSa's Space Science Programme monitors and forecasts space weather to protect our technological systems such as satellite communication and navigation systems. SANSa is also creating an infrastructure hub to support an ecosystem for a vibrant space industry. Human capital development is a big focus for SANSa and we have a growing bursary programme for developing space engineers and scientists in South Africa. A well supported Science Engagement team also promote STEM to learners across all nine provinces of South Africa.

SANSa is also now pioneering solar physics in South Africa under the guidance of the SANSa SARChi Research Chair in Space Weather, Dr Martin Snow. Dr Snow is actively looking for Post-Graduate students to take up solar physics. We are entering a new and exciting phase as we position ourselves for big infrastructure projects that will stimulate and help develop a vibrant private sector in the space industry. SANSa is also positioning itself as the leader in space in Africa during a time of rapid growth. We encourage young students and scientists to take up space science and become part of this exciting industry.

For more info click [here](#).

Follow SANSa on social media or look at their website !



1941

Hermanus Magnetic Observatory established

2008

South African National Space Agency Act passed

2010

SANSa is established

SEVERAL SANSa RESEARCHERS RECEIVED THEIR NRF RATING LAST YEAR. FROM THE LEFT IS DR JOHN BOSCO HABA- RULEMA, PROF MIKE KOSCH, DR ZAMA KATAMZI-JOSEPH, DR PIERRE CILLIERS AND DR SHIMUL MAHARAJ.



A DECADE OF SPACE INVESTMENTS IN SOUTH AFRICA

Depending on their mission, satellites have different orbits. Weather and communication satellites are placed in Geostationary Orbits (GEO) at an altitude of 36,000km above the equator, from which they have a constant gaze on the same region of the Earth. Other satellites are placed in Low Earth Orbits (LEO) between 400 and 600km, which complete on average one orbit around the Earth every 100 minutes. Such orbits are used for remote sensing, navigation and positioning, and space weather applications.

Satellite communications is a key technology that enables us to participate in the global information infrastructure. Telecommunications networks are the most cost effective way to ensure communications reach in areas where user density is lower than 200 subscribers per square kilometre.

Space weather refers to the conditions in space that can influence the performance and reliability of space-borne and ground-

based technological systems. Space weather is a consequence of the behaviour of the sun, the nature of Earth's magnetic field and atmosphere, and the Earth's location in the solar system.

Earth observation/remote sensing satellites use modern instruments to gather information about the nature and condition of Earth's land, sea, and atmosphere. These satellites use sensors that can "see" a broad area and report very fine details about our environment.

Satellite navigation uses satellites as reference points to calculate positions on Earth accurate to within a metre. With advanced techniques and augmentations, satellite navigation can provide measurements down to centimetre levels.

The above mentioned applications define our modern day lifestyle and contribute immensely to our quality of life. In addition, space-derived services is increasingly being

used as a decision-making tool for policy choices relating to our political, social, economic and environmental challenges. In order to ensure that South Africa capitalised on these benefits, the South African National Space Agency (SANSA) Act was passed in 2008, which aimed to align South Africa's space activities under one roof.

The SANSA Act mandated the formation of SANSA, and the agency was officially launched in 2010. Consequently, on 1 April 2011, SANSA came into existence and united several of South Africa's efforts in Space Science and Technology under one banner. This included the Hermanus Magnetic Observatory from the National Research Foundation (NRF) and the Satellite Applications Centre from the Council for Scientific and Industrial Research (CSIR).

The Hermanus Magnetic Observatory dates back to 1841 and is now the SANSA Space Science Programme. In 1960, the facility at Hartebeesthoek became one of NASA's 14 Satellite Tracking and Data Acquisition Network (STADAN) stations established around the globe. In 1975, NASA withdrew its involvement due to political instability and in 1980 it became the Satellite Applications Centre. The facility is now the SANSA Space Operations Programme. Also located at Hartebeesthoek at the time, the Earth Observation team had been receiving and processing satellite data since the first transmissions were received from LandSat1 in 1972. This is now the SANSA Earth Observation Programme. Two additional Programmes were introduced, namely the Administration Programme and the Space Engineering Programme, to take care of



SANSA OPERATES A MAGNETICALLY CLEAN ENVIRONMENT WITHIN ITS FACILITY AT HERMANUS. THE FACILITY HAS OPERATED AS A MAGNETIC OBSERVATORY SINCE 1940.

the administrative and engineering requirements, respectively.

Over the last decade, SANSA has delivered an impressive array of products and services to meet the evolving needs of government. To date, the SANSA satellite archives have more than 150 terabytes of remote sensing data over Southern Africa dating back to the 1970s, which allows us to understand how our landscape has transformed over time. SANSA currently tracks between 15 and 18 satellite passes every day and have consistently maintained over 98% success rate.

SANSA also hosts the only internationally accredited regional space weather centre and our magnetic field data is considered the most continuous in the world and have been used since the 1960s, as one of four global stations, as a proxy for understanding mid-latitude space weather phenomena. Our Antarctic base provides a crucial window into space where over 80% of the scientific equipment is space physics related –given that the magnetic field lines converge over the poles and phenomena occurring in space are mapped along these field lines.

SANSA also provides launch support services to foreign clients over the African region, as many of these clients lose sight of their rockets when it passes over Africa at which point SANSA assumes control and issues commands for the various rocket stages and the eventual ejection of satellite payloads into orbit. In addition, we perform in orbit testing and orbital corrections for various satellite missions.


These achievements have laid the groundwork for SANSA's aspirational future plans, which includes the recent announcement of a national Space Infrastructure Hub (SIH) worth R4.47 billion. The SIH was chosen in 2020 as a Strategic Infrastructure Project (SIPS), indicating the importance attached by the South African Government to investment in space infrastructure as a national priority.

The Hub is based on the concept of the space value chain and will include satellite builds for Earth observation and science missions, an expanded data reception, analysis and archiving capacity and a new data visualisation centre, the development of products and services for government and industry role players, along with human

capital development efforts.

The SIH includes a pipeline of projects, some of which have already commenced, such as SANSA's 24 hour Regional Space Weather Centre, a Concurrent Engineering Design Facility, an Earth Observation Data Cube platform, and teleport services to track and receive data from hundreds of satellites. The investment in the SIH is intended to assist the Agency deliver on its full mandate to the citizens of this country and the region; whilst growing the local economy and creating much needed employment.

Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, expressed his excitement about the future of SANSA and especially the plans for the Space Infrastructure Hub and recently commented "I am heartened to witness the incredible contribution by SANSA to our people and the global space industry through knowledge generation, service support excellence to our space partners around the world and contribution to the local industry and our economy despite the budget constraints the Agency had to endure for a period of years".



Earth Observation data enables the development of data services and products that promote socio-economic benefits, like environmental and resource management, disaster management, safety, security and health that is available to Government and the private sector. The Space Engineering Programme develops, builds and tests systems and sub-systems for satellites whilst providing space mission project management guidance and nurturing the local space industry.

Space Operations provides state-of-the-art and globally competitive ground station facilities and services for global space launches and missions as well as data download for the Earth observation programme. Space Science operates a wide range of infrastructure across southern Africa and in Antarctica, all dedicated to studying the Earth's magnetic field, the Sun and the near-space environment. SANSA maintains several space science and space weather projects in Antarctica, as well as on Marion and Gough Islands, providing valuable space science data for national and international research. The Space Science programme also hosts the only Space Weather Warning Centre in Africa, providing early warnings and forecasts of space weather activity for public and private sector clients.



SAIP PRESIDENT MACE HANDOVER



THE SAIP IS GLAD TO INFORM THE PHYSICS COMMUNITY THAT THE PRESIDENTIAL MACE HANDOVER CEREMONY WAS HELD AT THE SAIP OFFICE (CSIR CAMPUS) ON THE 10TH OF MARCH 2022.

In African culture going way back in the mists of time, it was a tradition that an ailing king would hand over his mace or spear used to win the kingdom's battles to his successor. Following similar African ethos and legacy, the South African Institute of Physics introduced the president's mace in 2013. A tradition and ceremony of handing over the president's mace by the outgoing to the incoming SAIP President was initiated. Unlike in the ages past, the health of the presidents is usually not in question. This ceremony symbolises an unconditional commitment by the leadership to the vision of SAIP and to the need to strengthen physics education, research and its applications for sustainable development in South Africa. The mace also symbolises the foundation, sacrifices and unity we are building for a world-class physics community in the country.

Traditionally the handover ceremony is held at the SAIP annual conference where the incoming council is announced. However, the ceremony could not be held in July 2021 as the SAIP2021 conference was held virtually. The SAIP is glad to inform the physics community that an opportunity finally arose, and the handover ceremony was held at the SAIP Office (CSIR Campus) on the 10th of March 2022.

At the handover, the outgoing SAIP President, Professor Deena Naidoo (Wits University), said it is a great honour to hand over the mace to the incoming president. He added that the mace represents the vision, ethos and legacy of commitment to ensure that the SAIP projects continue and leadership strive to serve the SAIP membership and the country.



In his acceptance speech, the incoming SAIP President, Professor Makaiko Chithambo (Rhodes University), thanked the SAIP membership for voting for him to lead the institute and acknowledged that the role comes with significant responsibilities. He promised to try his best to achieve the objectives of the institute. He also thanked the SAIP Office and reminded them that they are serving a membership that is close to 5000 people.

The ceremony is available for viewing on youtube. Click the icon below.



SAIP PRESIDENT WITH THE SAIP OFFICE STAFF

From Left: Brian Masara(Executive Officer), Queen Thabethe (Secretary and Administrator), Prof Chithambo (SAIP President), Prof Naidoo (SAIP-Past President), Ndanga Mahani (Projects Officer) and Tebogo Mokhine (IT Officer)

Thanks for reading!



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THE PC MAGAZINE TEAM

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