Physics Comment

A Southern African Physics Magazine

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Delegates at the 54th Annual South African Institute of Physics Conference held at the Westville Campus of the University of KwaZulu-Natal from 6 to 10 July 2009. Courtesy Francesco Petruccione and Claire Lee.

Editorial

What's in a name?

Jaynie Padayachee

Physics, like most of science, has many terms, units and concepts which are named after people. This has been done to pay homage to the work of the person concerned. Would the original scientists recognise their names as pronounced today? From what Physicists around me are saying, I think not! I feel that it a great sign of disrespect to incorrectly pronounce a name. Maybe this stems from having a mouthful and a half for both my first name and surname and I always ask if I am unsure how a name is pronounced. However, this would be difficult for

Physicists dead for more than a hundred years.

My quest for finding out the correct pronunciation of scientists names starts with a mathematician, whom I believe must have the most incorrectly pronounced name in science: Leonhard **Euler**. I have found myself cringing when I hear "yewler", which is not a good sign. Euler as most (some?) of us know is pronounced "oiler".

My lecturers always pronounced Louis **De Broglie** with the hard "g" and it came out as "de brog-lee", but the French pronunciation is apparently closer to "de Broy".

Albert **Einstein**'s name would in his native German be closer to "einschtein", while that of Swedish Physicist Anders Jonas **Ångstrom** would be close to "ore-ngstrom". One which I still cannot get is Léon **Brillouin** which is apparently pronounced as "briloo-ahn". I always thought that this was "bri-ween". But that's the French for you…

I hope you enjoy this bumper issue. Thank you to all contributors.

On a personal note, congratulations to Brian Masara (SAIP Executive Officer) and his wife Vena on the birth of their son Bradley, born on 4 August 2009 at the Sunnyside MediClinic in Pretoria.

A letter from the President

Peter Martinez

Dear Friends and colleagues,

It is my great pleasure and privilege to address readers of *Physics Comment* as the newly elected President of the South African Institute of Physics. I consider this to be a very special time for physics in South Africa, filled with promise as well as challenges. Let me then briefly describe some of these challenges and opportunities, as I see them.

One of the key challenges that I have identified for my term in office is to secure the future of the SAIP Executive Office. The Office is an outcome of the 2005 report *on Shaping the Future of Physics in South Africa*. With this Office in place, the Institute now has the capacity to take on numerous projects and to accomplish far more to advance physics in South Africa than was ever possible in the prior history of the SAIP. So, this challenge is also coupled to a fantastic opportunity for the SAIP to play a more active and prominent role in shaping the future of South African science. The staff of the Office, Mr Brian Masara and Ms Linette White, are doing sterling work, and I look forward to working closely with them in the coming triennium.

Another key challenge lies in the area of physics education at the tertiary level. There are worrying indications that an increasing number of students entering first year physics are ill-equipped to deal with the physics curriculum as offered in our universities. In 2008 the idea of a comprehensive study of this issue was suggested and in 2009 this has taken a further step with the suggestion that such a study should have the same prominence and support as the "Shaping the Future of Physics in SA" exercise conducted by the SAIP in 2005. I am hoping that we can make a significant start to this important activity in the remaining months of this year. Members of the SAIP will be able to follow this process in future issues of *Physics Comment*.

A third, ongoing challenge is to streamline the organisation of the SAIP Annual Conference and to improve the conference experience for the all participants and exhibitors. The Annual SAIP Conference continues to be the key event in the SAIP calendar. We recognise that organising the conference is an onerous burden for the hosting entity and that a number of wheels are reinvented each year. We also acknowledge that in certain areas, the experience of delegates has fallen short of expectation, and Council is taking steps to address these areas of concern. Starting in 2010, the Executive Office will be more involved in the planning of future SAIP conferences, allowing us to build on the experience of past conferences and to provide an improved and more consistent experience to delegates attending the SAIP conference in future. The first step is the development of a common IT platform for conference registration and abstract submission. Software tools for these aspects of the conference organisation are currently under development and will be tested at a meeting of the Heads of African Physics Societies in November this year. If this pilot is successful, the software will be implemented for the 2010 SAIP Annual Conference. We hope that through implementing these and other measures, we will lighten the burden on the host institution and improve the conference experience for all participants.

Turning now to some of the opportunities, the development of the new SAIP Constitution comes to mind. This is part of a long-term programme of renewal that every organisation should go through once every few decades to reorient itself in response the changing local and international environment. This process has been managed under the capable leadership of Nithaya Chetty, my predecessor as President of the SAIP. I am delighted that Prof. Chetty has agreed to

continue serving on Council to drive this process to its conclusion. During coming months, SAIP members will have the opportunity to view and comment on drafts of the proposed new Constitution and the proposed new structures of the Institute.

Another area that is rich in opportunity is the growing number of student members of the SAIP. Our student members present an important constituency, which we would like to see more involved in all aspects of the Institute. I will endeavour to create opportunities for students to take a lead in certain activities in the SAIP – for example, organising a scientific event in the programme of the Annual Conference.

We have a fine Council of dedicated individuals who give generously of their time and expertise to serve you, the SAIP membership. In this issue of *Physics Comment*, you will find the profiles of the newly elected Council members. The Council comprises a good balance between experienced Councillors and new blood. I wish them all the very best in the execution of their duties as SAIP Councillors and look forward to working with them to build on the successes of the previous Council. My predecessor, Prof Nithaya Chetty, started a number of initiatives that will bear fruit in the coming years. I would like to take this opportunity to acknowledge his tireless efforts to advance physics in South Africa and the SAIP in particular. I wish him all the best as he scales down his SAIP activities to take up a more active role in research than time allowed during his tenure as President of the SAIP.

The Mission of the SAIP is to be the "Voice of Physics on South Africa." That means, to be *your* voice. My fellow Councillors and I are here to serve you, to make sure that your voice is heard. We look forward to hearing from you.

Yours in the advancement of physics,

Peter Martinez

New South African Institute of Physics Council

Jaynie Padayachee

The South African Institute of Physics (SAIP) Council for the term 2009 to 2011 took office at the 2009 SAIP Conference in July. We at *Physics Comment* thought it would be a good idea to meet the new Councillors and see what plans they had for Physics in South Africa over the next two years. The Council is made up of:

Dr. Peter Martinez* (President)

Prof. Simon Connell* (President-Elect)

Dr. Jackie Nel* (Secretary)

Prof. Japie Engelbrecht* (Treasurer)

Prof. Nithaya Chetty* (Constitutional, Recent-past-president)

Prof. Frederick Scholtz (Awards)

Dr. Erasmus Rammutla (Conferences)

Dr. Andrew Forbes (Specialist Group Liaison)

Dr. Igle Gledhill (Industrial Liaison)

Mr. Gurthwin Bosman (Student Liaison)

The Executive is:

Dr. Peter Martinez, Prof. Simon Connell, Dr. Jackie Nel, Prof. Japie Engelbrecht and Prof. Nithaya Chetty

President: Dr. Peter Martinez

The new SAIP President, Dr. Peter Martinez is jointly affiliated with the National Research Foundation and the South African Astronomical Observatory (SAAO). Peter completed a PhD in Astrophysics and took up a position as Research Astronomer at the SAAO. His research fields are space science and technology. Peter relaxes by spending time with his family. (peter@saao.ac.za)

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A To sustain the Executive Office, to better serve our members, to raise the profile of physics in SA and to ensure that we navigate the challenges in the secondary and tertiary education systems to train the next generation of physicists in SA.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A The contribution of physics to society in general needs to be better understood. This will require overcoming the impression held by many of physics as an academic discipline. We also need to address all the "pipeline" issues in the training of physicists to ensure that South Africa has an adequate number of properly trained, internationally competitive physicists to meet its various development in future.

Q What successes would you like to see for the SAIP and Physics in South Africa over the next 2, 5, 10 years?

A Meeting the challenges described above.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A (i) Long-term stability of the Executive Office. (ii) Progress in addressing issues around the physics undergraduate curriculum, especially in the transition between school and university level.

(iii) Raising the profile of physics generally in SA through opportunities to demonstrate the value of physics in meeting challenges in areas such as energy, climate change and the emerging space programme.

Q What strengths do you bring to this Council?

A Experience in research, management of science programmes, capacity building and policy development.

President-Elect: Prof. Simon H Connell

The new SAIP President-Elect, Prof. Simon Connell is currently based at the University of Johannesburg. Simon studied at the University of the Witwatersrand and has held various positions ranging from a high school teacher science and mathematics teacher to the Director of the Accelerator Laboratory of the Schonland Research Institute for Nuclear Sciences. His research interests are as varied as his career and include High Energy Physics, Nuclear Physics, Quantum Physics, Applied Physics, Diamond Physics and Accelerator Physics. Simon relaxes by spending time with his family, dancing, computing and working on project cars.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A Continue to develop the role of the SAIP as the "Voice of Physics", to raise the profile of the Institute amongst the membership by developing the perceived and actual benefits to the membership, grow the membership, to raise the profile of the Institute with policy makers by developing its perceived and actual role as an important partner in building the Physics component of the SA science system, to play a role in improving the quality of input graduates to the tertiary science system, to develop improved linkages with industry, Africa, teachers, international partners, to match the growth of the Institute with the development of the capacity to ensure sustainability (transparency, good governance, effective administration, human and financial resources …)

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A The state of the teaching of Science and Mathematics at School level.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A That the SAIP should be seen to be effectively addressing the issues in 2 above.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A The development of the culture of education, the development of the Public Understanding of Science, the clear role for Physics in the creation of sustainable quality of life and the growth of the economy. All this leading to a Southern Africa with a much better representation of SET players in all sectors of society, and representative of society.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A Play a strongly supportive role to the President in the functioning of the Council and its various projects. Work within the Marketing Committee on the various initiatives there. Some current activities are: Developing new relationships with partners in the SAIP mission. The strengthening of the current growth phase, primarily through the sustainability and growth of the SAIP office (one concrete issue is the new SAIP web server which will facilitate the burgeoning array of SAIP services). Auditing, documenting and further promoting the successes (with colleagues) of the "Shaping the Future of Physics" exercise.

Q What strengths do you bring to this Council?

A I believe in South Africa!

Secretary: Dr Jackie Nel

The new SAIP Secretary Dr. Jackie Nel is a Senior Lecturer at the University of Pretoria. Jackie studied at the Univeristy of Port Elizabeth, University of Cape Town and the University of Pretoria, where she completed her PhD. She has previously worked in ceramics research at the CSIR. Jackie's field of interest is the structural and electrical properties of materials, mainly semiconductors like CdS, Ge and ZnO. Jackie relaxes by birdwatching, doing charity work through her church and raising her 2 teenage daughters, which while enjoyable is not always relaxing.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A To maintain the students as active members, even after graduating. They will then be able to mentor students and be role models for them in industry.

To involve industry more in the activities of SAIP.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A With the economy as it is at the moment, the biggest challenge is to find career opportunities for our graduates.

In the longer term, Physics in SA needs a higher profile, in the media and schools, to attract more students to the field.

To maintain the involvement of our graduates in a Physics-related career / environment.

Q What successes would you like to see for the SAIP and Physics in South Africa over the next 2, 5, 10 years?

A To increase our membership, so that we can be seen as a more representative body for Physicists in SA and Africa. If we can maintain the active involvement of our student members after they have graduated, this will be a huge success.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A Effective communication between the President and the Council members.

To communicate the decisions of council to the members via the website.

Q What strengths do you bring to this Council?

A I am organised and diligent in what I do and how I do things.

Q Why did you decide to stand for nomination to the SAIP Council?

A I felt that I could do the duties required of the position of Secretary effectively, even though the standards set by the previous secretaries are very high indeed.

Treasurer: Prof Japie Engelbrecht

Treasurer, Prof. Japie Engelbrecht has served on the SAIP Council in this Portfolio from 2001. I'm still not sure how he does it! Japie is based in Port Elizabeth where he is head of the Physics Department at the Nelson Mandela Metropolitan University. Japie studied at the former University of Port Elizabeth and held various positions in the at the University including that of Deputy Dean. Japie's research interests include Solid State Physics, with an emphasis on Optical Characterization by Fourier Transform Infrared

Spectroscopy. He relaxes by reading novels, gardening, watching rugby on TV.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A To become more involved at levels close to government, so as to make an impact where it counts, increasing membership, becoming a strong "voice" for Physics in South Africa, on the same level as e.g. Engineering.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A Lack of basic training at school level = decreasing number of students doing Physics at tertiary level, addressing this very issue (Physical Science curriculum at Grade 10-12 level), job opportunities for graduates.

Q What successes would you like to see for the SAIP and Physics in South Africa over the next 2, 5, 10 years?

A Very active and strong SAIP Office, government consulting SAIP on matters related to Physics. Acknowledgement of Physics as a subject on equal footing with Engineering, making a difference at school level, research breakthroughs.

Q List three things that you are going to accomplish in your portfolio in this term of office.

Striving to teach all members that deposits into the SAIP account must be linked to a specific member, timeous payment of all invoices submitted to the SAIP, increasing money awarded for prizes at SAIP conferences.

Q What strengths do you bring to this Council?

A Experience and humour.

Prof Nithaya Chetty

Prof. Nithaya Chetty of the University of Pretoria is the recent past President and chairs the Constitutional Committee which responsible for re-writing the constitution. Nithaya studied at the University of Natal and at the University of Illinois in the USA. Nithaya has held postdoctoral fellowships at the Technical University of Denmark and the Brookhaven National Laboratory. He has also held a Lectureship at UNISA and been a Senior Lecturer and Associate Professor at the University of Natal, and is currently Associate Professor at the University of Pretoria. Nithaya's research interests include Computational Solid State Physics, Computational Statistical Physics and Computational Physics Education Research. He relaxes by enjoying the great South African outdoors with favourite destinations being Drakensberg and Zululand (St Lucia wetlands, Hluhluwe-Umfolozi).

Q What challenges and successes do you see for the SAIP over the next 2, 5, 10 years?

A Establishing the Executive Office on a firm and sustainable financial footing, securing more funding for particular projects for the Institute, increasing membership to 1000, strengthening ties with industry

Q What challenges and successes do you see for Physics in South Africa over the next 2, 5, 10 years?

A Making a stronger impact on the quality of physical science teaching within the FET curriculum at high schools

Q List three things that you are going to accomplish in your portfolio in this term of office.

A Finalise the SAIP constitution, develop the structures that are defined within the new constitution

Q What strengths do you bring to this Council?

A Networking with government and higher education institutions, previous experience as president.

Prof Frederik G Scholtz

New Councillor, Prof. Frederik Scholtz holds the Awards Portfolio. Frederick has recently been appointed as Director of the taken over the reigns of the National Institute for Theoretical Physics. He studied at the University of Stellenbosch and has held positions in Theoretical Physics at the former Atomic Energy Corporation of South Africa and at the University of Stellenbosch. Frederick's field of interest is Theoretical Physics with a focus on quantum mechanics and quantum field theories and their applications in condensed matter systems.

Frederick reads and runs (hopefully not at the same time!) to relax.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A The physics community is confronted with a large number of research opportunities, such as SALT, MeerKat, NITheP, SKA etc, in the next decade. To fully exploit these opportunities will require a focussed approach, particularly in terms of human capacity building, which is becoming more and more problematic due to the problems in mathematics and science education at school level. The SAIP will have to provide a platform to the physics community in which these opportunities can be addressed coherently and systematically and will have to play a leading role in addressing the problems around training and education.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A The coherent and effective utilization of the research opportunities mentioned above, in particular against the background of the problems facing us in education and training.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A An effective service to the physics community in terms of education, training, utilization of research opportunities and other coordinating functions.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A The successful and effective utilization of facilities such as SALT, MeerKat and NITheP.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A (i) I hope to grow at least a facility such as NITheP into a user facility for the whole community.
(ii) A critical evaluation of the SAIP awards is necessary to recognise and support the SAIP members that play a significant role in critical issues such as education and training.
(iii) I would like to see a more coordinated approach to the development of research initiatives by the different role players in the research community, e.g., Universities, National Facilities, CoE's and SARCHI chair holders.

Q What strengths do you bring to this Council?

A More than five years experience in the management of a research and teaching environment.

Q Why did you decide to stand for nomination to the SAIP Council?

A I took over the directorship of NITheP and since I believe that facilities such as NITheP, which must act as user facilities for the community, should play an active role in advancing the role of the SAIP as a platform for strategic planning and coordination, I decided to become involved in the SAIP council when I was approached for nomination.

Q The SAIP's 2 medals and various student awards at the Annual Conferences have gained quite a good reputation. Are there plans for the SAIP to start awarding scholarships in Physics? If not, are there going to be other awards made to e.g. high school learners to promote physics amongst the youth.

A One or two substantial scholarships in Physics, for which sponsors will have to be found, will be useful, but I do not think that that will really promote Physics among the youth. A more effective approach may be to reward champions who are promoting Physics actively at school level. If a solid core of such people can be build it may have a much larger impact on the level of participation among the youth in Physics.

Dr. Erasmus Rammutla

Holder of the Conferences Portfolio, Dr. Erasmus Rammutla is currently department head of Physics at the University of Limpopo. Erasmus studied at the University of the North and completed his PhD in Physics at the University of the Witwatersrand in 2001. Erasmus has worked as a Lecturer at Vista University (Soweto campus) and was awarded an NRF post-doctoral fellowship abroad which he spent at the University of Kent in the United Kingdom as a postdoctoral research fellow. His research

interests are in the experimental and computer modelling studies of superionic conductors and nanocrystalline materials. Erasmus relaxes by watching sport (especially soccer and cricket), TV drama's and comedies, listening to classical music and reading. He also enjoys gardening.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A In South Africa, there are relatively few physicists. This I believe is because most pupils (especially in rural areas) are not aware that Physics can be taken as a career and SAIP has a challenge to popularise the subject. Outreach programs have to be intensified in rural areas since it is where a higher percentage of matriculants are found.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A Physics Education at high school level is a big challenge. Most high school physics teachers did not major in Physics. Young Physics graduates prefer the private sector (good salary) than teaching. If something is not done we will end up surviving by recruiting Physics teachers from other countries.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A (i) More focus has to be given to infrastructure investment if we want to be competitive worldwide in Physics research and SAIP has a role to play in this regard.
(ii) Nowadays the government subsidy at higher institutions depends on throughput rate and this in a way compromises the quality and I would want to see SAIP engaging the government on matters like this.
(iii) Bodies like SAIP should engage the government to address the shortage of qualified teachers.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A (i) I would like to see University Physics graduates being attracted to high school teaching.
(ii) It is presently rare to see more applicants for university positions coming from within the country and this has to change.
(iii) More collaborative partnerships between Universities and industries are needed. This would be more beneficial to student training.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A (i) The science shows and competitions have disappeared from the scientific programme and I would want to see them featuring again.
(ii) Improvement of conference attendance by physics teachers.
(iii) Historically disadvantaged institutions will be encouraged to host SAIP conferences.

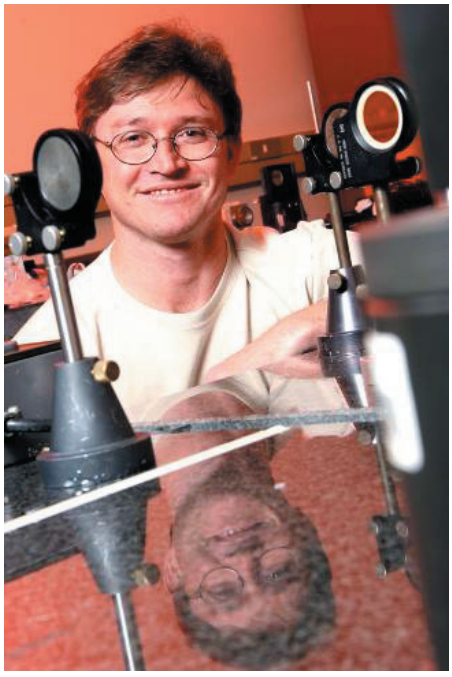
Q What strengths do you bring to this Council?

A I have chaired the 53rd annual conference of the South African Institute of Physics and I believe the experience gained from organising this conference would help in my portfolio on Council.

Q Why did you decide to stand for nomination to the SAIP Council?

A To serve the physics community.

Dr Andrew Forbes



Specialist Group Liaison, Dr. Andrew Forbes is based at the CSIR National Laser Centre but is also affiliated with the University of KwaZulu-Natal and the University of Stellenbosch. Andrew completed his PhD at the University of Natal I while working at the Atomic Energy Corporation, trying to separate Uranium. He then had a stint in the private sector where he was "trying to

make lots of money". He returned to research where he is "(still) trying to building a reputable group specialising in classical and quantum optics". Andrew's fields of research are laser beam shaping, laser resonators, non-diffracting fields, digital holography and quantum optics. He relaxes by drinking lots of wine, reading lots of books, and get bossed around by his (Editor's Note: very cute!) 4-year old daughter.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A Physics has to migrate to include multi-disciplinary research if it is to compete for funding in a thematic/directed research environment. I foresee that this will result in pressures to create new specialist groups, with a wider audience. Integrating this shift into the present SAIP without disturbing the status quo is going to be a challenge. However the major challenge is the present trajectory that the SAIP is on: an institution with professional aspirations but run mostly by volunteers. For the SAIP to fulfil the vision it has for itself it will have to shift away from a volunteer-run organisation, and this has implications for both finances and Council.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A Convincing ordinary South Africans that physics has a role to play in the development of the country, and enthusing young people to study physics and consider it as a career.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A In the short term, I would like to see the SAIP offer a well run annual conference. At the moment this is not the case, and yet it is the primary event of the institute, and possibly the only contact most members have with the SAIP. In the longer term I would like to see the SAIP advance physics through outreach to the general public.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A It would be wonderful if we could see physicists move up in the corporate ladders due to the advantages of having a background in physics. If physics and physicists promote themselves better, maybe this can happen. We tend to look down on physicists who move out of research and into management, but I think in the future we should embrace this, or otherwise accept that accountants will be deciding on our research funding!

Q List three things that you are going to accomplish in your portfolio in this term of office.

A Firstly, I aim to have excellent communication between the conference organisers and the SGCs – the lack of this has been a perpetual and unnecessary distraction to our major showcase event; secondly, I hope to convince the SGCs to take their websites seriously enough to offer regular updates and keep the content informative; and thirdly, I hope to see the student representatives of the various specialist groups more active in the activities of the group. Students tend to have more time and more energy than us old folks, yet they tend not to be incorporated into the groups in a meaningful way.

Q What strengths do you bring to this Council?

A I think being somewhere between industry and academia gives me a perspective that some may not have. I also have a passion for physics and students, so hopefully that can be translated into successful projects for the SAIP over my term.

Q Why did you decide to stand for nomination to the SAIP Council?

A I feel that everyone should give more than they take; at this stage of my career I find that finally I am able to contribute to the running of the SAIP, and so I have stood for Council in order to offer my services, for whatever they are worth.

Q The Specialist Groups are an integral part of the SAIP, however apart from the student prizes awarded at the Annual Conference, most Specialist Groups do not have actual plans for the year. How are you going to address this problem and ensure that there is an increase in Specialist Group activities throughout the year?

A We have many very active members with the SAIP, but not all activities are run through the SAIP. But I agree that more can be done. I have two approaches to changing this: firstly, to point out that the SAIP Executive Office is available to assist with logistical issues, and so the burden of organising an event need not be carried by the SGCs themselves, and secondly, I believe the students within a specialist group could be encouraged to play a more active role.

Mr. Gurthwin Bosman

Student Liaison, Mr. Gurthwin Bosman, is a PhD PhD Student in Laser Physics at the University of Stellenbosch. Gurthwin matriculated from Knysna High in 2001 and completed his BSc, Bsc Hons and MSc in Physics at the University of Stellenbosch. He has done some part-time Physics lecturing at the 3rd year and honour level. Mr. Bosman's research interest involves observing ultrafast molecular changes through femtosecond resolved spectroscopic techniques. Gurthwin's hobbies are playing basketball and

golf, watching rugby, cricket and soccer and he relaxes by reading and fishing.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A Within my portfolio the challenge would definitely be to increase the number of student members. Within the broader scope, SAIP requires to become a self-sustaining organization.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A The search for renewable energy and optimisation of current energy sources. Also to remain competitive with the international physics community.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A Self-sustainability. Being the voice of Physics in South Africa i.e. a coordinating structure for physics in SA.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A The large physics undertakings such as SKA, PISA, etc. Also the change of view of physics by the public.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A (i) Formalize and initiate a student based physics demonstration competition at the annual SAIP conferences.
(ii) Improve communication with the Marketing and Outreach Coordinator of the SAIP, such as to get more student members involved in SAIP outreach activities.
(iii) Improve the current arrangement of the Luncheon of Student members with the Plenary Speakers at the annual SAIP conference.

Q What strengths do you bring to this Council?

A Youthfulness and with this a general *change of perception* approach.

Q How are you going to increase the participation of physics students in activities of the SAIP?

A The biggest reason why student participation is so low is because students are not fully aware of the various activities. Thus we require an awareness campaign, which will inform the students of all the SAIP activities. This will be done together with the Marketing and Outreach Coordinator and the Elected Student representatives.

Dr Irvy (Igle) Gledhill

The Industrial Liaison on the current Council is Dr. Igle Gledhill.

Q Summarise your career for Physics Comment.

A My BSc (Hons) is from Rhodes University, and my PhD is in plasma physics. I completed the Executive National Security Programme in 2001; this is the most senior course that the SANDF offers, and is one of the steps in the conversion of Colonels to Generals and Captains to Admirals. (However, I didn't get any scrambled egg on my shoulders.) My post-doc work at UCLA was on the simulation of instabilities in thermonuclear fusion, and as a Postdoctoral Research Associate at Stanford University, I wrote a plasma simulation for use in space shuttle physics and galactic simulation on a Massively Parallel Processor at NASA Goddard Space Flight Centre. I came back to South Africa to model ordinary fluids, thinking they should be a cinch, and discovered

aerodynamics with a rude shock.

I'm a Fellow in the Operating Unit of Defence, Peace, Safety and Security at the CSIR, a Member of Academy of Science of South Africa, Past President of the SA Council for Automation and Computation, Immediate Past President of the SA Association for Theoretical and Applied Mechanics, a Member of Council of SA Institute of Physics, a member of the International Union of Pure and Applied Physics Working Group 5 on Women in Physics, and a member of the of International Union of Theoretical and Applied Mechanics Working Party: Education and Capacity Building.

Within the CSIR, I chair the Strategic Research Panel, which has oversight of research projects and encourages collaborative work and young researchers. I serve on the Research Advisory Panel of Defence, Peace, Safety and Security, and on the CSIR Quality Assurance Panel on career ladders.

Q What are your research interests?

A My interests in aerodynamics and transonic Computational Fluid Dynamics (CFD) are particularly in store release from aircraft and in the aerodynamics of sharp manoeuvre.

I have an ongoing interest in cellular automaton models of fluids and lattice gases. I've used CFD in modelling methane explosions in coal mines, in climate and weather models, and in comparison of wind tunnel, CFD and other numerical results for validation. My computational fluid dynamics background is being used at present in numerical modelling of harbour breakwaters, and the impact of ocean waves on dolos structures.

I've taken up a challenge to use molecular dynamics to combat disease in SA, and contribute in an interdisciplinary biotechnology team as a computational physicist. I'm putting the electronic structure methods useful in this field to work in a collaborative non-linear optics project, seeking methods of assisting with the molecular design of materials that protect eyes and sensors from high-powered lasers.

Q What are your hobbies/how do you relax?

A Mike, who is a Chemical Engineer, and I have a growing daughter, and when we can, we travel. I have retained my love of great cars, and have progressed from the Triumph 2000 in Natal to a 350 cubic inch-engined Camaro, a Cortina 3.0S, an Alfa Giulietta, to a Ford Falcon, and am presently getting to know a turbo 2.5 boxer-engined Subaru.

This is an absolutely suitable hobby for Gauteng, in which each of us can spend 4 hours a day on the road at the moment.

Q What challenges do you see for the SAIP over the next 2, 5, 10 years?

A SAIP is going faster than ever before: the Executive Office is moving the pace up several notches. From my point of view, an indispensable fundamental is sustain SAIP's excellent atmosphere as a meeting place for physicists and a forum where we recognise each other, and discuss a subject that is so cool, so basic, and so useful.

SAIP has kept an excellent and strict eye on finances and governance, and will continue to do so. Sustaining the Executive Office is a priority, because it enables SAIP to do in a year what used to take at least n years. Sponsors love initiating, an they often love it more than sustaining the initiatives of their predecessors. The challenge to successive Councils is to keep the income flowing, through different economic circumstances, to support our enabling Office.

Q What challenges do you see for Physics in South Africa over the next 2, 5, 10 years?

A Change is certain. I have little doubt that the global economic conditions will have an effect on government. Breaking the chain of innovative contributions to the economy from science and scientists would be a disaster.

Q What successes would you like to see for the SAIP over the next 2, 5, 10 years?

A SAIP is setting up closer ties with Institutes in other countries. I'd like to see close, but not exclusive, alliances with the Institute of Physics, UK, and the American Physical Society. I think it will take 5-10 years for relations with African Institutes to come to fruition.

We are already embarking on the Voice of Physics mission, with better communication among members, better links with government, and (even) better international liaison.

Q What successes would you like to see for Physics in South Africa over the next 2, 5, 10 years?

A Additional great physics. A project from the physics community that alleviates the plight of our people. Physics students finding rewarding jobs. At least one Nobel Prize.

Q List three things that you are going to accomplish in your portfolio in this term of office.

A Link graduates to industrial opportunities.

Bring physics applicants to the attention of industries.

Support the Applied Physics Specialist Group in their diverse and useful initiatives.

Q What strengths do you bring to this Council?

A Persistence, passion and a love of the subject. Working under the stress of contract research deadlines, and having an academic background, I have an understanding of both worlds.

Q How are you going to increase the participation of physicists in industry in the SAIP?

A To *Physics Comment* Readers: Have a look at the Physics500 project at www.saip.org.za/physics500/. The project collects contact data from physicists working in industry and business. They give us starting points from which we can work. The Physics500 project is up and running, and is a point from which to work.

The initiative has grown from the Project 'Shaping the Future of Physics in South Africa', http://www.saip.org.za/ShapingTheFuture.html. Here are recommendations 3 and 13:

3. Job prospects in Physics are perceived by many young people to be poor, and this affects the take-up of the subject in schools and universities, but this is illusory. Both industry and business welcome them, for both technical and managerial careers, but this is not made apparent. The fault appears to lie on both sides, employers not making it clear that physicists are welcome to apply for their vacancies, and physicists not being sufficiently proactive. We recommend that SAIP mount a "connectivity-campaign".

13. An important effect of physics research projects is technological spin-off. Advanced research projects not only bring immediate "rewards" to industry and commerce in the form of orders for technologically advanced equipment, but they also raise the possibility of new, previously unforeseen, developments. "Astro-technology" is an excellent example and we recommend that it be used as a prototype, and that physicists make use of the structures that encourage links to industry and innovation.

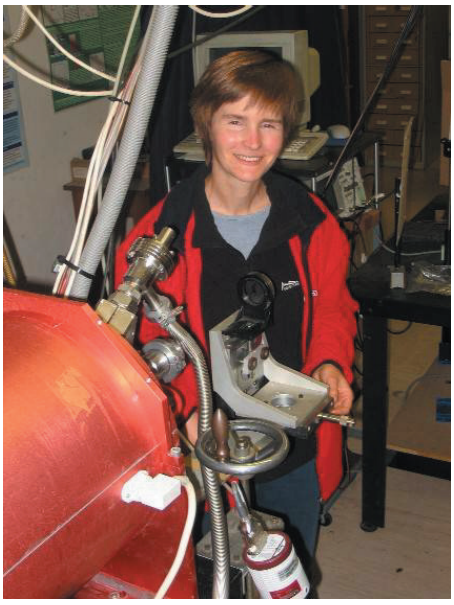
The Council Industrial Liaison Committee and the Applied Physics Specialist Group are in the process of finding the next step forward, and we'll steadily progress in the next two years.

Breaking News: HRTEM for NMMU

Nelson Mandela Metropolitan University
for tomorrow

On 27 August 2009, the Department of Science and Technology approved the establishment of the High Resolution Transmission Electron Microscopy (HRTEM) Centre which will be based at the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth. More details will be available in the next issue of Physics Comment.

2009 Silver Jubilee Medal Award



The 2009 Silver Jubilee Medal was awarded to Dr Christine Steenkamp for her outstanding contributions to laser spectroscopy in South Africa. Her achievements are all the more remarkable in view of the fact that her scientific output of an excellent standard occurred in the field of experimental physics, where no research infrastructure was available when she started out her career.

She was responsible for the design and construction of most of the apparatus currently being used in her investigations. She constructed and used a unique vacuum ultra violet laser source, and has used it to investigate super-cooled CO molecules. Rotationally resolved spectra of electronic excitations could be studied using this source. For the first time measurements of the spectra of the rare CO isotopomers could be obtained in a laboratory. This is of great interest to the astrophysics community, since such information is required to interpret results obtained from space station observations of interstellar space. Two publications in the Astrophysical Journal including follow up work in the Journal of Molecular Spectroscopy testify to the relevance of this research. Together with a PhD student she continues the project owing to the international interest in the unique laser facility that she has constructed.

The quality of her work attracted the attention of Prof Carl Wieman, Nobel laureate in 2001, who, subsequent to a visit to South Africa, invited her to join his group in Boulder, Colorado for an extended research visit in 2004/5. This has led to a new experimental initiative, supported by the African Laser Centre, where Christine started a project aimed at laser cooling of atoms. Under her supervision, an MSc student has produced an excellent thesis.

Her achievements, however, go far beyond the publications and presentations at international and national conferences. She has been able to inspire students to become involved in research at the Laser Research Institute in Stellenbosch. Her experimental skills and her ability to handle theoretical aspects of the work have become well known amongst her peers, and her leadership has lead to the establishment of a team of students and colleagues. Her influence has made an impact within the Lasers, Optics and Spectroscopy Specialist Group of the SAIP where she has become a well known and respected member of the research community. She has contributed considerably to initiatives of the African Laser Center and the African Institute for the Mathematical Sciences, both initiatives aimed at establishing and improving science research in Africa. Here, her pioneering spirit and ability to do excellent experimental science with meagre resources has demonstrated her creativity. Her ability to work as a team member while leading an initiative makes her contributions highly effective.

The unique qualities of Christine Steenkamp have been acknowledged at various stages of her short career, as is evident from the long list of awards appearing in her CV. Here we note that in 1997 she was the recipient of the Stellenbosch University Chancellor's Award. In 2003 she was one of three national recipients of the Women in Science Fellowships awarded by the Department of Science and Technology. Her research achievements are recognized by her peers and she has received support for her research from the NRF through the Thuthuka program, the National Laser Centre, as well as the African Laser Centre. Christine's personality and career represent the type of role model that the South African Institute of Physics can proudly identify with. She is indeed inspiring a new generation of young physicists. She is the obvious candidate to be awarded the Silver Medal in this year 2009, the most prestigious award bestowed by the Institute to young researchers under the age of 35 years.

CB Van Wyk cash prize

This Silver Jubilee Award is augmented by a cash prize of R5000.00 donated by Prof CB van Wyk, who was the key driver in the founding of the SAIP in 1955, and was its second president form 1957 to 1960.

I wish to mention that in 2007, Prof CB van Wyk very generously donated R50 000 to the SAIP Council to use this money to recognise excellence in physics. The Council decided to augment the Silver Jubilee Award in a sustainable way by allocating R5000.00 for the 2009 prize. On behalf of the SAIP Council and all the members of the SAIP, I wish to express my sincere appreciation to Prof CB van Wyk for his generosity and for his continued commitment to excellence in physics.

It is my pleasure on behalf of Prof CB van Wyk and on behalf of the SAIP Council to hand over a cheque of R5000.00 to Dr Christine Steenkamp as an augmentation to her Silver Jubilee Award.

Nithaya Chetty (President SAIP 2007-2009)

2009 South African Women in Science Awards

Claire Lee and Jaynie Padayachee

In celebration of National Women's Month, the Department of Science and Technology (DST) announced the winners of the 2009 *South African Women in Science Awards*. Launched in 2003, the awards aim to increase the number of women scientists and their access to research professions in South Africa, and to profile them as role models for younger women scientists and girls countrywide and form part of the DST's celebration of National Women's Month.[1]

The 2009 awards ceremony was held on Friday, 21 August 2009 at the Sandton Hilton in Johannesburg where Minister of Higher Education and Training, Blade Nzimande, and Minister of Science and Technology, Naledi Pandor, both spoke. Two physicists were honoured at the event: Dr. Amanda Weltman and Ms. Buyisiwe Sondezi-Mhlungu.

Amanda Weltman

Dr. Amanda Weltman was named Best Emerging Young Researcher in the Natural Sciences and Engineering. She grew up in Johannesburg but, "then my parents moved to Cape Town and I lived there until the age of 21. I spent the next 9 years travelling and studying abroad." Her undergraduate degree is from the University of Cape Town, where she majored in Physics and

Applied Mathematics. She also completed her BSc Honours at UCT in Theoretical Physics, where she graduated top of her class. Dr. Weltman then completed her postgraduate studies in Physics (MA, MPhil and PhD) in the Physics Department at Columbia University in the USA. Her PhD supervisor was Brian Greene.

Amanda returned to South Africa to a permanent lectureship at UCT "but immediately took 2 years leave to take a postdoctoral research position at the Department of Applied Mathematics and Theoretical Physics at Cambridge University working in Stephen Hawking's group."

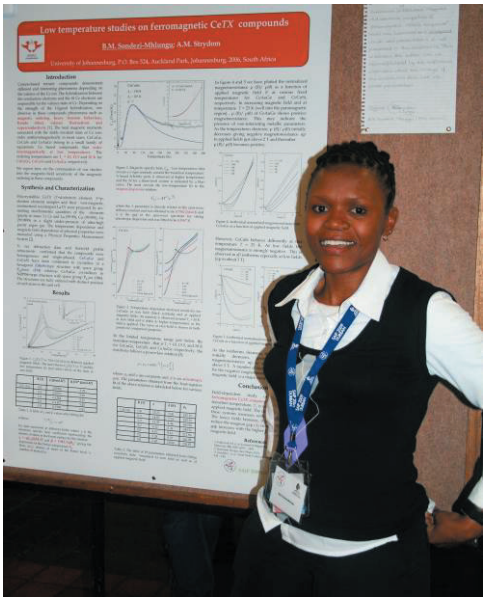
Amanda describes her broad area of research as "string cosmology". "The idea is to test string theory ideas through cosmology and in so doing hopefully solve some of the big hard fundamental problems of cosmology." She has spent much time focussing on Dark Energy, which makes up about 70% of the energy content of the universe and yet very little is known about what it is or what it is made of. "What we do know is it causes the universe to accelerate, which essentially means everything is getting further and further apart ever faster. We have measured this and believe it is happening but we cannot explain what is causing it. Because our understanding of the cause is currently limited by cosmological observations it is very difficult or maybe even impossible to distinguish between theoretical explanations."

In her PhD, Amanda proposed a possible solution called Chameleon fields2 or Chameleon cosmology. "(This) essentially solves the dark energy problem (i.e. explains the observed acceleration) but also makes predictions for gravity tests in space as well as tests that can be done in the laboratory. This is exceptionally exciting and is the first known Dark Energy theory that can be tested in these complementary ways. In particular there is an experiment in Fermilab, Chicago, USA testing chameleon theories - the GammeV experiment."

Amanda's work has attracted a lot of attention both scientifically and in the popular media and she has been interviewed for many popular science magazines3 abroad. She was also part of the Columbia University team that was responsible for the design, development and implementation of Physics Emasondosondo, which was a Physics outreach programme in the townships and rural areas of Gauteng, South.

Amanda has received many fellowships including from Columbia University, Cambridge University and NASA and in 2008, she was elected onto the Council of the South African Gravity Society. She is married to fellow UCT string theorist, Jeff Murugan.

Buyisiwe Sondezi-Mhlungu



Buyisiwe Sondezi-Mhlungu was awarded a fellowship for a women scientist working in a field where participation by women is traditionally low.

Buyi was born on a farm in Newcastle, Kwa-Zulu Natal, the first of 10 children in the family. She has been happily married for 12 years, and has two daughters of her own.

She has always enjoyed the experimental sciences, despite attending a school with no science laboratories, and did not let this hold her back when considering a career in science. After high school she moved to Johannesburg, where she initially started with a teaching degree, but then switched to a BSc through Vista University in Soweto, majoring in Physics, Chemistry and Statistics.

She then moved to Rand Afrikaans University (now the University of Johannesburg) where she completed her BSc (Hons.) and MSc in Physics. Her Masters Degree was based on Solar Cells

Technology, where she investigated the suitable growth conditions (time, temperature and gas concentration) for growing a homogenous single phase material with high conversion efficiency.

After completing her Masters degree she worked as a scientist in the Radiation Utilisation Division at the Nuclear Energy Corporation of South Africa (NECSA), where she was responsible for a neutron powder diffraction instrument. In August 2007 she returned to the University of Johannesburg, accepting a position as a lecturer while working towards her PhD.

For her PhD, Buyi is studying cerium-based compounds and intermetallic systems, a particular aspect of strongly correlated electron systems. Her PhD supervisor is the head of the physics department at UJ, Prof. A.M. Strydom. On completion of her thesis, she will be the first South African woman to hold a PhD in this field.

Buyi already has a number of papers under her belt, and has attended conferences all over the world. She has also been awarded prizes for the presentation of her work: she won the prize for "Most Outstanding Oral Presentation in the field of Condensed Matter Physics and Material Science" for her MSc work in 2004, and in 2008 was awarded the "Most Outstanding Poster Presentation in the field of Condensed Matter Physics and Material Science" for her PhD research.

Buyi is also passionate about motivating more young South African girls to pursue a career in science and research. In 2003/2004 she was involved in a programme called "Ipi ntombi", by Sci-Bono, which focused on motivating girls into doing science. More recently she has been involved with WiPiSA in the same duty of encouraging girls to do science. She believes that "a lot can be achieved and we can see a number of women enrolling into science related research if they get the right motivation and support."

Buyi is planning on completing her PhD next year, and is then looking to undertake a postdoctoral fellowship in either Dresden, Vienna or the UK. Afterwards she would like to return to South Africa to grow the field of heavy fermion systems, and is keen on supervising future postgraduate students with research topics in this area.

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SA wins bid for IUPAP Conference on Women in Physics

Igle Gledhill

WiPiSA [1] and SAIP are happy to announce that the 4th IUPAP International Conference on Women in Physics will be held in Stellenbosch in 2011.

The conference combines scientific papers and invited talks by eminent speakers on their fields of specialisation, with a series of workshops and working group discussions. Both women and men attend.

Universal access to science, and participation in science, is a principle that runs through the activities of ICSU[1] and its member unions. In 2003 IUPAP recognized a particular need to foster the participation of women in physics, and, through a resolution at the General Assembly of 2003, initiated Working Group 5.

The mandate of Working Group 5 is to survey the current situation, report to the IUPAP Council and the liaison committees, and to suggest means to improve the situation for women in physics. Working Group 5 decided to undertake these tasks with two main instruments: a survey of women in physics across many countries to provide data; and the ICWIP conference series to provide a forum in which data can be presented, obstacles can be identified, and actions may be formulated.

So far, about 50 countries have presented data. A common factor in all studies is the observation that the percentage of women actively participating in the field declines with age (or seniority, or professional level). The differences between cultures are clear, and some features of the decline can be attributed to local factors: in India, a sharp decline in the percentage of women is observed after the PhD is obtained and the pressure to remain in the family environment rises, while in China, a well-intentioned law requiring retirement at 60 for women and 65 for men means that many women do not stay in universities and academies until the typical age at which the professorial level is achieved.

In South Africa, a recent study[2] of women graduating between 1995 and 2005 has elicited some of the most important factors in the working lives of respondents. Pre-eminent factors such as a supportive partner and personal safety are followed by fairness in judging everyone by

[1] Women in Physics in South Africa, a joint DST and SAIP project

the same standards, a safe environment in which to raise concerns, and access to funding for projects, search, and study.

Men share many of the concerns that have been identified, and some are those of parents in general. Other minorities in departmental groups share some obstacles voiced by women. In South Africa, stating that the percentage of black and women physicists must rise is, at the least, discourteous to white men – unless there are resources for the community to grow.

Discussions in departments, industry and institutes can be uncomfortable, and can sometimes be downright divisive. For many people in the field, physics is life's work, and we do not wish to see it trivialised by well-intentioned efforts to treat it as a "job" in the "workplace". Departmental atmosphere is a primary factor in building diversity[3]. The South African physics community is free of some of the obstacles besetting other countries – but there is much still to be learned.

Several of the Working Group members were present at the International Conference on Physics and Sustainable Development in Durban in 2005. Following this conference, WiPiSA was launched at the Blue Waters Hotel. In the best traditions of South African physics, the banquet dance floor was closely packed with high energy dancers. It is unlikely that any of the international guests – who participated vigorously – will forget the sound of Mafikizolo. Please join WiPiSA and SAIP in welcoming this IUPAP initiative to Mzanzi, to South Africa.

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Tuneable laser spectroscopy at the Laser Research Institute

Christine Steenkamp

Introduction

Lasers providing light with a narrow spectral bandwidth that can be continuously tuned over a wavelength range have revolutionised spectroscopy and are facilitating the manipulation of atoms and molecules by means of photons. Spectra can be obtained with spectral resolution of the order of the laser bandwidth, weak spectral lines can be detected due to the high spectral brightness of the source, and individual quantum states in atoms and molecules can be selectively populated. The tuneable laser spectroscopy at the Laser Research Institute (LRI), Physics Department, University of Stellenbosch (US) is focused on two areas: spectroscopy using a laser source in the vacuum ultraviolet spectral region and applications of tuneable external cavity diode lasers. This paper gives a brief overview of the investigations in these two fields for which the Silver Jubilee Medal of the SAIP has recently been awarded to the author.

Vacuum ultraviolet spectroscopy

Tuneable narrow bandwidth laser sources in the vacuum ultraviolet (vuv) spectral region (100 – 200 nm) are not available commercially and only a few such sources exist worldwide. In the vuv laser source used in this work, the tuneable vuv light is generated by the third order nonlinear optical process termed four-wave sum-frequency generation[1]: two strong electromagnetic fields at frequencies ω_1 and ω_2 in the visible region drive the atoms of the medium into anharmonic behaviour, producing radiation of light at the sum-frequency $\omega_s=\omega_1+\omega_1+\omega_2$. An atomic gas is used as nonlinear medium since nonlinear crystals become opaque below 200 nm. A two-photon resonance of frequency ω_1 with the atoms of the medium, as well as careful phase matching – matching of the indices of refraction of the medium at the visible frequencies (ω_1 and ω_2) and the vuv frequency (ω_s) – are required.

Our main application of the vuv source is spectroscopy of carbon monoxide (CO) molecules that are adiabatically cooled in a supersonic jet. CO has a particular significance in astrophysics as it is the second most abundant molecule (after H_2) in the interstellar space and stellar atmospheres[2]. Transitions of different CO isotopomers are observed in spectra recorded by satellite based telescopes and the data is used to map the distribution of molecular matter in space and model the evolution of stars[3]. Accurate laboratory measured wavelength data of CO, in particular of the rare CO isotopomers and weak forbidden transitions, are essential in the interpretation of the astronomical observations.

The experimental setup for the vuv spectroscopy

of CO is described in detail elsewhere[4]. The beams of two dye lasers are focussed in a magnesium vapour-krypton gas medium prepared inside a heat pipe oven to ensure homogeneity and stability[5]. The frequency of dye laser 1 is fixed to a two photon resonance with the $3s^2$-3s3d transition of magnesium, whereas the frequency of dye laser 2 can be tuned in order to tune the generated vuv frequency. Phase matching is achieved by fine tuning the pressure ratio of the magnesium vapour and the krypton gas. The vuv beam crosses a supersonic jet of CO gas containing the CO isotopomers in natural abundance. The undispersed fluorescence from the irradiated CO is measured by a photomultiplier tube while the transmitted vuv light is measured by a second photomultiplier tube. Laser induced fluorescence (LIF) and absorption spectra are obtained simultaneously by recording the signals of both photomultiplier tubes as function of the vuv excitation wavelength. Wavelength calibration was done using the lines of $^{12}C^{16}O$ and $^{13}C^{16}0$ of which the wavelengths are known.

The high spectral resolution (approximately 0.2 pm) and excellent signal to noise ratio in the measured LIF spectra facilitated the detection of the weak spectral lines of rare isotopomers, as well as forbidden transitions. Twenty nine rovibronic transitions of the rare isotopomer $^{12}C^{17}O$ (0.04% in nature) for which laboratory wavelengths were previously unavailable were detected in our experimental LIF spectra. Figure 1 shows an example of a LIF spectrum containing lines of four isotopomers of CO, including $^{12}C^{17}O$. As example of the applicability in astrophysics the new wavelength data for $^{12}C^{17}O$ were used to calculate the heliocentric velocity of an interstellar gas cloud, helping to resolve a discrepancy in previous calculations[6]. Additionally, forbidden rovibronic transitions of $^{12}C^{16}O$, from the singlet ground state to triplet excited states, were investigated. A total of 52 such lines have been detected to date and for 15 of these accurate laboratory wavelengths were measured for the first time[7].

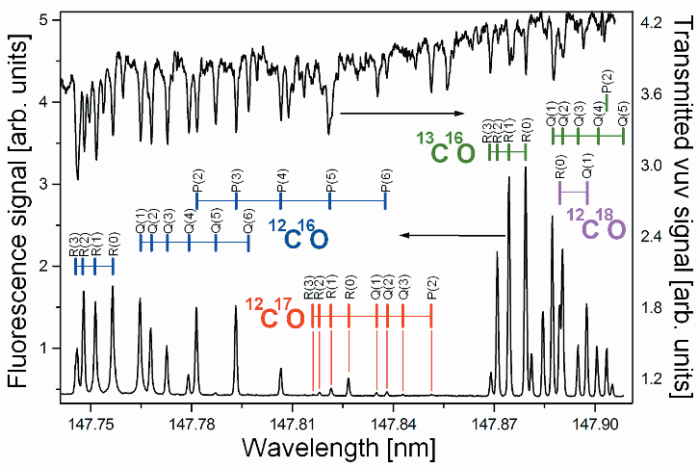

Figure 1. LIF and absorption spectra of the $A^1\Pi(v'=2) - X^1\Sigma^+(v''=0)$ vibronic band showing lines of four isotopomers of CO.

The vuv setup has recently been expanded to include a setup for measurement of absorption and fluorescence spectra of vuv transparent solid materials such as CaF_2. This is currently used for the investigation of impurity induced and light induced defects in such samples.

External cavity diode laser applications

External cavity diode lasers (ECDLs) combine the advantages of diode lasers (relatively low cost, high efficiency, compactness) with a narrow frequency bandwidth and the ability to accurate control and tune the output frequency. This makes ECDLs useful in demanding applications such as high resolution spectroscopy, laser cooling and trapping of neutral atoms and frequency metrology. The first aim of this project is to gain technical expertise in ECDL technology by developing an ECDL and building the necessary control electronics in-house. Further aims are to apply the ECDL to absorption spectroscopy, Doppler-free spectroscopy and to demonstrate laser cooling and trapping of neutral rubidium (Rb) atoms.

An ECDL was developed using a commercial GaAlAs laser diode and providing frequency selective optical feedback by a holographic grating. The geometry of the external cavity formed by the grating was designed to maximise the spectral range over which continuous tuning is possible[8]. Electronics controlling the laser diode temperature and injection current, as well as a PID controller that facilitates the locking of the ECDL output frequency to an absorption line, by controlling the injection current and external cavity length, were developed. The ECDL has been characterised and found suitable for the envisaged applications. It was used to measure the regular absorption spectra of the four D_2 lines of atomic Rb near 780 nm. A setup to apply the ECDL to Doppler-free saturated absorption spectroscopy has been developed and the hyperfine splitting of the D_2 lines was detected. Locking of the ECDL output frequency to an absorption line was demonstrated. A basic experimental setup that will be used to demonstrate laser cooling and trapping of Rb atoms in a magneto-optical trap[9] is currently being developed.

Acknowledgements

Collaborators who have contributed to the vuv spectroscopy are Prof. E.G. Rohwer, Prof. H. Stafast (Institute for Photonic Technology, Jena, Germany), Dr. A. du Plessis (as PhD student), Mr. G.D. Dickenson (MSc), Mr. A.C. Nortje (MSc). Collaborators on the ECDL project are Mr. G.P. Nyamuda (MSc), Ms. G.N. Botha (MSc), Mr. C.I. Rigby (MSc), Prof. P.E. Walters, Mr. R. Mukaro (Bindura University, Zimbabwe) and Mr. T

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Solid State lighting at Kovsies

Hendrik Swart

Prof. Hendrik Swart and Dr Martin Ntwaeaborwa were honoured at this year's National Science and Technology Forum (NSTF) awards where they received prestigious awards during a gala dinner held in May 2009. Prof. Swart received the award for research capacity development over the last five to ten years for his significant contribution towards the development of students in the niche area of nanophysics. The award, sponsored by Eskom, includes a prize of R100 000 which will be used for research purposes. Dr Ntwaeaborwa, senior lecturer in the same department was the recipient of the T.W. Kambule National Research Foundation (NRF) award in Category J as distinguished young black male researcher over the last two to five years for his contribution to the understanding and harnessing of light emitting nanomaterials for application in light emitting devices. The award also includes R100 000 prize money towards his research.

Figure 1: Dr Martin Ntwaeaborwa and Professor Hendrik Swart were recipients of NSTF awards at the 2009 gala dinner.

Solid State Lighting

Solid State lighting promises to replace conventional light sources, with significant economic and environmental savings. These low energy consumption and high efficiency lighting sources will impact on the quality of life, especially for the poor who still use candles and lanterns. Nanotechnology, the science and engineering of extremely small (~1-1000 nm) structures, has emerged in recent years as a major research theme in fields ranging from microelectronics to biomedicine to structural materials. Nanotechnology is pervasive in many applications, including light emitting diodes, Electroluminescence (EL) devices, nanocatalysts, sensor technology and bio-medical probes etc. Progresses in each of these areas depend on the ability to selectively and controllably deposit nanoparticles and nanotubes. This in turn, requires control at the atomic level of film microstructure and microchemistry. Semiconductor nanoparticles with dimensions smaller than or of the order of the size of bulk excitons, show unique optical properties.

Nano Solid State Lighting Research Group

The Nano Solid State Lighting Research Group at the Physics Department of the University of the Free State is in the process of establishing research capacity in luminescent nano-particles through basic and applied research initiatives. The research plan consists of multiple projects connected by the experimental and theoretical skills of the researchers involved and also includes links with other institutions. The projects are chosen to promote collaboration both nationally and internationally and to facilitate the

development of quality postgraduate students and staff members, who will have the necessary skills to fit into any scientific community. The Group gained international recognition for the theoretical and experimental studies on the degradation of field emission display phosphor. Both fundamental and industrial research is addressed through the development of technical knowledge when determining physical and chemical surface properties.

One strength of the Research Group is the ability to do surface characterization studies on phosphor nanomaterials and industrial steel and alloy samples. The group therefore concentrates on surface characterization with the research apparatus available to them. Two new surface characterization techniques were recently added to the laboratories in the form of a Scanning Auger Nanoprobe (4-8 nm resolution) and a Versaprobe Scanning X-ray photoelectron spectroscope (4 µm resolution). Other equipment to their disposal are: Atomic Force Microscopy (AFM); Cathodoluminescence (CL); Photoluminescence (PL); X-ray diffraction (XRD); UV-VIS-NIR spectroscopy; Auger electron spectroscopy (AES); X-ray photo electron spectroscopy (XPS); Low energy electron diffraction (LEED); Electron beam evaporation system; Raman and Fourier transform infra red (FTIR).

Presently field emission display (FED) and plasma display (PD) technology developing rapidly due to their potential to provide thin, lightweight displays with higher brightness, high contrast ratios and low power consumptions and has the potential to become one of the most competitive technologies in the expanding flat panel market. To find a set of FED and PD phosphors, several factors need to be considered: chromaticity, efficiency, saturation, ageing, rise and decay times and contrast ratio. A key factor that will determine the future success of FEDs as a competitive technology in the flat panel display market is obtaining a red, green and blue phosphor set that will satisfy a strict set of criteria, including the chemical and physical properties of the phosphor in the FED and PD environment of the device. Under electron irradiation the phosphor luminance degrades over time. Although the mechanism for the degradation of ZnS is now almost completely understood due to the research done by this Group, and the Group at the University of Florida, the mechanisms of degradation of the other phosphors used in the display are still poorly understood. Experimental tests are done and the results are used to verify postulated theoretical mechanisms of the degradation process. An example of the CL degradation due to electron bombardments of a SiO_2:PbS nanophosphor is shown in Figure 2.

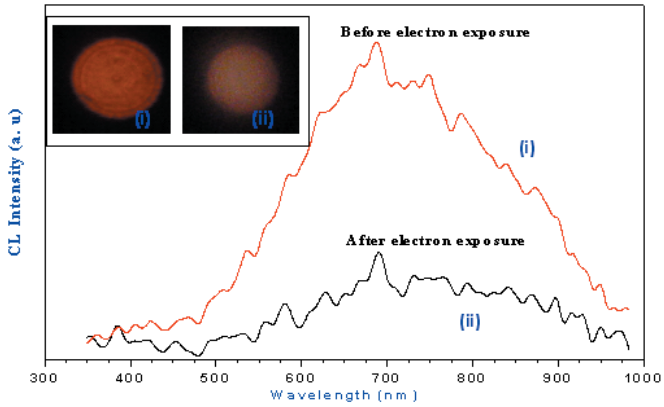


Figure 2: CL emission spectra of SiO_2:PbS nanophosphor before and after electron exposure in 1×10^{-7} Torr O_2. The insets are photographs of the irradiated spot.

Long afterglow phosphors are mixed with infrastructure materials through either mixing it with the substrate (i.e. cement) or adding it after construction (i.e. through a paint-like base). The nano-particles are then excited with UV light (sunlight) throughout the day and the luminescence is observed when ambient light levels drop low enough to observe the level of light emitted by the nano-particles. The ultimate objective is to enable the supply of luminescent infrastructure materials to the construction industry. This would allow the construction of luminescent infrastructure such as streets, roads, road signage, buildings and mine tunnels. The envisaged benefits of such luminescent infrastructure includes improved road safety (especially in rural areas), improved community safety (through luminescent hospitals and police stations specifically in rural areas), the development of smart infrastructure, and supporting the drive towards sustainable cities and towns through a decreased dependence on electricity by the supply of luminescence to built-up areas.

Long afterglow Eu^{2+} and Dy^{3+} co–doped calcium aluminate, barium aluminate and strontium aluminate phosphors are synthesized with different methods. Example images of the phosphors excited with UV light are shown in Figure 3.

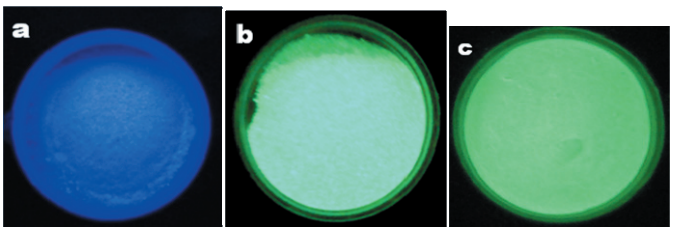


Figure 3: Images of (a) $CaAl_2O_4$:Eu^{2+}, Dy^{3+}, (b) $BaAl_2O_4$:Eu^{2+},Dy^{3+} and (c) $SrAl_2O_4$:Eu^{2+},Dy^{3+} long afterglow phosphors, synthesized at the University of the Free State, after UV excitation.

Although the motto of the Group is to be excellent in what they do and everything must be of the highest quality they are not afraid to make a mistake. As Albert Einstein said: *A person who never made a mistake never tried anything new*.

The group has several bursaries and post doc bursaries available for students and post docs that want to join the surface characterization group.

Figure 4:Surface characterization group members.

Author Biography:.Prof Hendrik Swart is currently a senior professor in Physics and Head of the Department of Physics at the University of the Free State. He is the leader of the developed IRDP NRF Niche Area – Nano Solid State Lighting. Email: swarthc.sci@ufs.ac.za

It has never been this cold in Africa

Magnus Rehn and Francesco Petruccione

Introduction

At the Centre for Quantum Technology of the University of KwaZulu-Natal, we have trapped and cooled rubidium atoms to the micro-Kelvin range. This has been achieved in the first realization of a Magneto-Optical Trap (MOT) on the African continent. The Magneto-Optical Trap, with its ability to trap and cool atoms to temperatures close to the absolute zero, has become, during the last few decades, the workhorse of research in many areas of physics, from quantum information processing to metrology [1].

Trapping and cooling with lasers

Every time an atom scatters a photon, the atom receives a momentum kick. For many photons, this will average out to a force on the atoms in the direction of the light. The rate of scattering, and thus the force, will of course depend on the intensity of the light, but also on the frequency. Far from any atomic transition, the scattering rate is negligible, but in a narrow band around the transition frequency the scattering rate is high.

By using narrow banded light that has a slightly lower frequency than the atomic transition frequency, i.e., red detuned light, we can utilize the Doppler shift to cool atoms. In the reference frame of an atom moving towards the direction of the light, the light will be Doppler shifted closer to the atomic transition frequency. Thus, the scattering rate for these atoms will be higher than for atoms moving in the opposite direction away from the light.

Adding red-detuned light beams from all directions gives rise to a force that is directed against, and, to the first order, proportional to the velocity of the atoms. This is what we usually call a frictional force, and the image of the atoms moving around in this strongly damping light field has given rise to the notion of the Optical Molasses. Since the temperature of a monoatomic ideal gas is just a measure of the average kinetic energy, the described process is a cooling process, and it has proved to be remarkably efficient.

With a gradient magnetic field, arranging the polarization of the beams in clever ways, and utilizing the Zeeman shift of the atomic transition frequencies, we can make the force dependent on the position and always directed to the zero crossing of the magnetic field. In a limited range the force is proportional to the distance from the zero-crossing.

Thus, we have two effects: one can be described

as a friction force and the other one as a spring force. Together they will force the atoms to behave like a damped pendulum, thus cooling and trapping the atoms.

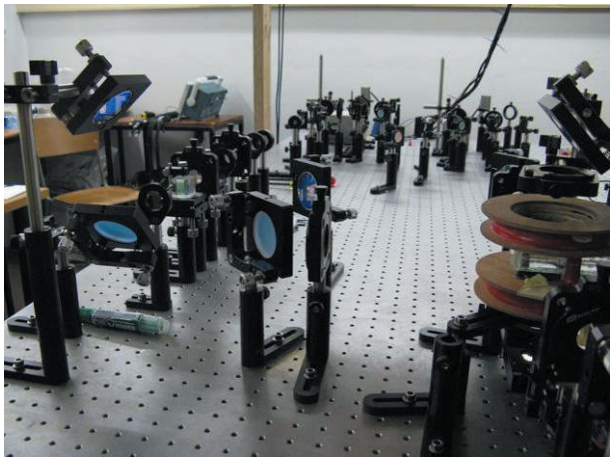
This simple model of laser cooling can be used to predict a minimum temperature that is an equilibrium between heating due to photon recoils and the above described cooling processes. This limit is usually of the order of 100 micro Kelvin depending on the type of atoms.

When the temperature of the atoms in a MOT was measured for the first time, it was one of those rare occasions in which the result was several times better than predicted by current theories. The measured temperatures were much lower than predicted.

This induced development of new theoretical descriptions of the cooling processes, which also take into account the dipole shift of the magnetic sub-levels and optical pumping between those levels. The most renowned is probably Sisyphus cooling, that got its name from the image of the atom always climbing upwards in a periodic light potential, but as soon as it has reached the summit it is optically pumped to lower energy level and has to resume its climb. There exists now a pletora of different laser cooling processes with different theoretical descriptions, but a full understanding is yet to be achieved and it is still an active area of research.

Experimental setup at UKZN

The laser system consists of two relatively inexpensive external cavity diode lasers from Moglabs, locked with two separate saturated absorption spectroscopy setups. Although the transition used for the cooling and trapping is cyclic two lasers are needed because some atoms will always be lost to a second ground state. The second laser is used to pump those atoms back into the cyclic transition.



The cloud of ultracold atoms is very sensitive to disturbances. Any hot atoms, i.e., atoms at room temperature hitting our sample will scatter a large number of atoms and thus destroy the sample. Later stages of the experiment will be even more sensitive to background collisions.

Our vacuum cell is made of simple window glass and glued with very ordinary epoxy. This is for obvious reasons a temporary solution. The outgassing from the epoxy is large, and we haven't dared to bake out the system. Nevertheless, with a 10 l/s ion-pump we manage to keep the pressure around 10^{-5} Pascal. This has proved to be low enough to make a MOT, but the glass cell is the part that has highest priority to be replaced. We plan to work with a pressure that is at least 3 orders of magnitude lower.

The magnetic fields are created with 2 coils in an approximate anti-Helmholtz configuration. They have each 500 windings and are run with 450 mA to create a gradient field of the order of 10 Gauss/cm.

Current work and outlook

Right now we are improving the system for diagnostics, to get accurate measurements of the number of trapped atoms, density and temperature. This will be done with absorption imaging. Measuring the resonant absorption with an expanded laser beam and a CCD-array gives a 2-dimensional density profile. By measuring the expansion of the cloud after turning off the trap, we can deduce the velocity distribution of the atoms and thus the temperature.

In parallel with improving the diagnostics, we prepare the experimental setup for the next stage, where we will be able to do some fundamental research. The current glass-cell will be replaced for the reasons stated above. The whole vacuum system will be extended to incorporate a second vacuum cell. The MOT will be transformed to a so called $2D^{+}$-MOT, which will be functioning as a source of very cold and slow atoms for a second MOT in the second vacuum cell. The motivation for the 2-cell approach is that we need better vacuum for the planned experiments than is possible with just a MOT loaded from a background of hot atoms. From the second MOT, we plan to transfer the atoms to a conservative atom trap for a final evaporative cooling stage to reach lower temperatures and higher density than is possible in a MOT. The conservative trap will most likely be a far detuned optical dipole trap made with a high power CO2 laser.

The same laser will also be used for making optical lattices [2,3]. Several interfering laser beams are used to create periodic potentials that will be loaded with ultra-cold atoms. Atoms in an optical lattices are a beautyful example of an open quantum system [4] and can be used as a register of qubits. Thus they are very interesting from the perspective of the current research done at the Centre for Quantum Technology in quantum information processing.

We also plan to do research related to nanofibres, where a few ultra-cold atoms are trapped in the evanescent field around ultra-thin unclad optical fibers.

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Authors Biography: Dr. Magnus Rehn did his undergraduate studies at Stockholm University, Sweden. He finished his Ph.D. at the end of 2007 and has been with the Centre of Quantum Technology at UKZN since early 2008.

Prof. F. Petruccione is holder of the South African Research Chair in Quantum Information Processinga nd Communication at UKZN and can be contacted at petruccione@ukzn.ac.za.

Good news for South African synchrotron users

Bryan Doyle

On April 16th, 2009, a Memorandum of Understanding for using the French national synchrotron radiation facility SOLEIL was signed between the National Research Foundation of South Africa and SOLEIL. This agreement will provide more opportunities for South African scientists to work with their French counterparts in the field of synchrotron technology and in sciences using synchrotron radiation as a multidisciplinary research instrument. The NRF has thus set aside R500 000 a year for the next two years to fund visits to SOLEIL. The next deadline for proposals to SOLEIL, the 15th of September (for experiments to be performed in the first half of next year), will most likely have passed by the publication date of this article. The next proposal deadline is likely to be in March next year. The contact person at the NRF is Rakeshnie Ramoutar (rakeshnie@nrf.ac.za).

Left to right: Dr Maharaj and Dr Van Jaarsveld of the NRF, Mr Orliange of the French Embassy and Mr Kriger of the NRF, signing the memorandum in Pretoria. © DR

Two projects co-submitted by South African and French teams to the most recent SOLEIL call for proposals were allocated beamtime on two different beamlines. Both teams are from iThemba LABS, led by Drs Miroslava Topic and Jolanta Mesjasz-Przybylowicz respectively. Apart from such short visits, which have the purpose to carry out set experiments, South African researchers and students are strongly encouraged to propose longer visits to SOLEIL, with the express aim of gaining deeper experience in the use of synchrotron radiation. Such visits are expected to last from 3 weeks to up to one year. At present South African has a significant lack of people skilled in the use of synchrotron radiation. In the future it is also planned that engineers and technicians also take advantage of these visits, to increase our base of technologically skilled people.

Synchrotron Radiation in Brazil

A planning workshop on the next synchrotron radiation facility, LNLS-2[2], that will be built in Brazil, was recently held. The present facility, LNLS[3], has been in operation for twelve years and was the first synchrotron radiation facility in the South Hemisphere. Of most significance was that a large proportion of the sophisticated instrumentation needed for the original facility was manufactured in Brazil. Apart from lowering the cost, this was the catalyst for the creation of various high-tech companies in Brazil. Brazil now even sells synchrotron technology to other, nominally more developed countries. The new source is expected to cost in the order of R2 billion, a large amount for a scientific project in a developing country. To put this figure into perspective, that is slightly less than one tenth of the cost of the Gautrain, so is something that in the future is not out of reach of South Africa. Given the importance of the India-Brazil-South Africa (IBSA) agreement, South African participation in the conference was requested and collaboration between our two countries in the sphere of synchrotron-based science is benefitting accordingly.

Acknowledgements

This article is partially based on one which appeared in the July 2009 issue of the CNRS International Magazine. Kindly reproduced with the permission of Dr. Anne Corval, CNRS Office for sub-Saharan Africa.

[2] http://newsource.lnls.br
[3] http://www.lnls.br

Author Biography: Bryan Doyle is a lecturer in the Department of Physics at the University of Johannesburg (UJ). He holds a doctorate in Physics from Wits and spent almost 10 years overseas working at synchrotron radiation facilities. He can be contacted at bpdoyle@uj.ac.za, and is happy to help any researchers or students access synchrotron radiation facilities.

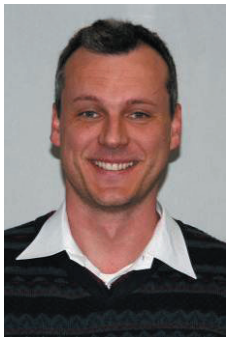
Physics 500

The Physics 500 Project aims to identify and track physicists in Industry. The purposes of the project are:

- To identify industries in South Africa that employ physicists,
- To identify physicists working in South Africa,
- To use this information to promote physics,
- To promote collaboration between the SAIP and industry.

For more information, visit the project website at: http://www.saip.org.za/physics500/login.php

Roger Nilen (Johannesburg)



Qualifications

In 1998, **Ph.D.**, from **Physics** at **WITS**, **"Positron Dynamics in the Diamond Lattice"**

Career

Started 2006 at **Element Six** in **Long Term Research** as **"Senior Research Scientist"**

Started 2004 at **CSIR** in **Materials Science and Manufacturing** as **"Polymers & Bioceramics"**

Started 2000 at **Element Six** in **Long Term Research** as **"Research Scientist"**

Survey

Why did you originally choose to study physics at university?

Enjoyed maths & science, and seemed to be good at them, at school. Physics seemed like the ultimate academic challenge.

Did you enjoy your university physics? What inspired you about physics?

Moderately so on the theory, very much so on the lab work. Was inspiring that it was (a) difficult, (b) good people seemed to do it, (c) greatly benefits society in terms of technological progress etc.

What did you do after graduating from university with your highest physics degree?

Did an 18month post-doc at the same institute where I did my postgrad work (Schonland Reseach Centre, then headed off to the DRL at Element Six for 3years, then a 3 year stint at CSIR, then back to the DRL.

What made you choose a career in industry rather than a career in academia?

Financial.

When did your industrial career really take off?

I guess 2 years into my 1st industrial job (it takes a while to find your feet and start making a difference in industry).

If you consider yourself no longer a physicist, what made you give up physics to pursue your career?

Never really considered myself a physicist - just thought of myself as someone who liked solving problems using a bit of maths and a bit of science. Physics just provided the perfect training ground for this, but there was never any true commitment to 'the physicist life', whatever that might be! So in a sense, any industrial career path would have fitted, regardless of the physics content.

Is there a particular contribution in industry that you are especially proud of and that you attribute to your training in physics?

In my opinion it is impossible to deconvolute anything that you do in life to what you have been taught / trained in. Everything you have learnt, in every subject, feeds into everything you find yourself doing at any given time. Having said that, physics in particular taught me that we don't know everything - indeed, that true "understanding" eludes us, leaving what can best be described as pattern recognition in its place. Based on this 'feeling' (right or wrong!) then, I find it much easier in my work to just try something off the wall - i.e. physics taught me to look beyond the theory (there are always 10 reasons not to try something in materials science) and just follow the gut!

How does your physics training help with your career?

Well, for a start, people seem to think you're clever if you've done physics, so the first half hour at the new job should be a breeze! Physics drums into one good logic, good experimental strategy, good science communication skills, and good lab practice, all essential in an industrial research career.

What advice do you have for physics students thinking of embarking on a similar career?

Any job can be boring. Any job can be exciting. It all depends on the individual attitude and goals. So get in there and have a bash - if it doesn't take your fancy, have a go at something else, because if you can nail a physics degree, there's a lot of different things you can do out there.

What advice would you give to university departments to make their physics teaching and research programmes more useful for industry?

In my day there were enough practicals and demonstrations etc., so that is not lacking. For me it's all about the quality of the lecturing. If the lecturer was poor, I did poorly, and vice-versa. (I know one should be self-motivated by then, but there you have it!) So perhaps some sort of communication / presentation skills training for lecturers?

What are your perceptions about the importance of physics in present-day society?

Essential, because fundamental understanding & technological progress are what will ultimately get us out of the mess we're in, improving quality of life for all. Unless, of course, some sociological miracle can remove our need to outcompete and outconsume ourselves!

TechTrack

Maths is the fundamental language of life

Kelvin Kemm

Why study English at school if you are English speaking. After all, the person can speak and write English. Right?

Well no, not quite. Firstly, an English-speaking person learns English at school to be able to read, write and speak better, but that is not the only reason. A second reason is to be able to analyse sentences, and to really think about what the information is really telling one.

Students learn to analyse poetry to be able to rearrange words in their mind and to grapple with subtle alterations that can actually affect meaning quite substantially.

So there is good reason for an English speaking person to study English at school, or for a Zulu speaking person to study Zulu at school.

So what about maths, why study maths at school. Well maths is also a language; it is the language of science. If one rolls a ball down a slope one can see that it rolls. In fact, it rolls faster and faster, this is acceleration. But unless one measures the time, and points on the slope, and distances, it is not possible to actually calculate the rate at which the ball is travelling, and also the acceleration. One can go further and work out the rotational, or angular velocity of the ball. So why bother about rolling balls.

This all becomes much more meaningful when talking of a factory, or other process situation. It then becomes necessary to know at what rate rollers are turning, and therefore how fast the conveyor belt is moving, and so how much processed sugar is heading towards the packaging department, or to the bulk delivery truck.

Maths often sounds like some exotic subject, reserved for the few very intelligent school learners. It is not. Maths is a fundamental language of life. We do not go through a single day without using maths in some form or other, even if it is just punching the numbers of the TV channel into the remote control.

Every time you buy something at a shop you do maths, you work out how much change you expect to get. Just learning the basics of maths, just like learning the basic of English, allows one to operate at a low level in the subject. But learning more maths, like studying poetry, allows one to manipulate the subject to give more meaningful answers. It allows someone to work out how fast the bulk truck will fill up with sugar from the conveyer belt.

Such abilities empower people to be able to carry out much more complex jobs. The point is that the teaching of maths, to many school folks over a wide front, is important. Maths is a universal language of life. Without any maths ability a person goes through life as a partly disabled person, so to speak.

It is important for as many school kids to learn as much maths as they can, for as long as they can. Unlike a subject like history, maths is a one-way valve. If a person never studied history at school, but then suddenly takes an interest in the subject at age 20, then it is possible to go to a

library and take out books on history and learn the subject. But if one has never studied any maths, then at age 20 it is virtually impossible to backtrack and start learning maths at home alone.

So, not studying maths at school is a one-way valve. If you don't do it, then the chances are that you cannot go back. Getting to know maths well is beautiful because one can see it operating in everyday life. One can look at the wake left behind a boat travelling across still water, and notice that angle of the wake is the same, whether the boat is a rowing boat or an oil tanker. There is a reason for that.

One can see that ice blocks in the fridge usually have a bump in the middle and never a dip. There is a reason for that.

One can marvel at an eclipse of the Moon, knowing that maths can tell one exactly when and where an eclipse can be seen a hundred years into the future. Maths is a language of life and as many school learners as possible should study as much maths as they can. The world is going to demand more and more technological understanding from the ordinary citizen of life.

Techtrack appears each week in Engineering News (www.engineeringnews.co.za). It has been reprinted here by permission of K. Kemm. This Techtrack appeared in Engineering News, Vol 29 No 3, 30 January – 5 February 2009).

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Update on Outreach activities of the SAIP

Roelf Botha

The outreach activities of the SAIP continued since our last report (Physics Comment Issue 2 of 2009). The main focus remained on secondary learners, especially grades 11 – 12. The goal is for them to realise that physical science is fundamental to all sciences and that it can also be an excellent career choice. Our focus remained on three types of events: exhibitions and workshops at science shows, school visits to the CSIR and visits to schools. This was achieved in collaboration of SAIP Outreach with the CSIR National Laser Centre Outreach program. This provides us with a very good 'attention grabber', *the laser*.

Presenting a miniature laser show has proven to be extremely effective in drawing learners' attention. It is then relatively easy to engage with them: what can one do with lasers, how do they work, did you know we call that laser physics etc. etc? Furthering the concept of physics at this stage never proved to be difficult. Examples of all the fields/areas in SA physics are then highlighted, with special focus on big and upcoming projects like MeerKAT. The learners find these sessions highly entertaining and informative and it definitely broadens their perception of physics and related fields.

A magazine-style booklet has also been compiled for the National Laser Centre Outreach Program, titled 'The world of Light and Lasers'. It contains 2 information sheets on Light and lasers in line with the secondary syllabus, as well as articles on the various applications of lasers and research being conducted. Information 'Snippets' provides numerous useful concepts and a special Quiz as well as 'Own Experiment' was also included. It proved a highly successful modus operandi: Presenting a talk / workshop and providing the booklet with the important concepts. The future expansion of this concept to all 7 specialist group fields of the SAIP will be investigated.

SAIP has been involved in 5 events since our last report:

Science Olympiad group visit to the CSIR: SAASTA arranged various events for the Science Olympiad participants. The group consisted mostly of South African students, but some were from SADC countries and other continents as well.

Visits to various schools: Shoshanguve Secondary, Bokgoni Technical, Gerrit Maritz High, Mmanotshe Moduane High and Lyttleton Manor High were visited. These visits took the form of a presentation on light, lasers and the importance of physics, as well as an interactive workshop.

National Science Week: NSW is a national event, for awareness in SET fields. It is focused around specific centers. We covered the Northern Cape area, centered at Kimberley. Four main activities were employed: Laser, Light and Physics Workshops, lectures on Light and Biology, an exhibition was in place for the duration of the event and a Dinaledi school (Weslaan in Douglas) was visited to take the lectures and exhibition to them as well.

Sasol TechnoX: This is an exhibition that focuses on displays, workshops, tours, talks and hands-on activities aimed at enthusing learners, students and the general public about the endless possibilities of science and technology. We were part of the CSIR group and presented talks and an exhibition.

Science Unlimited KZN: This is a Science, Education and Technology (SET) Education and Awareness week comprising science shows, workshops, lectures, demonstrations and interactive exhibitions. Their aim is to offer our

youth a life-changing experience by opening a wide and exciting window on science, engineering and technology during these Science Unlimited weeks. Talks and an exhibition were the main tools employed.

The overall figures and impact for these events were:

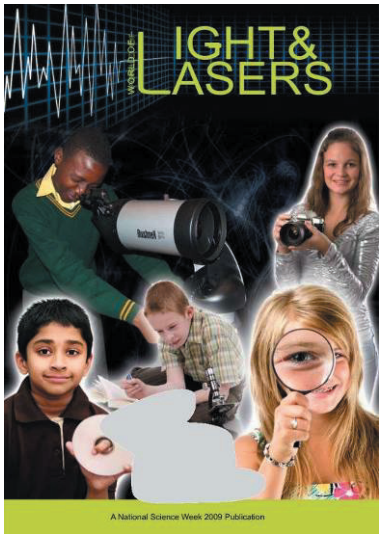
- Impact (persons reached): 4871
- Specific Individual Contact: 110
- Weighted Impact (time in hours x number of persons): 4814 person hours

These bring the total figures and impact for the year to:

- Impact (persons reached): 8111
- Specific Individual Contact: 320
- Weighted Impact (time in hours x number of persons): 7450 person hours

From the experience gained during 2009 we plan to compile a comprehensive Marketing and Outreach plan for the SAIP. SAIP student members were also presented with the activities of the Marketing and Outreach section of the SAIP during their meeting at the annual SAIP conference. The importance of focusing on pre-graduate university students was highlighted, and will be incorporated in the overall plan. A list of students willing to assist in outreach activities was also compiled. The new Marketing and Outreach Plan will be implemented during 2010.

If you are willing to assist in these activities or have any comments, suggestions or queries, please contact the author.



The cover of the magazine style booklet that was compiled for the National Laser Centre.

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Physics For Economic Development – Entrepreneurship Workshop

Brian Masara

In this issue this article will divert from the stage gate process which we have focused on in the past two issues. We will however revert back to this topic in the next issues. In this issue I have decided to focus on the upcoming entrepreneurship workshop which will take place from 9 – 13 November 2009 at iThemba labs in Cape Town.

Why must you attend this workshop?

Science and technology should be pivotal in fighting poverty, unemployment and sustainable socio-economic challenges that Africa faces today. A lot of effort is put in research and development and promotion of innovation. Contribution of science and technology is mainly emphasised in terms of innovation but innovation alone does not lead to implementation and diffusion of the innovative ideas for sustainable socio-economic development.

It is the central philosophy of this project that in order to bridge innovation to implementation gape we need to inculcate the culture and skills of entrepreneurship among scientists and engineers. Innovation might only create new products, services or processes whereas entrepreneurs will gather resources, organize talent and provide leadership to develop viable ventures using these innovations.

Definition of entrepreneurship

We have been discussing entrepreneurship but maybe we need to ask what the definition of entrepreneurship is, what does it mean to be an entrepreneur.

The is no universal definition of entrepreneurship, for the purpose of this article and aims of upcoming workshop in November we will adopt the definition by Ronstadt (1998) who defined entrepreneurship as,

"The dynamic process of creating incremental wealth, this wealth is created by individuals who assume the major risk in terms of equity, time and or career commitment of providing value for some product or service. The product or the service may or may not be new or unique but value must somehow be infused by the entrepreneur by securing and allocating necessary skills and resources"

Holt (2003) stresses that it is important to note that entrepreneurs are not the same as inventors; inventors through innovation might only create new products, services or processes whereas entrepreneurs will gather resources, organize talent and provide leadership to develop viable ventures using these innovations.

Why do people become entrepreneurs - Push and Pull factors?

People or economies that are involved in entrepreneurship do so mainly because of a deliberate choice through attractiveness of opportunities presented by entrepreneurship or they are pushed by poverty, hardships and economic factors.

Jamal (1997) showed through research that entrepreneurs are hardworking people and their average work day can easily stretch twelve hours or more. Kauanui and Thomas (2004) tried to explain why entrepreneurs assume the risk, stress and long working hours to build a business by arguing that there are *push and pull factors* that either force or attract entrepreneurs into this stressful life. *Pull factors* are intrinsic factors that drive the individual to engage in entrepreneurial activity. These aspects were observed by McClelland (1961) and include such factors as high need achievement, internal locus of control, higher propensity to risk, belief in self-determination and a strong sense of personal ability to perform. *Push factors* on the other hand are factors such as low levels of job satisfaction, *economic necessity*, carrier setbacks or limited alternative opportunities. Solymosy (1997) on the other hand contends that a high percentage of entrepreneurial activity is the results of synergetic combination of both pull and push factors.

*This project is the birth of **push factors** because we want to build a deliberate entrepreneurship culture among scientist and engineers in order to address the socio-economic ills faced by Africa today.*

Are entrepreneurs born or trained?

The debate about whether entrepreneurs are born or trained is still not concluded. The trait approach which assumes that entrepreneurs are a special type of people and are born is criticized by many authors among them, Wickham (2001:74) argues that such an idea is not only wrong but dangerous because it fails to recognize the knowledge and experience that entrepreneurs must have if they are to be successful in sectors in which they operate. On the other hand Brereton and Jones (2002) concluded that while certain skills associated with entrepreneurship can be taught and appropriate attributes and behaviours encouraged successful entrepreneurship still require a certain type of individual to engage in the risk of starting their own business hence the trait approach is still valid.

It is hoped that through implementing deliberate strategies such as the proposed project entrepreneurship skills and behaviours can be imparted to many scientist and engineers who already have entrepreneurial traits.

Forms of entrepreneurship

Entrepreneurs may decide to pursue their dreams using different methods. One may decide to exploit a new technology in manufacturing a product in technological entrepreneurship, or they may want to use their scientific and engineering skills to benefit communities in what is termed social entrepreneurship. Yet another option is to use skills gained or a process developed to start a consultancy company. Below we try to explain these forms of entrepreneurship.

Technological Entrepreneurship

This workshop will focus on training scientists and engineers to be entrepreneurs; hence we want to promote Technological entrepreneurship, in the next paragraph I will try to outline what technological entrepreneurship means?

According to Byers (2008), "Technology Entrepreneurship is a style of business leadership based on the process of identifying high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principled, real-time decision-making skills. An attractive business opportunity consists of a great value proposition, technically feasible products, strong intellectual property, a sustainable competitive advantage, a large potential market, and a proven business model. It can be based on either a revolutionary breakthrough in technology or an evolutionary advancement; and it can target an existing market or create an entirely new one."

It is critical to note that technological entrepreneurship and technological innovation are two different things. Entrepreneurs put together all the resources needed – the capital, the management, the people, and the business strategy – to transform the invention into a product, process, or service innovation that finds a market and affects the economy. In other words, they build whole companies upon their innovations. Above all technological entrepreneurs take significant calculated personal risk in building their companies but technological inventors maybe risk averse, they just do the innovation and put in a shelf to gather dust admire and write some academic papers on it.

Finally technological entrepreneurs have skills and instincts required for success with little or no government assistance. As a result technological entrepreneurs do the following to their countries

- Use innovations to improve the quality of life
- Create new jobs.
- Improve their country's economic competitiveness in the global market
- Create economic growth and new wealth for reinvestment in their countries

Social Entrepreneurship

It is interesting to note that the concept of entrepreneurship is now associated with solving social problems in what is termed social entrepreneurship. This is because finding effective solutions to sustainable social development also requires the ingredients associated with successful business ventures hence social entrepreneurship (Alvord et al, 2004).

Social entrepreneurship may come in two forms which are

a) Combining commercial enterprise with social impacts where entrepreneurs use business skills to create enterprises that accomplish social development in addition to being economically viable (*It is hoped this project will focus more on this form on social entrepreneurship because it is sustainable there is no need for external funding*)

b) In the second category commercial enterprises have used their excess profits for social development in what is known as corporate social responsibility. These profits maybe used directly or given to not-for profit organizations that have a social development agenda.

Alvord et al (2004) found that all successful social enterprises focused on mobilizing existing assets and resources of marginalized groups to improve their lives, rather than delivering outside resources and services. Secondly all successful social enterprises followed one of three core basic forms of innovation. These forms are either building local capacity, information packages or building a movement.

Building Local Capacity

Building local capacity involves working with the poor and marginalized to identify capabilities for self-help projects then helping build those capabilities. The assumption is that given an increase in local capabilities local actors may solve many of their problems. Under this model it is paramount to work with local groups to identify issues they see as critical for their development.

Information Package

An underlying assumption of this approach is that information and technical resources can be reconfigured into user-friendly forms that will make them available in forms/packages that make marginalized individuals benefit from them. This strategy may involve development of appropriate and low cost technologies.

It is hoped that social entrepreneurship by scientist and engineers can be used to leverage local resources in marginalised societies through combining local capacity building and appropriate technology packages to transform Africa's socio-economic landscape.

Financing your business idea

Whether you decide to be a technological entrepreneur, social entrepreneur or a consultant you may need to raise money to finance your business. Local and international venture capitalists including local banks will present on the various options that you can take. Please do not miss this.

Register now

To get the skills as well as contribute through sharing your ideas on how we can take Technological Entrepreneurship forward in South Africa please register by visiting the following link

http://www.saip.org.za/events/entrepreneurship/

See you in Cape Town!!

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Funding Opportunities

The MSSA Trust Bursary

The value of the student bursary for one year will be R15,000 by competition. The project involved must contain a significant microscopy component.

Application forms and details are obtainable from the Secretary of the Trust, Alan Hall at alan.hall@up.ac.za ; Telephone: 012 420 2075.

DEADLINE for applications is Friday, 25 September 2009.

Please note: Applications not containing all the required information will not be considered. The Trust will not enter into any form of correspondence regarding the final award of the bursary.

General Microscopy Funding

The Microscopy Society of Southern Africa (MSSA) Trust wishes to promote microscopy in Southern Africa and improve the microscopy skills of people. As such, it invites applications for funding towards the following areas:

1. promoting microscopy and science careers in Southern Africa,
2. towards the organization of microscopy based workshops or schools in Southern Africa,
3. promoting microscopy to learners in schools,
4. attendance at microscopy conferences or workshops*.

*PLEASE NOTE: The MSSA Trust is now finally registered as a Public Benefit Organisation (PBO), unlike MSSA itself. While we have not yet received from SARS the rules under which we must operate, it is possible that at some point we may not be able fund travel or accommodation expenses. The Trust must thus be cautious. Please submit two versions of the budget part of the application: one quoting an overall figure, the other a detailed breakdown of the costing. In addition, it is important for the applicant to say in the application that they would give their gained knowledge to others on your return eg. give a lecture/seminar(s), hold a workshop, write articles based on what learned etc. No proof of this will be required by the Trust.

Applications must be by e-mail only to the Secretary of the Trust, Alan Hall at alan.hall@up.ac.za

DEADLINE for applications is Friday 25 September 2009.

Applications must contain all information considered relevant including:

a. letter of support from the head of department or supervisor,
b. CV of the person or persons involved,
c. details of the conference, workshop, event or project planned,
d. specific benefits to be obtained by the person(s),
e. say will give lecture(s)/seminar(s), hold a workshop, write article(s) on return,
f. detailed budget,
g. global budget figure as a separate document,
h. details of applications made or to be made to other funding sources and their response etc.

NOTE: Applications not containing all the required information and good motivations will not be considered. The Trust will not chase any missing information.

Depending on the size of the application, it is normally expected that that the Trust will only partially fund the total budget.

Hopefully all applicants will be notified by late October 2009 of the decision of the Trust. Successful applicants will be required to provide proof of attendance at the funded event or audited accounts when organizing events etc., write a detailed article on their attendance or event for the MSSA Newsletter. A presentation on what was learned/gained is expected at the scientific sessions or Technical Forum of the following MSSA conference.

Call for Proposal: 2010 Consortium Research Projects

In the past three years, the CHPC Flagship Project grants have provided the partnership framework to support the development of several noteworthy research projects (More information about the previous Flagship Projects). As the results of this fruitful partnership, the projects have made significant progress in fulfilling their research missions. In the 2010, the CHPC intends to leverage the expertise of our computational researchers in addressing a variety of scientific- and socio-economic challenges whose solution can be advanced with the utilisation of innovative HPC solution(s). Considering that the nature of these grand challenges can be highly intricate, their solutions may require a multifaceted range of expertise which may well be dispersed over different niche research groups within the country. Hence the objective of the Consortium Research Project is to provide a leveraging mechanism to harness collaboration between South African-based scientists and promote an exchange of knowledge amongst the members of our HPC communities. For more information, guideline and application form, please kindly refer to http://www.chpc.ac.za/research/flagships.php

Postdoctoral Scholar Position: WRF-CHEM Model Development

Professors Michael Kleeman and Shu-Hua Chen of the Atmospheric Science Graduate Group and

the Department of Civil and Environmental Engineering, University of California – Davis (USA) invite applications for a postdoctoral scholar with an interest in advanced model development within the framework of the Weather Research Forecast (WRF) model with Chemistry (CHEM). Qualified candidates will hold advanced degrees in Chemistry, Engineering, Atmospheric Science, or a related field with detailed knowledge of the WRF model and the techniques used to model pollutant concentration in the atmosphere. Knowledge of FORTRAN is required, with further knowledge of C and MPI programming desirable. The position will include opportunities for model development, model application, model verification, and documentation of results in peer-reviewed scientific journals. The position is available immediately with funding renewable annually, depending on performance, for at least the next 2 years.

Please send a copy of your CV to Mike Kleeman (mjkleeman@ucdavis.edu) by Oct 1, 2009 for full consideration.

Physics Comment Editorial Policy

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

1. The author(s) assures the material is original, his/her own work and is not under any legal restriction for publication online (e.g., previous copyright ownership).
2. The author allows PC to edit the work for clarity, presentation, including making appropriate hypermedia links within the work.
3. The author gives PC permission to publish the work and make it accessible in the Magazine's archives indefinitely after publication. The author may retain all other rights by requesting a copyright statement be placed on the work.
4. Authors should respect intellectual integrity by accrediting the author of any published work which is being quoted.

2009 Publication Deadlines

Physics Comment is published four times a year.

Issue	Closing Date	Publication Date
Issue 1	27 February 2009	16 March 2009
Issue 2	29 May 2009	15 June 2009
Issue 3	28 August 2009	14 September 2009
Issue 4	27 November 2009	14 December 2009

Specification and Submission of Content

1. 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.
2. Article types. The magazine is devoted to articles, reports, interesting facts, announcements and recent developments in several areas related to physics:
3. 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.
4. Re-use. The publisher reserves the right to reuse the printed piece in full or in part in other publications.
5. 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.
6. Style. AP style is followed for punctuation, capitalization, italics and quotations.
7. 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 its credibility could be enhanced by publishing a 40 word resume of the author. 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.