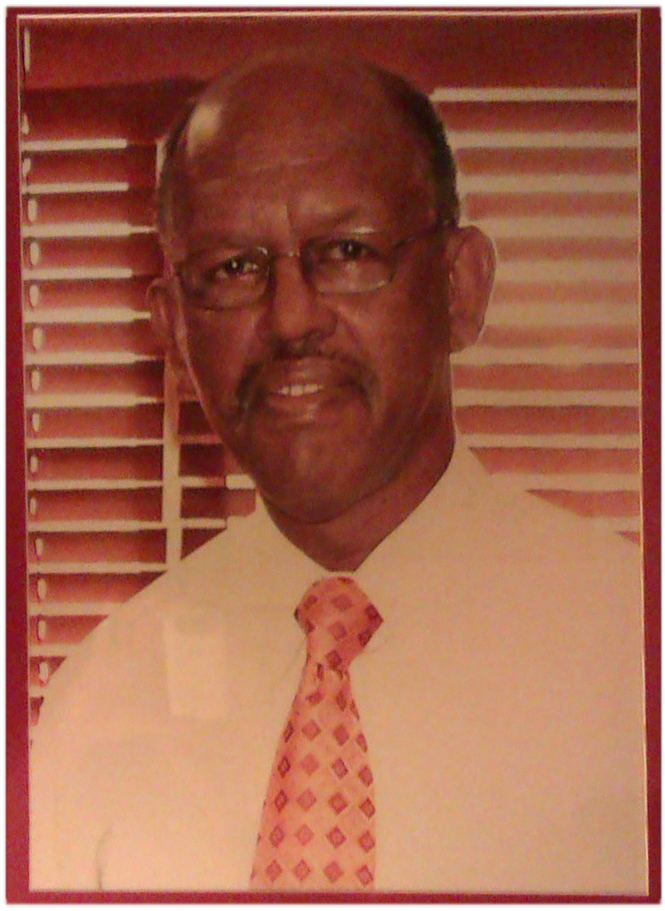
VOL 5, ISSUE 2, JUNE 2013 WEBPAGE EMAIL

Physics Comment

A Southern African Physics Magazine



Edmund C. Zingu (1946-2013)

Past SAIP President and IUPAP Vice President helped to *shape the Future of Physics in South Africa*

A Quarterly Newsletter Issue No 2 - Summer 2013

South Africa partners French synchrotron

New access to synchrotron light source allows physics, but also paleontological findings to be studied.

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The purpose and method of Science Education

Do we need a science education aiming at critical reflection to face the challenges of our time?

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A telescope bigger than the earth

Record resolution by combined radio telescopes on earth and on Russian satellite with highly eccentric orbit. **Page 14**

Precision Farming

SANSA, the South African National Space Agency, launches balloons in Antarctica to study the space weather but also investigates satellite-assisted farming. **Page 18**

Editor: Prof T. Konrad

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Editor‘s Note

Prof Edmund Zingu, Physicist and President of the SAIP from 2004 to 2006, died on the morning of the 20th April 2013. Known to many of us in his friendly manner he had a profound influence on the development of physics in South Africa through his involvement in projects such as the *Shaping the Future of Physics in SA* and the *Review of Physics Training in SA*. The former led to the creation of the National Institute of Theoretical Physics (NITheP) and its impact on physics in SA cannot be underestimated. The *Review of Physics Training*, and thus Edmund's work, is still ongoing. Tributes to Edmund can be found and posted on a specially created webpage. This issue of *Physics Comment* publishes an obituary that Prof Mmantsae Diale, Member of SAIP Council and Academic at the University of Pretoria, wrote for her former mentor Edmund, see p. 9.

At the upcoming 58th annual SAIP conference at the University of Zululand (cp. p. 8) the findings of the *Review of Physics Training* will be released and discussed in the AGM and elsewhere. Other stake holders such as the Council on Higher Education (CHE) will also be represented which promises interesting interactions in this context. The *Review* is part of the efforts of South African Physicists to improve and establish standards in the physics training. As SAIP President Simon Connell puts it: "We will use the recommendations from the *Review* to massively change the situation to the better!"

Apart from a fabulous scientific programme at the conference, I am also looking forward to getting hold of the book on the *History of Physics in South Africa* which will be launched at the opening ceremony.

As announced on the cover page we have a collection of interesting articles in this issue of *Physics Comment*.

I wish you an enjoyable read and hope to see you soon at the SAIP conference.

With best regards
Prof Thomas Konrad

Caption of picture on cover page: Prof Edmund C. Zingu

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

News from Africa

Proposal to change SAIP Constitution

by Brian Masara (SAIP Office)

The SAIP is in the process of registering with SAQA as a Professional Body and this also involves the development of a Physics Professional Designation. SAIP is developing the *Professional Physicist* (Pr.Phys) designation. A member registered with SAIP as a *Professional Physicist* can use the letters Pr.Phys after their name e.g. George Brown (Pr.Phys).

Constitutional Change Proposed at July 2012 AGM

In order to achieve the above it was necessary for the SAIP to add new clauses to its constitution and bylaws. The constitutional change proposal was announced by the President Prof Simon Connell at the July 2012 AGM at University of Pretoria. There were no objections and members supported the proposal. Additionally the matter was open to members for discussion for more than a year in the *Physics Comment* Magazine and the Online Membership Community on SAIP website.

Circulation of Draft Changes to Membership

In line with the constitution the draft changes must be circulated 2 months before the AGM at which voting on the changes will take place. Following the proposal at AGM of 2012 and this circulation of proposed changes, all constitutional requirements for this proposed change to the constitution are satisfied.

Click here to download a letter from the SAIP Secretary giving background information on the proposed changes

Click here to download the proposed constitution

Click here to download the proposed bylaws

Please note that the proposed changes in the linked documents above are highlighted in red text.

The proposed changes to the constitution and bylaws will be decided by a secret vote by members through SAIP Electronic eVoting System. Electronic voting will be open from 1 July 2013 and will close on 11 July 2013. Results will be announced at the AGM to be held on 12 July 2013 at University of Zululand Richards Bay Campus.

South Africa joins the World's Premier Light Source for Scientific Research

Issued by the National Research Foundation

On 20 May 2013, the National Research Foundation (NRF) in South Africa signed an agreement with the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, to become a full international scientific partner in this facility along with 19 other countries from the broader European region. This new relationship will facilitate the access of South African scientists to the ESRF research facility, and also the access of European Scientists to South African expertise and research opportunities.

"This is a remarkable achievement, and it recognises the excellence of our local scientists as well as the global research opportunities that can be accessed from South Africa," says Dr Albert van Jaarsveld, CEO of the NRF. Signing the agreement on behalf of South Africa was Professor Nithaya Chetty, the Group Executive: Astronomy, NRF. In attendance were Dr. Thomas Auf der Heyde from the Department of Science and Technology (DST): Deputy Director-General for Human Capital and Knowledge Systems, who is responsible for the national research infrastructure programmes at the DST, including providing support for mobility and access to international infrastructures, such as the ESRF synchrotron facility; Mr Tshepo Ntsoane, Chairperson of the South African Synchrotron User Community (SRRIC); and Professor Simon Connell, President of the South African Institute of Physics (SAIP) and academic from the University of Johannesburg. The signing of this agreement will make South Africa the first African country to join the ESRF.

A synchrotron is a brilliant source of near laser quality "light", which covers the spectrum from the infra-red to the hard X-ray regime in a continuous manner. It can "see" in many different modes, capable of observing structure, composition and dynamics at the extreme limits of sensitivity and resolution. It enables research of the highest scientific impact in a wide range of fields including medicine, the biosciences, materials science, nanoscience, the heritage sciences, the environmental sciences and the geosciences to name a few. Since the early '90s, scientists from South African research organisations and the ESRF have established strong collaborations. South African achievements using synchrotrons have featured prominently in leading international scientific journals such as *Nature* and *Science* and have been highlighted in several ESRF reports.

Several South African industries have also conducted research at the ESRF, for example; Sasol which has developed a significant cohort of experts who conduct ground breaking research in catalysis using this facility. Synchrotrons have led to an increase in the amount of information which can be retrieved from a fossil, even while it is still partially encased in rock. This puts paleontology well into the realm of "big data", joining the ranks of the CERN and the SKA projects. Not surprisingly, therefore, South African paleontology also recently made international headlines when the brain of an early human ancestor Australopithecus sediba specimen nicknamed Karabo was visualised and studied in the fossilised skull buried in stone. This was a world first application for synchrotron technology. The atomic resolution insights gained from using the ESRF to visualise drug targets will assist us to better understand the functioning of drugs to address the considerable disease burden in African countries.

Skull of Australopithecus sediba, the brain of which has been investigated by synchroton radiation. (Picture from Wikipedia and caption added by the Editor)

According to Dr Auf der Heyde, "For some years now, we have seen a new growth trajectory in science in South Africa, and the agreement between the NRF and ESRF serves to further build human capital and research capacity for sustainable growth and development in South Africa". The signing of this agreement is accompanied by a companion budget that will be managed by the NRF to fund access to a selection of similar synchrotron facilities worldwide. End of Statement.

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Photo from meeting in December 2012 of the scientific and industrial user community of Synchrotron Radiation in South Africa to craft a strategy for Synchrotron access, cp. our article in the December issue of Physics Comment (the Editor).

First SA Fellow of International Optics and Photonics Society

from media release of CSIR

SPIE outreach coordinator, Brent Johnson, says: "It is our pleasure to announce the promotion of Prof Andrew Forbes to SPIE Fellow. It was by the recognition of his significant service to this society and to the greater science community, as well as the recognition of noteworthy technical achievements, that the SPIE Fellows Committee and the Board of Directors concluded to promote him."

Forbes was presented publicly with his new fellow plaque at the SPIE Photonics West conference in February in San Francisco, USA.

Forbes comments: "It is always nice to get recognition for the work you have done and continue to do. Over and above this, my Fellowship appointment is a reflection of the fact that we [at the CSIR] do scientific work which resonates with what SPIE is about – applied science."

Prof A. Forbes (middle) obtains the plaque of SPIE fellowship from SPIE officials.

Forbes is one of 69 new Fellows recently inducted into SPIE. They have been drawn from industry and universities around the world.

"All these people are highly esteemed," he says and adds, "I feel honoured and humbled to be included in the ranks of the SPIE Fellows."

As an active member of SPIE, Forbes has served as a programme committee member for conferences on laser beam shaping; laser resonators and beam control conference; and optical technologies for arming; safing; fusing; and firing. He is also the founder and Student Chapter Advisor for the CSIR SPIE Student Chapter. In addition to being a regular volunteer at SPIE events and conference attendee, he has been an author or co-author of over 50 SPIE conference and/or SPIE journal papers.

The other two African academics who were both promoted to SPIE Fellows (in 2009) are Professors Paul Buahbassuah of Ghana and Zorah Ben-Lakhdar of Tunisia.

It is also noteworthy that since its inception in 1955, SPIE has only inducted over 1000 of its members to fellowship status, making this a truly exclusive club and a rare honour for South Africa and Africa.

About SPIE:

SPIE is the international society for optics and photonics, a not-for-profit organisation founded in 1955 to advance light-based technologies. The society serves nearly 225 000 constituents from approximately 150 countries, offering conferences; continuing education; books; journals; a digital library in support of interdisciplinary information exchange; professional growth; and patent precedent. SPIE provided R29.7 million (or US$3.3 million) in support of education and outreach programmes in 2012.
SPIE recognises significant scientific and technical contributions in the multidisciplinary fields of optics, photonics, and imaging. SPIE Fellows are honoured for their technical achievements and for their service to the general optics community and to SPIE in particular. More than 1 000 SPIE members have become Fellows since the Society's inception in 1955.

About CSIR:

The CSIR (Council for Scientific and Industrial Research) is one of the leading R&D, technology and innovation institutions in Africa, with a track record spanning over 65 years. Structured to manage the entire research and innovation value chain, the CSIR strives for excellence in all its endeavours in order to improve the quality of life of South Africa's people and to increase the global competitiveness of South African industry. See CSIR webside or contact tel 012-841-2000. [The motto of CSIR is] "*CSIR - our future through science*".

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Free SAIP Membership for 3rd Year and Honours Physics Students

by Brian Masara (SAIP Office)

There will be a limited run of hard copies for the initial release, as well as a free electronic version available to SAIP members. Should you wish to purchase a hard copy at cost price please reserve this by writing to the SAIP Executive Office. Further details on the release are also available from the Executive Office.

The SAIP Council passed a resolution to extend free membership all 3rd Year Physics students and all Honours Physics Students. In order for 3rd year and honours students to be given free SAIP membership they must do the following.

- Approach their supervisor or physics head of department and ask them to send a request to SAIP
- The HoDs / Supervisors can choose to make their students free SAIP members
- The supervisor or HOD can send an email with the students' names and email address to SAIP on info@saip.org.za
- The 3rd year and honours students will have the following benefits
- Receive all SAIP electronic communication such as the Physics

- Comment magazine and adverts for scholarships, conferences and jobs.
- Attend the SAIP annual conference as student membership rates

This subscription will be valid for 1 year from January to December only hence for honours students they can ask their supervisor/HoD to renew it every year in January.Physics in South Africa

Join SAIP Membership

By Brian Masara (SAIP office, Pretoria)

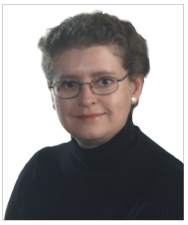
Physics is a basic science that is a basis for all science and technology disciplines. This results in physics graduates working in every sector imaginable. Therefore SAIP caters for a wide range of industries and economic sectors.

SAIP membership includes any physicists who graduated with at least physics related degree working in either; industry, commerce, government, academia, research, theoretical physics, 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 your professional development from activities such as conferences, schools and workshops and abiding by an acceptable code of conduct. Membership of a professional society is an important addition to a physicist's personal credentials for example when competing for a job membership of professional society will distinguish one from other applicants with similar qualifications but no professional affiliation.

What members say about SAIP membership



Dr Igle Gledhill - It's useful to have a professional home that is not an employer or an alma mater. I came back from four years in the USA and switched fields at the same time. Funnily enough, SAIP is home – the banquet is a hoot, the conferences keep me up to date, the Institute is serious about science in South Africa and gets things done, and my colleagues keep me on my toes.

Dr Daniel Moeketsi - SAIP provide a platform to showcase physics research progress and direction in the country and expose students to many career opportunities both in public and private sector. I encourage postgraduate students to subscribe for SAIP membership and actively participate in the organisation's annual activities.

Membership benefits

I. Stay informed - News flashes and alerts to 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.

II. 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.

III. Save Money - You'll receive discounted rates for SIAP conferences, and have the benefit of paying affiliate membership fees for IOP membership.

IV. Employment opportunity information - Job advertisements will be displayed on our new website and mailed to members from time to time.

V. Access to current information on sources of funding grants and scholarships - Exclusive service provided to our members via a direct email system.

VI. Scientific meetings - The annual conferences and workshops provide learning opportunities for different specialisation areas and varying degrees of experience.

VII. Especially for the global physics community - You'll have the opportunity to be partake in events organised by the SAIP for the Physics community in South Africa as well as Africa: developmental workshops, schools and conferences.

VIII. Additional resources - Your membership privileges also include information and guidance when applying for and acquiring visas to study, participate in scientific meeting and research opportunities in South Africa and abroad. There is also an exclusive member-only area on our website.

IX. Career guidance and resources- Career assistance is provided to all members to find their career path in industry or academia.

X. Opportunities to win awards for excellence - SAIP recognises contributions to physics in SA by awarding two different medals and various student prizes at the annual conference.

XI. 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

SA Physics Graduates Database

By Brian Masara (SAIP office, Pretoria)

If you have a degree in physics and you are currently working, studying or unemployed and resident in South Africa, or have studied physics in South Africa we kindly request you to sign up and give us your personal statistics. We need you! The statistics we collect, with your help, will be used to influence legislation, decision-making and all matters related to physics funding required for training more physicists.

Read more details here on confidentiality and great benefits of signing up and updating your details

To register click here .For enquiries contact SAIP Office at info@saip.org.za

SAIP 2nd Entrepreneurship for Scientists and Engineers in South Africa May 2013

by Brian Masara (SAIP Office, Pretoria)

Group photo of the delegates of the workshop

The SAIP in collaboration with the Institute of Physics UK (IOP) organised the second workshop for entrepreneurship for scientists and engineers in South Africa from 20 – 24 May 2013. The Workshop was held at Protea Karridene Hotel in Durban. The first workshop was held in November 2009 at iThemba Labs in Cape Town. The workshop was attended by 58 delegates. Some delegates travelled from outside South Africa to attend, the countries represented were Nigeria, Lesotho, Zimbabwe, DRC, Senegal and Cameroon.

The workshop was opened by Ms Cristina Pinto, Chief Director: Innovation Planning and Instruments in the Department of Science and Technology (DST). Ms Pinto gave a keynote address highlighting the DST innovation strategy and instruments available to help the science community commercialise their research and bridge the innovation chasm. Other local speakers included Ms Nelisha Naidoo, Business Development Manager with Technology Innovation Agency, who spoke on opportunities for funding in technological start-ups and Mr Vishen Pillay from Adams and Adams who spoke on the South African law and procedures on patenting, protection and benefiting from intellectual property.

The purpose of this workshop was to introduce scientists and engineers in the region to the process of innovation, generation and protection of intellectual property, technology transfer and commercialisation of inventions. The workshop consisted of lectures by invited speakers, case studies, group discussions and role-playing sessions related to the transitioning of research into innovative products.

At the conclusion of the workshop the delegates agreed that such an event must not be once-off workshops but the SAIP must start a project to continuously help and nuture the spirit of entrepreneurship. It was agreed that SAIP will start a Physics in Industry programme, a forum where physicists will meet with industry, venture capital and commerce stakeholders. In such a forum industry will present technical challenges which physicists can solve to start business opportunities, physicists with research ready for commercialisation can present their proposal to industry to look for adopters or venture capitalists interested in funding a start up.

This was a very successful workshop. Some feedback videos from participants can be watched here:

http://www.youtube.com/watch?v=jA4w7JGvlus&feature=youtu.be
http://www.youtube.com/watch?v=pYrX4qCozVQ&feature=youtu.be
http://www.youtube.com/watch?v=BXKsOXScz9s&feature=youtu.be
https://www.youtube.com/watch?v=O-3gSqz4jnw
http://www.youtube.com/watch?v=L75wwSdG4uI&feature=youtu.be
http://www.youtube.com/watch?v=gsP4-2UJRkI&feature=youtu.be
http://www.youtube.com/watch?v=MQpklsKBNHs&feature=youtu.be

South African Institute of Physics Conference 2013
University of Zululand, Richards Bay Campus 8-12 July 2013

from Press Release of the SAIP 2013 LOC (University of Zululand)

The 58thSouth African Institute of Physics (SAIP) Conference will be held at University of Zululand's (UNIZULU) Richards Bay Campus from 8 to 12 July 2013. The conference will provide a platform for scientists to share the latest developments in Physics and will be attended by 500 international delegates. The conference is preceded by three winter schools covering *Biophysics*, *High Energy Physics* and *Science at Synchrotrons*. Major highlights at this year's event will include the launch of the *National Report on Physics Undergraduate Training in South Africa* and the book "History of Physics in South Africa" at the Welcome and Opening Function on 8 July.

The conference aims to:

- Serve as a forum to promote Human Capital Development for skills in physics for the continued development of South Africa's research and teaching capability. This will be achieved by exposing students and also researchers to the wide range of physics programmes within South Africa and to the current cutting-edge research activities throughout the world.
- Contribute to knowledge generation as delegates share research results, collaborate to solve research problems and establish research networks.
- Improve the health of the Science and Technology pipeline, as those delegates involved in Physics Education identify challenges and possible solutions in Science and Mathematics at Schools, Universities and Colleges.
- Promote physics research as an important and exciting science frontier.
- Provide a platform of understanding the needs of areas such as nanotechnology, nuclear sciences, biosciences, industry, mining, medicine, agriculture, energy, space science, and in general technology and environment issues.

As a leading institute of higher learning, UNIZULU is focused on expanding academic interest to build and strengthen research capacity, broadening current offerings, establish new partnerships and create multiple platforms to further the exchange of information and encourage discourse and debate. To ensure a value added experience, eight plenary sessions have been planned with international speakers who are distinguished leaders in their respective fields of expertise.

The five-day event will also be attended by international and local scientists, academics and teachers. Papers presented will focus on the fields of Applied, Particle, Radiation and Nuclear Physics, Solar Cells, DLC Coatings, Nanotechnology, Physics Education, Applications of Synchrotron Radiation, and Condensed Matter Physics, Thermochromic Coatings, Photonics, Space Science, Theoretical and Computational Physics.

The conference will be concluded by hosting a Conference Banquet at which SAIP awards physicists for excellence. Excelling students will be honored for their research work and the Silver Jubilee Medal will also be awarded for outstanding achievement by a young physicist below 35 years.

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Obituary: E.C. Zingu (1946-2013)

by Prof Mmantsae Diale (University of Pretoria)

Edmund Charles Zingu was born in Gouda in 1946, Western Cape. He was educated at Harold Cressy High School, Cape Town and went on to study science at the University of the Western Cape, where he graduated in BSc (1968) and BSc (HONS) in Physics (1970). During his honours studies at the University of the Western Cape, he worked as a technical assistant in the Physics department. After completing BSc (HONS), he proceeded to Silverstream Senior Secondary School, Western Cape, where he taught mathematics and physical science for less than a year. This is where he met his wife, Julia and was blessed with three children.

He was awarded a Stichting Nederland Zuid-Afrika scholarship (1971) for further studies at Delft University of Technology, in the Netherlands, where he graduated as MSc in 1975. He worked as a physical engineer in the Netherlands for a year before returning to South Africa. He then joined the University of the Western Cape as a lecturer in Physics (1976-1984), while registered at UCT as PhD candidate. He was awarded a CSIR post-MSc overseas bursary (1982), which allowed him to spent time at Cornell University, USA doing research for his PhD at UCT. After graduating as PhD in 1985, he joined the University of the North at Qwa-qwa as head of department of Physics (1985). He was awarded an SMM postgraduate student award at SAIP for the most outstanding work in the field of Solid State Physics based on a publication in a scientific journal (1986). He then moved on to MEDUNSA where he held the positions of associate professor in the medical physics department (1986-1988), then, professor and Head of department of Physics (1989-1993)) and finally Dean of Science in the same institution (1990-1993). He received another award as Senior Fullbright Research Fellow at California Institute of Technology, Pasadena in USA, in 1993. On his return to South Africa, he went back to University of the Western Cape as professor in the department of Physics (1994-1996), followed by departmental chair in the same university (1995-1996). He finally took up a position at Mangosuthu University of Technology in Umlazi, as Vice-Principal, Academic, which removed him completely from research and laboratory work, the position he occupied till he retired (1997-2009). During his time at Mangosuthu he acted as Principal of the university from 1999-2000 and from 2008 to 2009, when he finally decided to retire. A true leader indeed.

Edmund Charles Zingu began his physics career as a materials physicist, and with his collaborators at Cornell University invented a new method to study atomic diffusion by transmission electron microscopy. Later he studied diffusion phase transitions in thin films due to induced thermal stress.

Edmund Zingu served on the council of the South African Institute of Physics (SAIP) from 1999 to 2006, and was President of the SAIP from 2003 to 2004. He was in fact the first black President in the history of the SAIP. He believed that local scientists needed to re-examine their role in society and how physics could impact on the national development objectives, including keeping the country up to speed with international research and technology. When Zingu, joined SAIP Council, physics in SA was in crisis. The numbers of

undergraduate students enrolling had been dropping for several years, the image of physics among the public and decision makers was poor, finance for physics projects was very limited and the SAIP itself, particularly its leadership, was not representative of the community of physicists in SA, and people rightly wanted to know what SAIP was going to do. By the time Edmund left the SAIP council, physics in SA was in a very different place. A true leader has again showed that he can handle crisis for the benefit of the country. The tribute by Japie Engelbrecht, who has been treasurer of SAIP, since 2001, demonstrated the diplomatic Edmund in dealing with real matter; I quote " I have nothing to add except my sadness at the passing of a truly great South African, whose impact on my own life enabled me to transform to our new democracy". He led the transformation activities of the SAIP council to an extent of revision of the constitution and by-laws for the SAIP, more involvement of the specialist groups in council, a president who was directly elected by the membership, and a new mindset and symbolism of a new logo of SAIP to prove it. All these great contributions took some time and efforts from Edmund.

Since 1994, it became necessary for Edmund Zingu to be involved in the transformation of South Africa from the apartheid regime to the new dispensation in particular, Physics and higher education. He was in the boards that moved the Department of Arts, Culture, Science and technology (DACST) to Department of Science and Technology (DST), Atomic Energy Corporation (AEC) to Nuclear Energy Cooperation of South Africa (NECSA) and Foundation for Research and Development (FRD) to National Research Foundation (NRF). In addition, he played crucial leadership roles in many projects, particularly in physics related development issues and higher education in general. He was Vice President of the International Union of Pure and Applied Physics (IUPAP) from 1999 to 2005, and Vice-Chair and Chair of the C13 IUPAP Commission on Physics for Development from 1997 to 2005.

Zingu led projects that brought South African Physics landscape into the bright spot. He was primarily responsible for bringing to South Africa, the iconic 'Physics for Sustainable Development' conference in 2005 as a part of the International Year of Physics. This conference cast a distinct spotlight on physics as an instrument for development in Africa. After the Sustainability conference, he was the SAIP council past president who saw the birth of Women in Physics in 2005, under the leadership of Zingu's student, Dr Mmantsae Moche Diale. He also led the highly successful Shaping the Future of Physics in South Africa project, where he contributed to the design of the project and also served as chair of the Management and Policy Committee that oversaw the international review in 2003. The report on Shaping the Future of Physics is among the greatest of tributes to Edmund Zingu as it continues almost a decade later to have a substantial impact on thinking about South African Physics landscape. The report challenged all of the stake-holder communities to plan on multiple levels. Projects like the SAIP Executive Office, National Institute for Theoretical Physics (NiTheP), South African National Research Network (SANReN), SA-CERN, and SKA-Africa have become a reality through his contributions to the South African Physics issues. The report also called for the possibility of other 'flagship' projects such as a South African synchrotron, to drive the large scale development of the field, and there has been significant encouraging progress here. At the more granular level there was a call for transformation so that the field would be open to all citizens of the country. Physics in South Africa has grown significantly since then, largely because of the implementation of many of the recommendations from the Review. Also during this time Dr. Zingu authored the very influential article, Promoting Physics and Development in Africa, which appeared in Physics Today.

The last project was the Review of Undergraduate Physics Education. Once again he contributed to the design of the Review and chaired the Management and Policy Committee. He led the development of the South Africa Draft Benchmark Statement for Physics Training, and guided the Review process, including the partnership with the Council for Higher Education. The Review of Physics Training is well advanced but still in progress.

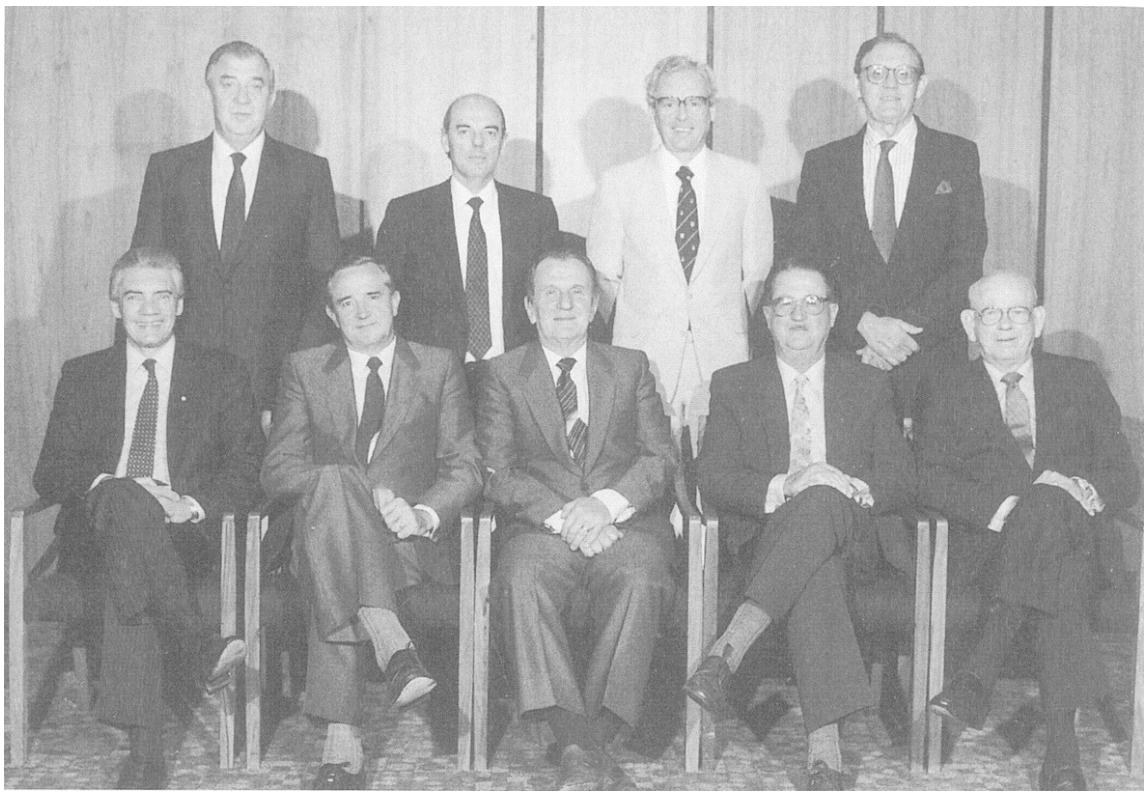
Edmund Charles Zingu had a musical gift which he inherited from his father. He played several music instruments, including a recorder and a piano. He bought himself a digital piano and worked hard at his music carrier that he is considered as an accomplished jazz pianist. He performed at concerts, parties and church from young age. Zingu passed on in hospital at age 67.

May his soul rest in peace.

Obituary: L. Alberts (1924-2013)

by Prof Simon Connell (University of Johannesburg)

Dr Louw Alberts has passed away on the 16 May 2013, at the age of 89.
Dr Alberts was a distinguished physicist who played an important role in South African Science and Physics. He spent some time at the University of the Free State (1946-67), then he went on to become the first Head of Department, Physics, at the Rand Afrikaans University, now the University of Johannesburg (1968-70). Following this he was Vice President of the Atomic Energy Board (1971-79) and then President of the National Institute for Metallurgy (1977-84). He also served as the Director-General of the Department of Mineral and Energy Affairs (1984-87). He was a member of the CSIR Board and served also as the Chair of this Board in 1998 before retiring in 1991. He had a particular interest in the development of young researchers, and he shaped Physics in South Africa directly and with vigour. He is also known as a dedicated Christian who was deeply involved in the development of the Church.



Dr Louw Alberts as Chairman of the CSIR board in 1988 (middle of front row). In the front row: Dr W. P. Venter, Dr C. Garbers (President of CSIR), Dr. L Alberts, Dr L.B. Knoll. Dr C. van der Pol. In the back row: Mr P. J. van Rooy, Mr E. van As, Prof D. R. Woods and an unidentified colleague.

Opinion & Discussion

Science Education: The Urgent Need for Critical Reflection

by Dr Peter Krumm; Dr Rudi Kimmie (UKZN's UNITE Programme, Durban)

We are in crisis; not only South Africa, but the whole world! We have an educational crisis (high failure and dropout rates), a social and moral crisis (crime, corruption, poverty and unemployment), and a technological crisis (depletion of mineral and energy resources; pollution of the environment). This situation should force us to reflect on the world; how we live in it, our actions, as well as our roles and responsibilities towards one another and the environment. It is the technological crises which require scientific and ethical solutions. Thus we are challenged to produce scientists and engineers who reflect critically and contemplate deeply on how we apply our scientific and technological knowledge in pursuit of social and economic development.

A widely accepted view is the correlation of a nation's higher education quality and its economic progress. Hence education, specifically higher education, plays a powerful role in emerging economies where life opportunities are intricately dependent on educational qualifications. In the South African context, science and technology are assumed central to improving quality of life and accelerating economic opportunities. However despite elevated exposure, not only do the failure rates at higher education institutions remain high, but social problems of conflict, hunger, unemployment, ecological destruction and disease are expanding at an alarming rate. These escalating problems reveal critical gaps in the teaching, learning and application of science, especially of physics. A critically informed teaching and learning approach provides the ideal opportunity to resolve the above crises. However, what is needed is a transformation in the consciousness of the learner. This transformation should enable learners to take complete ownership of the learning process through interrogative, critical and reflective thinking.

The Vital Need for a Critical Science Educational Praxis

Science knowledge must and can play a role in preparing students to become critical and responsive citizens. The 'body' of Physics stands firmly on two 'legs': application and contemplation, and both legs are essential.

Rote and passive learning as practiced at school and expected by many to be continued at University, might help students through the exam, but will not prepare them to manage their lives and careers, let alone contribute to finding solutions to our problems. There is a common belief amongst students that by being shown many numerical examples of how to solve Physics problems they will acquire subject understanding and learn how to pass the dreaded examination. Experience has shown this to be a misconception. This is supported in a remark, attributed to physicist, Erwin Schrödinger, "It is the object of Physics, and of Physics calculations, not so much to obtain a numerical answer but to gain insight."

Application is one of two vital pillars on which Physics rests. Although students have to learn how to apply their knowledge by solving problems, this has to be pursued within the epistemological framework of reflexive cognition. It is through doing that we learn, and this doing must imply thinking. Therefore the other vital pillar Physics rests on is contemplation.

Physics, like religion, is an attempt to understand or make sense of the world. This contemplation, the attempt of making sense of the world, the search for answers to questions of "how" and "why" and "could it be different", is at the forefront of physical enquiry and precedes any applicability. For instance, Einstein's special theory of relativity, which expressed his belief that all inertial frames moving or at rest (whatever that may mean), are physically equivalent, was sheer contemplation. However, this led him to the formulation of his most famous equation, $E = mc^2$, which opened the door to thorough investigations into the nature of the

nuclear force and of nuclear energy. Reckless application of the theory resulted in the development of nuclear bombs, dropped on Hiroshima and Nagasaki. All of this is a well-known but often forgotten reminder: when talking Physics we are talking Life AND Death. With the power, bestowed on us human beings by deciphering the writings of nature, comes responsibility, a recognition never too early to be passed on to our students.

Reframing Science Education

Students of physical science should fully understand their purpose for pursuing a higher education degree in the sciences. They are at University not only to acquire a passport to a career in science and technology by passing the required examinations, but also to be shaped for a meaningful, creative and productive life, which not only carries rewards but also responsibilities. This is not only for their well-being, but also for the benefit of their fellow human beings.

Integrating the 2 pillars of contemplation with application in the higher education formal curriculum requires a fundamental epistemological shift. Undoing some of the reactive practices of rote learning and learning for facts only, have stifled the naturally curious minds of young learners. Hence it is imperative that teaching and learning must be reorientated away from its current focus of passing exams, towards the shaping of consciousness that understands knowledge in relation to its relevance in the world. Contextual learning, analysis and critical reflection must underpin all teaching and learning praxes.

Although all of the above applies to all science students, our main concern rests with physics and engineering students. The crises alluded to at the beginning requires political, scientific and technological, hence, engineering solutions. Thus rather than producing highly qualified scientists and engineers who know how to follow every instruction, we have to produce original thinkers, who dare to question the system and challenge established assumptions; people with imagination capable of contributing to finding solutions to our problems.

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Articles

Supermassive Black Holes Observed with Telescope Bigger than the Earth

by Michael Bietenholz (Hartebeesthoek Radio Observatory & York University in Toronto, Canada)

The RadioAstron Telescope

Many astronomical objects, even though they are physically large, subtend only a tiny angle on the sky, and are not resolvable even with the largest telescopes, so astronomers are always hunting for higher resolution. The resolving power of a telescope is proportional to its diameter and inversely proportional to the wavelength of operation. Radio astronomers are hampered in this respect by the long wavelengths of radio waves – to obtain resolution equivalent to that of a 1-meter diameter optical telescope, we would have to build a telescope approximately 70 kilometres in diameter. To build a single dish of such diameter likely [is] beyond our capabilities and certainly beyond our means. Radio astronomers have therefore turned to interferometers, where one combines several telescopes to obtain a resolving power given by the distances between the individual elements rather than the diameter of each one.

Very Long Baseline Interferometry, or VLBI, is the process of combining radio telescopes at great distances from each other into such an interferometer, and thus obtaining very high resolutions. In principle, the same process could be used at shorter wavelengths such as optical ones for even higher resolutions, but it is much more technically challenging, so currently VLBI radio observations give the highest generally available resolution for astronomical observation. For VLBI, the telescopes are not physically connected, but rather the signal is recorded at each station and the recorded signals later played back and combined by cross-correlation. To correlate them usefully, the individual signals must be time-tagged to an accuracy comparable the inverse of the observing frequency, typically nano-seconds or even pico-seconds. This accuracy is achieved by the use of Hydrogen masers as clocks.

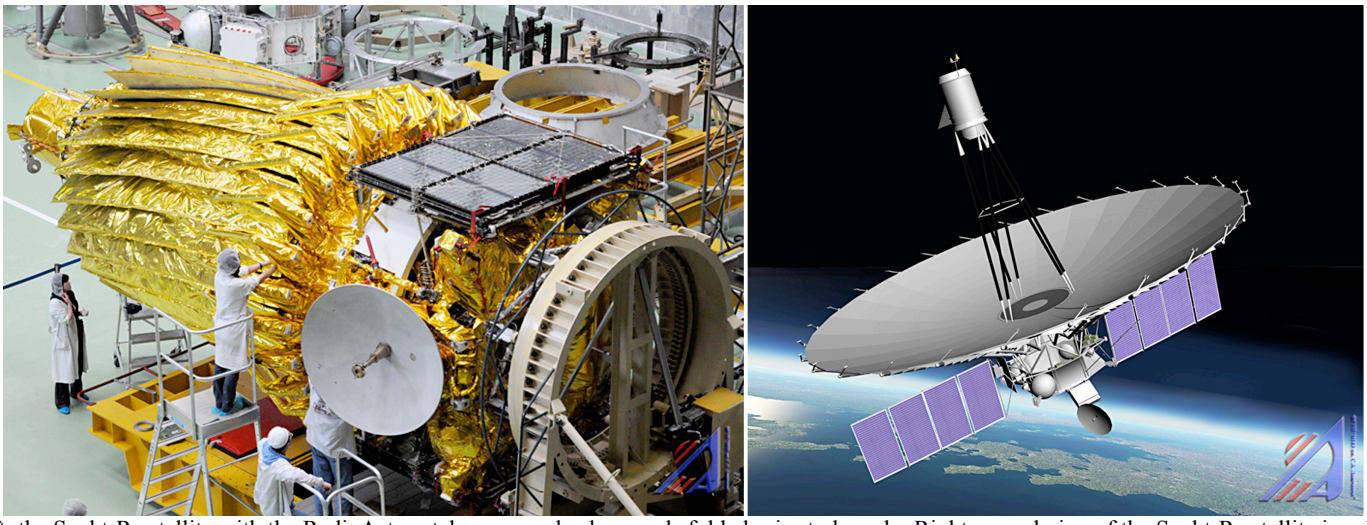
The available resolution can be increased merely by using telescopes that are farther apart, and radio astronomers rapidly advanced to the point of using telescopes many thousands of km apart. Telescopes an earth-diameter apart give resolutions on the order of 1 milli-second of arc for typical wavelengths of a few cm. The diameter of the earth, however, places an obvious limit the possible separation of ground-based telescopes, and thus on the attainable resolution. The obvious solution is to put a radio telescope on a satellite, which has been implemented as the RadioAstron project. RadioAstron is an international project led by the Astro Space Centre of Lebedev Physical Institute in Moscow, Russia. The RadioAstron project comprises a 10-meter diameter radio telescope, on board the Spekt-R satellite, which is in a very elliptical orbit around the Earth (see Kardashev et al. 2013). The satellite observes the astronomical target simultaneously with ground-based radio telescopes. The satellite time-tags the signal, using its on-board Hydrogen maser, and then streams it to the ground at a rate of 128 mega-bits per second, where it is recorded and subsequently correlated with the signals from the ground telescopes. In order to function, therefore, RadioAstron needs both radio telescopes on the ground (observing the same astronomical targets), and ground stations which receive the downlinked data from RadioAstron.

RadioAstron can observe in the 0.3, 1.6, 4.8 and 22 GHz bands. Its orbit is ~9 days in length, and at its apogee, it reaches distances around 300,000 km from the earth. At these distances and its highest operating frequency of 22 GHz, this will allow a resolution of ~10 micro seconds of arc, equivalent a human hair in Capetown as seen from Johannesburg. The satellite was launched from Russia in July 2011, and has now passed all its in-orbit tests and is returning excellent data. The key science program will start in June 2013. Thirteen proposals with over 200 authors around the world were submitted, and the two which received the highest rating involve a survey of Active Galactic Nuclei (AGN) and the study of pulsars, both at hitherto unavailable

resolutions. South Africa will provide both ground radio telescopes to work with RadioAstron – the Hartebeesthoek Radio Astronomy Observatory (HartRAO) 26-m dish, and MeerKAT in future – as well as a downlink station, which latter will be an 18-m diameter dish located near HartRAO. An agreement between the South African National Space Agency (SANSA) and the Russian Federal Space Agency (Roscosmos) was signed on 26 March 2013 in Durban.

Supermassive Black Holes Observed with RadioAstron

AGN are thought to be powered by supermassive black holes with masses of $>10^6$ times that of the Sun. One of the key science questions that RadioAstron will address concerns the "brightness temperature" of AGN. The brightness temperature is the temperature an object would need to emit thermal radio emission with a surface brightness equal to that observed at the frequency of observation. Radio astronomers use this term even in cases such as AGN, where the radio emission is not thermal. The brightness temperature does not, therefore, correspond to any physical temperature in the AGN, but it is nonetheless a useful diagnostic of the source physics.



Left: the Spekt-R satellite with the RadioAstron telescope and solar panels folded prior to launch. Right: a rendering of the Spekt-R satellite in orbit. Images Lavochkin Association

In the case of AGN the radio emission is thought to be synchrotron emission from a population of relativistic electrons. It can be shown that inverse Compton scattering within the source, the so-called "Inverse Compton Catastrophe" limits the intrinsic brightness temperatures in this scenario to about 10^{11} K. Although Doppler boosting is likely to increase the apparent brightness temperatures above this value, the observed bulk-motions suggest that Doppler factors of greater than 100 are rare. Therefore, brightness temperatures in excess of 10^{13} K are not expected. From the ground, it has not been possible to measure brightness temperatures above this limit. Since brightness temperature is essentially a measure of surface brightness, the unmatched resolution obtainable with RadioAstron, allows us to probe unprecedentedly high values of brightness temperature up to ~10^{16} K. If many AGN can be shown to have brightness temperatures higher than 10^{14} K, a serious modification of the current paradigm of AGN emission would be required, for example the introduction of synchrotron emitting protons or coherent emission mechanisms (see, e.g., Kellermann 2002, and references therein).

Another area where the unique resolution of RadioAstron finds application is in resolving structures around the supermassive black holes powering AGN (and occurring even in galaxies like our own). Despite having masses of $>10^6$ times that of the sun, the large distances to even nearby galaxies means that the Schwarzschild radii of such black holes subtend very small angles on the sky, with one of the largest being the relatively nearby supergiant elliptical galaxy M87, which is ~16×10^6 parsecs (~54×10^6 lightyears) away. Its central black hole has an exceptionally large mass of ~> 3 $\times10^9$ Solar masses, and a Schwarzschild radius a little

smaller than the orbit of Pluto, so on Earth, the diameter subtends an angle of about ~>4 micro-arcseconds. Although observations with RadioAstron will not attain this resolution, the distortion of space around a black hole surrounded by infalling, radiating material will appear as a bright ring (called the photon ring) surrounding a dark center, with the photon ring having a diameter of approximately 5× the Schwarzschild diameter. The existence of the photon ring and the black-hole shadow depend on the existence of the event-horizon, and thus their detection would constitute fairly direct proof of the latter's existence. The highest resolutions obtainable by RadioAstron are just sufficient to marginally resolve the photon ring in M87. In fact, RadioAstron, working together with the Jansky Very Large Array, Greenbank, Arecibo and other telescopes, successfully observed M87 at its highest working frequency of 22 GHz in Feb. this year, with a resolution comparable to the photon ring's diameter. The RadioAstron AGN working group is currently reducing the data.

The RadioAstron team eagerly awaits the commissioning of the South African tracking station as well as the results from M87 and the many other areas where the unprecedented resolution possible with RadioAstron will contribute.

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High-dimensional Entanglement

by Melanie McLaren, Stef Roux, Andrew Forbes (NLC at CSIR, Pretoria)

The first quantum entanglement experiments in South Africa were performed in the Mathematical Optics laboratories of the CSIR National Laser Centre in 2011. We have now gone on to demonstrate high-dimensional entanglement, a useful tool in quantum studies.

What is Entanglement?

One of the most astonishing areas of quantum mechanics is entanglement, where particles separated in space can have correlated physical properties. That is, for an entangled pair of particles the measurement of an observable for one particle immediately determines the corresponding value for the other particle, regardless of the distance between the two particles. This "spooky interaction" has become the heart of many quantum-related fields such as quantum teleportation, quantum cryptography and quantum information processing.

Generating Entangled Photons

Entangled pairs of photons are commonly generated via spontaneous parametric down-conversion (SPDC) by pumping a non-linear crystal. Both energy and momentum are conserved during this process. The angular momentum of photons is also conserved; in particular, the orbital angular momentum (OAM) of the pump photons equals the sum of that of the two entangled photons [1]. These spatial modes span an infinite dimensional Hilbert space and have therefore become a popular avenue for high-dimensional entanglement or *qudit* entanglement.

Quantifying the Entangled State

The generated two-photon quantum state can be analysed by performing a state tomography on the system. This requires a series of measurements (the details of which can be found in ref. [2]) to be performed on each photon, such that the density matrix used to describe the statistical state of a quantum system can be calculated. We chose to calculate the fidelity, which is a measure of how close our reconstructed state is to the target state: a pure, maximally entangled state in this case with a fidelity of 1. OAM is often associated with the Laguerre-Gaussian (LG) modes, however Bessel-Gaussian (BG) modes are also known to carry OAM. We therefore measured the fidelity of high-dimensional entangled states in both the LG and BG bases [3]. Figure 1 shows our results compared with threshold states, which lie on the threshold of the high-dimensional Bell inequality. Any value above the threshold state indicates a valid entangled quantum state. Our results demonstrate successful high-dimensional entanglement in both the LG and BG bases; however, the BG states are clearly entangled at higher dimensions than the LG states. Thus the BG modes allow higher information capacity per photon pair, which is crucial for most quantum information processes.

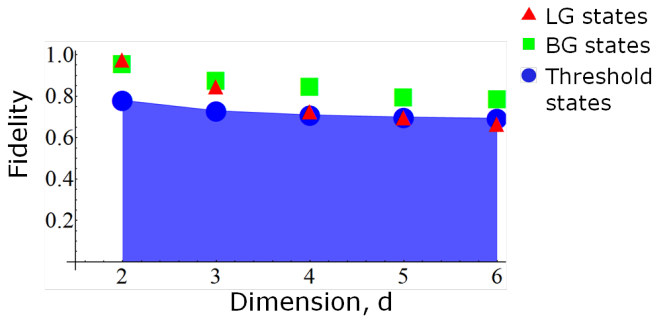

Figure 1: Fidelity as a function of dimension. The red triangles represent the experimental measurements using the LG basis, the green squares represent the experimental measurements using the BG basis and the blue dots represent the threshold states.

For more information, please visit our tutorial paper [4] on the generation, measurement and characterisation of high-dimensional entanglement.

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SANSA Activities

By Catherine Webster SANSA

Launching Balloons in Antarctica

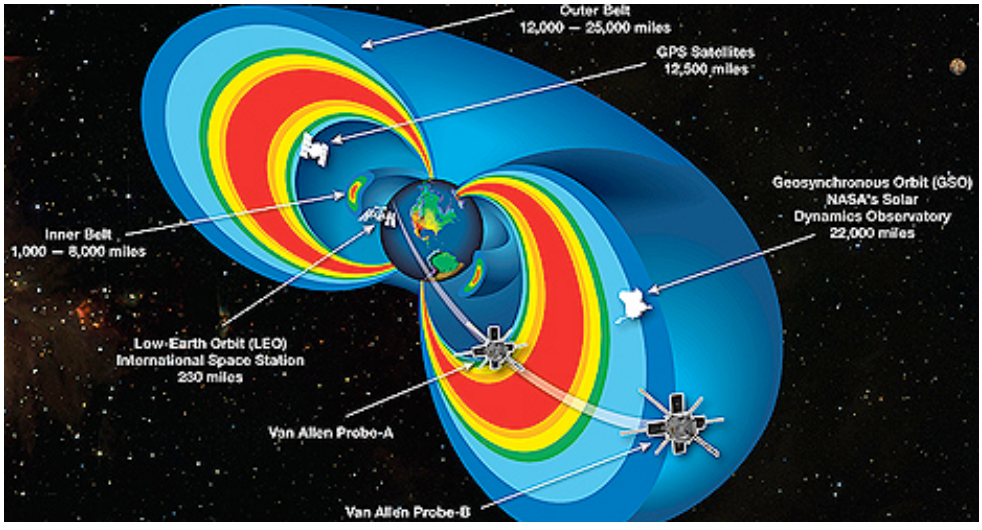
The South African National Space Agency (SANSA) is a key player in the South African National Antarctic Programme and has several on-going space science and space weather related projects in Antarctica, as well as Marion Island and Gough Island.

SANSA is particularly interested in Antarctica research because it is an ideal location for scientists to study space weather. The inward-curving magnetic field lines at the pole provide the perfect opportunity to do space particle research. This opens up a unique window into geo-space, which allows SANSA to study the Earth's magnetosphere, ionosphere and other related space weather phenomena.

South African Antarctic base SANAE IV

During summer take-over at the South African Antarctic base SANAE IV, the SANSA team assisted in a NASA funded project as part of the first science campaign of the Balloon Array for Radiation belt Relativistic Electron Losses (BARREL) project.

BARREL; works in conjunction with NASA's Van Allen Probes, two satellites currently orbiting Earth collecting data in the heart of the Van Allen Radiation Belts. The Van Allen belts are affected by space weather phenomena such as solar storms, the solar wind and coronal mass ejections.



This NASA image [on the right] shows the Van Allen Radiation Belts and the Van Allen twin probes.

The project aims to track where radiation goes when it escapes the belts, as the charged particles within the belts can damage space-based technologies such as communications and GPS satellites. Data collected from BARREL payloads complement the Van Allen satellite data, and help to fill in the space weather picture.

The NASA/SANSA team successfully launched 13 helium-filled balloons from the South Africa Antarctic base, measuring 40 meters in height, each carrying an identical payload to an approximate altitude of 38 km. Sevenadditional balloons were also launched from the British base, Halley Bay.

On the left: The team launching the first BARREL payload from the South African Antarctic base

The main objective is detecting X-rays produced by precipitating relativistic electrons as they collide with neutral particles in the Earth's atmosphere. This is best achieved over a period of 10 days in the thinner layers of our atmosphere which is why the payloads are sent up with balloons.

A second science campaign, consisting of an additional 20 payloads, is scheduled to take place during the 2013-2014 austral summer. Projects such as these are vital in understanding space weather conditions that affect satellites orbiting the Earth within the Van Allen Radiation Belts.

Precision Farming trial findings: Satellite Based Augmentation System yields positive results

SANSA's Navigation unit completed three Satellite Based Augmentation System (SBAS) trials during February and March, 2013. Together with the trials, a Lead User Group meeting was held to confirm user requirements and illustrate the importance of this development to Treasury.

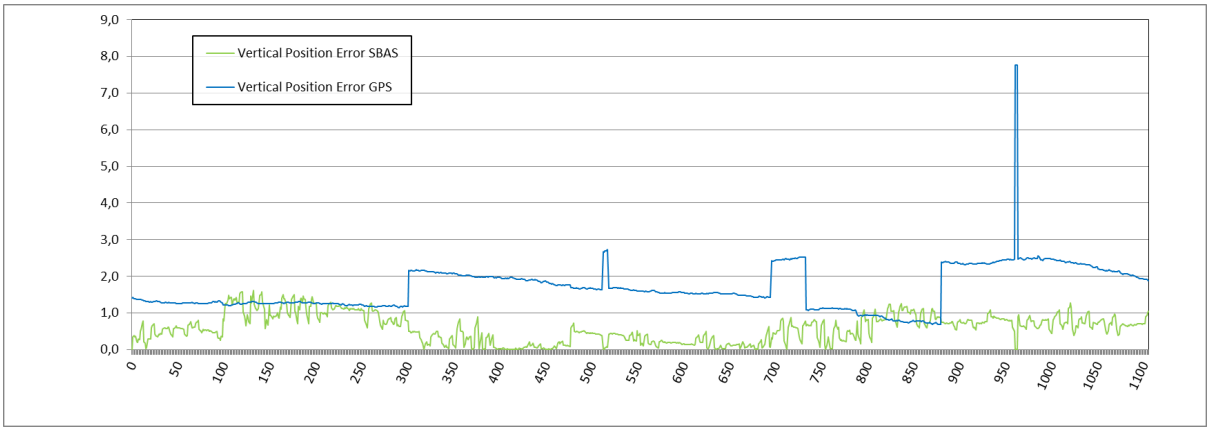
The first trial was held in Heidelberg and was based on Precision Farming, the second took place in Gauteng together with *Tracker*; and the final trial took place at the Kruger National Park. The trials aim to illustrate the necessity of an improved navigation system, by comparing the results of a normal GPS to that of the SBAS.

For the Precision Farming trial, a tractor equipped with both the standard GPS as well as the SBAS was driven along specified lines on the farm. To test their accuracy, breaks were taken in between and the 'same' positions resumed – simulating a typical farming pattern. Results from the trial prove that the SBAS unit is indeed more accurate than the current GPS being used; and that the system could potentially eliminate several challenges faced by farmers.

"Mainly wheat farmers make use of GPS alone for auto guidance of the tractors and Variable Rate Application (VRA) of lime, pesticides and fertilizer," explains Eugene Avenant, SANSA Space Operations Chief Engineer and project representative. "The VRA controllers can control up to 16 nozzles on the beam and so for these applications, pass-to-pass accuracy is very important." In addition, farmers have a major problem with poor GPS repeatability – with the same passes of the tractor in the field giving different routes on the farm map. "It is hoped that SBAS will make a difference to yield monitoring and mapping and possibly result in vertical information being beneficial, as a number of farmers' base maps are already in 3D," he adds.

In South Africa, the main objectives of the dissemination activities of the SBAS Awareness and Training in South Africa Project (SATSA) are twofold. The first is to inform political stakeholders in government departments of the progress made related to SBAS training and trials in South Africa; and the second is to raise awareness of EGNOS for South Africa (EGSA) among potential user communities in the country.

The following illustrates results obtained from the Precision Farming trials:



Comparison of the Vertical Error in GPS and SBAS modes

A tractor equipped with both the standard GPS and the SBAS antennas, as well a radio antenna; used to conduct the Precision Farming trials

Demagnetising Ships for the Navy

A steel-hulled ship is like a huge floating magnet with a large magnetic field surrounding it. The process of building a ship, within the Earth's magnetic field, develops a certain amount of permanent magnetism in the ship. When the ship moves, this field also moves and adds to or subtracts from the Earth's magnetic field. Essentially the moving ship builds up a magnetic signature which can trigger magnetic sensitive devices such as [explosive] mines that are designed to detect these magnetic signatures.

Larger ships have DC coils systems built into the ship in various locations, which create a field equal and opposite to the ships permanent magnetic field, known as degaussing. However, using degaussing coils in a surface ship can only compensate the ship's own magnetic field to a certain level and thereafter the vessel has to undergo a *deperming* procedure in a dedicated deperming facility.

The model ship is placed in the degaussing coil system designed to reduce the magnetic signature of the ship.

The ship is tested using a magnetic sensor to determine if it has been sufficiently degaussed.

During the deperming procedure large coils are wrapped around a ship and DC currents are used to cancel the remaining permanent magnetism of the ship. The process is repeated a number of times slowly whittling down the permanent magnetic field of the ship, making it "magnetically invisible". The ship is then able to pass over mines and other magnetic sensitive devices without triggering them.

Emile Lochner, a physics and engineering student currently working on his Master's degree at SANSA Space Science, has developed a small scale model of the Flash D deperming procedure. The model demonstrates how the procedure can be used on a larger scale for applications such as degaussing or deperming ships for the Navy.

Emile obtained a BSc in physics from Rhodes University, after which he made the leap to engineering completing his bachelor's degree in electrical engineering at the University of Stellenbosch.

SANSA provides opportunities for students to work with highly sensitive and specialised equipment in an engaging and friendly environment. Working with SANSA has allowed Emile to build good rapport with fellow scientists and engineers in the field of Space Science and has boosted his confidence in the work place. He describes his future goals as wanting to combine physics and engineering with the hope of developing new scientific instrumentation. Emile's advice to aspiring engineers is not to be afraid of approaching people or of failure as this is how you learn.

SANSA to support radio astronomy infrastructure in Africa

Following the signing of the RadioAstron space satellite agreement between the South African National Space Agency (SANSA) and the Russian Federal Space Agency (Roscosmos) at the 5th BRICS Summit held in Durban this year, SANSA will be responsible for the installation, operations and maintenance of the receiving antennae [cp article on p.12].

The RadioAstron satellite was launched on 18 July 2011 and carries a radio telescope that will obtain images and coordinates of various radio-emitting objects. As a single, virtual telescope, it will be the world's largest radio telescope, with a "dish" measuring approximately 390 000 km. The mission has an expected lifetime of five years and will support and improve investment in radio astronomy infrastructure in Africa and complement radio astronomy facilities such as the Square Kilometre Array (SKA), enhancing the continent's reputation as a premier destination for radio astronomy.

"SANSA's Space Operations ground station will undergo an equipment upgrade to accommodate the operational requirements to support the Russian RadioAstron orbiting space telescope," says Eugene Avenant, Chief Engineer at SANSA Space Operations. Aligning with the National Development Plan, one of SANSA's strategic goals is the positioning of South Africa as a recognised global citizen, to offer world-class and efficient services and societal benefits. "By participation in this international collaboration, SANSA will be in a position to contribute to job creation whilst fostering international relationships," Avenant adds.

The RadioAstron project is an international collaboration led by the Astro Space Centre of the Lebedev Physical Institute (Russian Academy of Sciences) in Moscow. Other partners include the European Space Agency, the National Radio Astronomy Observatory (USA), the Tata Institute for Fundamental Research (India), and the Commonwealth Scientific and Industrial Research Organisation (Australia).

SANSA's role will include acting as a central point between Telkom – whom has made an 18-m C-Band antenna available for the RadioAston tracking and acquisition in South Africa, the Roscosmos system and the Hartebeesthoek Radio Astronomy Observatory (HartRAO). Raoul Hodges, Managing Director of SANSA Space Operations explains this in more detail. "The control of the ground based equipment and data relayed from the spacecraft via TCP/IP connections will be aggregated in a router/switch at the Telkom Earth station and relayed to SANSA Space Operations via Fibre Optic connection. SANSA Space Operations will allocate a dedicated area with the required computer interfaces and apparatus to relay data to-and-from Roscosmos using terrestrial communication infrastructure." The idea is to complement the capability of ground-based Very Long Baseline Interferometry (VLBI) instruments with a space-based VLBI instrument.

President Jacob Zuma with Russian President Vladimir Putin at the 5th BRICS Summit in Durban, South Africa. Photo courtesy of allafrica.com via Govt of South Africa/ Flickr

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Chief Scientific Officer: Electron Microscope Unit

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The overall purpose of the Chief Scientific Officer in the Electron Microscope Unit (EMU) is to assist the Director in developing, maintaining, marketing and managing the physical sciences component of a world-class, EMU at UCT. The post-holder will instruct and assist electron microscope users and will develop new methods and instrumentation appropriate to physical science, as well as perform independent scientific research, in collaboration with physical scientists, engineers and students at UCT and other relevant institutions.

The EMU provides a service to all faculties at UCT, as well as external users. Currently located in the R.W. James building, the Unit will move to new, purpose-built premises from mid-2014. The Unit offers services on a number of electron beam platforms viz., *a FEI Tecnai F20, a FEI Tecnai 20 with Tridiem energy filter, a FEI Nova Nano SEM, a Zeiss 912 and a Leica S440* and has recently been granted funding for a field emission QEMSCAN. In addition, the EMU has a suite of associated equipment for sample preparation.

Minimum Requirements:

- A PhD degree in Engineering, Physics, Materials Science or equivalent discipline
- At least 3 years' relevant experience in using electron microscopes
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- Experience in configuring electron microscopes and associated software
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An application which does not comply with the above requirements will be regarded as incomplete. Only shortlisted candidates will be contacted.

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SAIP2013 website: http://indico.saip.org.za/conferenceDisplay.py?confId=32

International Conference on Optics and Lasers Applications ICOLA2013

Optics and laser technology is a fast growing technology, which has wide range of applications in all the branches of science and engineering. Optics and laser applications are used in medicine, agriculture, energy and mines, defense, computers, industries, and entertainments. Recently the University of Namibia started the Faculty of Engineering and Information Technology at the northern campus in Ongwediva with the blessings of the Government of Namibia. The faculty is equipped with latest available equipment and technology in the world. The faculty has several departments and all the departments have highly specialized experts hired from all over the world. We wish to share the excellent existing facilities and expertise of UNAM with rest of the world to further advance the knowledge in the relevant fields of lasers. Therefore, we will organize an international conference on optics and laser applications (ICOLA2013) in 2013 from July 9 to 12, 2013, during the best climatic conditions of Namibia in Windhoek.

For more information and how to register click here http://www.unam.na/icola2012/index.html

9th International Workshop on Adaptive Optics for Industry and Medicine 2 – 6 Sept 2013

ABSTRACT SUMISSION & REGISTRATION NOW OPEN

To register or submit an abstract visit www.saip.org.za/aoim2013/

The aim of the workshop is to discuss the use of novel adaptive optical elements, concepts and systems as they apply to high power lasers, medical devices, imaging, industrial lasers and microscopy. The International Workshop on Adaptive Optics for Industry and Medicine (AOIM) provides scientists and engineers from both industry and academia with opportunities to explore recent developments, current practices and future trends in adaptive optics and related fields. A key feature of this single-session meeting is the relaxed atmosphere with all participants encouraged to present and discuss their work either as a talk or a poster.

Topics will include:

- Adaptive optical (AO) devices,
- Wavefront sensing and measurement,
- Aberration correction,
- AO in imaging systems,
- Digital holograpy in AOs,
- Spatial light modulators,
- Applications of AOs.

Easy Java Simulations (EJS) Workshop – Cape Town 2-4 September 2013

We are delighted to announce that Prof Wolfgang Christian (Brown Professor of Physics at Davidson College), a leading figure in computational physics and instructional software design, will be running a workshop on Easy Java Simulations (EJS) at the University of Cape Town from 2-4 September 2013.

This hands-on workshop will train participants to usethe EJS package to develop JAVA simulations for use in teaching and research. Participants already familiar with EJSwill benefit from several break-out sessions on advanced topics and other Open Source Physics (OSP) resources.

Please contact Spencer Wheaton (spencer.wheaton@uct.ac.za) if you are interested in attending this workshop. Partial financial support for this workshop has been provided by NITheP.

6th International Conference Hard Probes 2013 on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions

By W A Horowitz and Heribert Weigert for the LOC

It is with great pleasure that we announce that the "6th International Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions (Hard Probes 2013)" will take place from Nov 4 to Nov 8, 2013 at the Stellenbosch Institute for Advanced Studies in Stellenbosch, South Africa, a delightful 30 minute drive into the wine country surrounding Cape Town.

We anticipate topics for the conference will include Jet quenching and observables; High transverse momentum light and heavy flavor hadrons; Initial state and proton-nucleus collision phenomena; Heavy flavor production and quarkonia; and Hard and thermal electroweak probes. A student summer school will be held prior to the conference.

We plan to construct a website, set registration dates, etc. soon. In the meantime, please mark your calendars, forward this notice to any potentially interested parties, and if you have any questions feel free to send them to this address, hp2013@tlabs.ac.za

School on Bayesian Analysis in Physics and Astronomy

HC Eggers, for the organising committee

Bayesian Analysis has grown strongly in the last decade as massive increases in data collection and computational power have opened up many opportunities and applications. Applications on which Bayesian Analysis can now be brought to bear include dealing with uncertainty in measurement, determining probabilities for questions not based on counting or relative frequencies, proper handling of small datasets, quantitative comparison between different models or hypotheses, and proper handling of nongaussian distributions.

The School on Bayesian Analysis in Physics and Astronomy will be taking place at the University of Stellenbosch and the National Institute for Theoretical Physics from 23 to 26 November 2013. The School is aimed at both established researchers in physics and astronomy who regularly work with datasets and at postgraduate students. No previous knowledge of Bayesian inference as such is required. Participants should have some basic background in statistics as used in data analysis.

While the invited speakers have backgrounds in high energy physics and astrophysics, participants from all fields are welcome.

Introductory theoretical lectures will be complemented by hands-on data processing sessions; participants are encouraged to bring their own laptops and datasets. A limited number of talks on Bayesian-related topics can be accommodated. Posters on data analysis in general are encouraged.

The 2013 SKA Bursary Conference will be held from 25 to 29 November also in Stellenbosch; simultaneous registration for both the School and the Bursary Conference should be possible.

This is a first announcement. For details and updates, see
http://indico.tlabs.ac.za/conferenceDisplay.py?confId=42

The Abdus Salam International Centre for Theoretical Physics
www.ictp.it

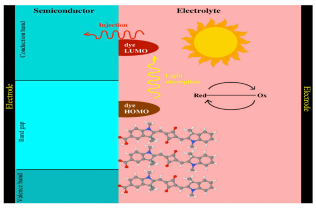
IAEA

Regional Workshop on Materials Science for Solar Energy Conversion (4 - 8 November 2013)

Hosted in:
iThemba Labs. - National Research Foundation (SA), Cape Town, South Africa

This Workshop will address the fundamental principles, basic processes and technological challenges of solar energy conversion, in particular in nano-structured materials. It will be organized in close coordination with ANSOLE (African Network for Solar Energy) and NANOAFNET (Network for Nanoscience and Nanotechnology in Africa). These two networks co-involve many of the active researchers in Africa in this field.

The topics will include: Solar energy conversion - solar cells; Solar fuels; Solar energy concentrators; Solar thermal energy; Solar based hydrogen production; Computational modeling of materials for solar energy; Algae based solar systems and biomimetics; Educational concepts in renewable energy; Green nanotechnology.



The world is currently facing an unprecedented energy crisis. It is very likely that the foreseeable shortages and increased cost of fossil fuels will be particularly strongly felt in developing countries which often have to compete on the worldwide energy market with financially much more potent industrialized countries. As an alternative, many developing countries can strengthen the use of renewable energy sources, which are (especially in Africa) often very abundant.

Solar energy, the subject of this proposed Workshop, stands out amongst renewable energy sources by its enormous potential. A widespread use of solar energy is however still hindered by relatively high capital costs of current photovoltaic technologies and by the intermittency of sunshine. This Workshop will address key scientific challenges in the field of materials science which are relevant to the development of cheaper and more versatile solar energy technologies.

PARTICIPATION:
Scientists and students from all countries that are members of the United Nations, UNESCO or IAEA may attend. Priority will be given to advanced undergraduates, graduate students, post-doctoral researchers, faculty and research scientists from South Africa. As the event will be conducted in English, participants should have an adequate working knowledge of this language. Although, the main purpose of the Centre is to help research workers from developing countries, through a programme of training activities within a framework of international cooperation, a limited number of students and post-doctoral scientists from developed countries are also welcome to attend. As a rule, travel and subsistence expenses of the participants should be borne by their home institution. Every effort should be made by candidates to secure support for their fare. However, very limited funds are available for partial support of some participants, who are nationals of, and working in, a developing country, and who are not more than 45 years old. Such support is available only for those who attend the entire Workshop. There is no registration fee for attending this activity.

HOW TO APPLY FOR PARTICIPATION
Applicants **from South Africa, or working in South Africa**, should apply via the website
http://indico.tlabs.ac.za/confRegistrationFormDisplay.py/display?confId=41
Queries from South African applicants can be addressed to
Ms. Naomi Haasbroek using the e-mail address
ICTPworkshop2013@tlabs.ac.za

Applicants **from all other countries** should apply using the ICTP online system available at the website
http://agenda.ictp.it/smr.php?2515
Once in the website, comprehensive instructions will guide you step-by-step on how to fill out and submit the Application Form.

Deadline for Application: 1 AUGUST 2013

Telephone: +39-040-2240346
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Fax: +39-040-224163
ICTP Home page: http://www.ictp.it/
Trieste, May 2013

in collaboration with:
ANSOLE and NANOAFNET

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(2iE, Burkina Faso)

Serge BERTHIER
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Gilles FLAMANT
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(University of Addis Ababa, Ethiopia)

LOCAL ORGANIZATION IN CAPE TOWN:

Ms. Naomi HAASBROEK
(iThemba Labs.)

Physics Comment Editorial Policy

Deadline for submissions for the Sept 2013 issue of Physics Comment is 31. August 2013

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 review journal.
Physics Comment publishes innovative reports, features, news, reviews, and other material, which explore and promote the many facets of physics. Physics Comment endeavours 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, which endeavours to inform readers and to encourage writers in their own researches. 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, which are being published, may contain personal opinions of the authors.
It is our 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:
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).
The author allows PC to edit the work for clarity, presentation, including making appropriate hypermedia links within the work.
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 reflects 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 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 illustration 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. Acknowledgement must be made within the article.
News: These are short editorial items usually not more than 250 words. Full colour pictures must be clearly referenced on the editorial submission and on 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 by 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 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, which 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/