Physics Comment

A Southern African Physics Magazine

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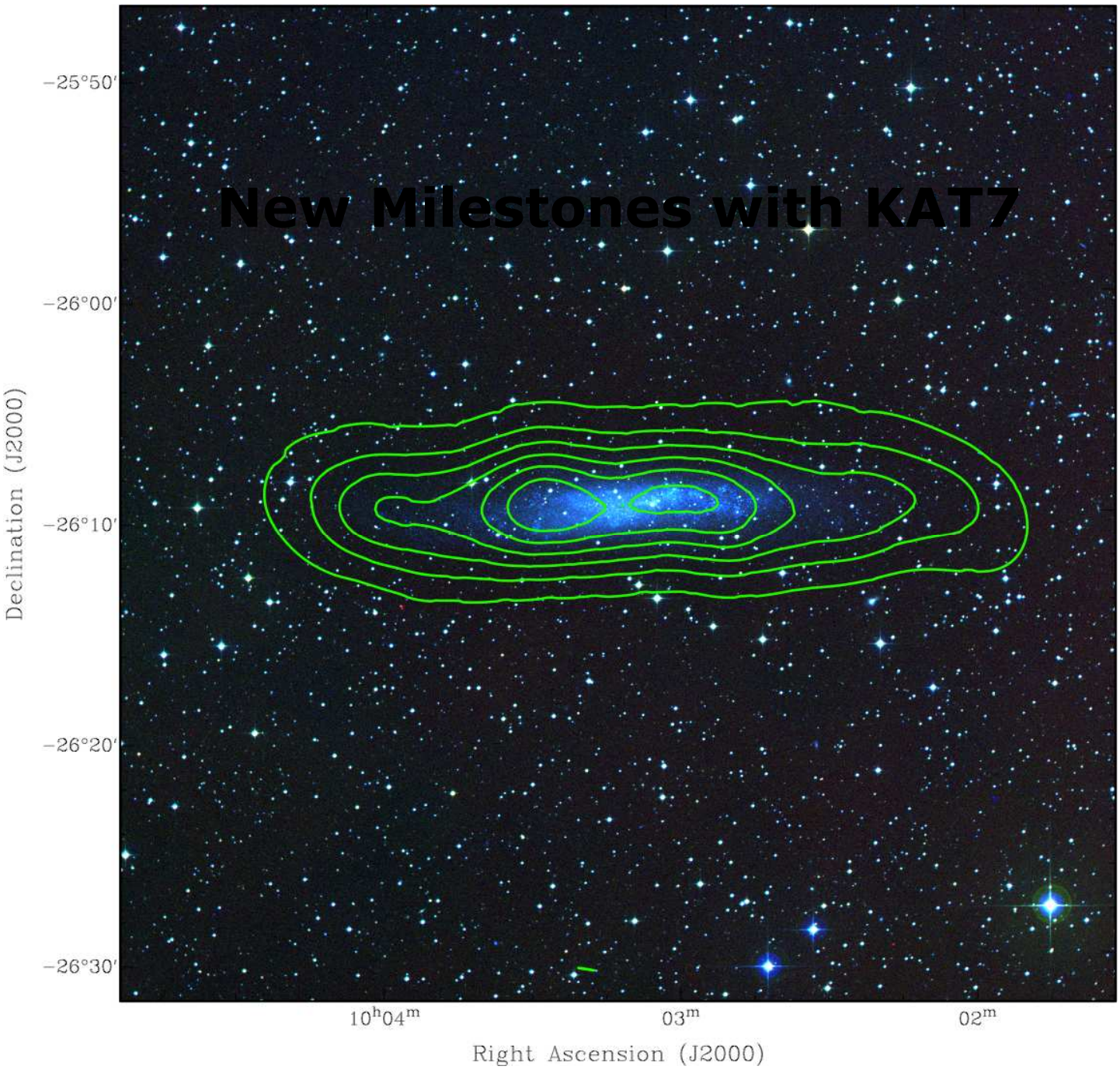

New Milestones with KAT7

Editor: Prof. Thomas Konrad

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Editor's Note

…and the exciting times continue; cp. my note inthe previous issue of *Physics Comment.*While the decision over the bid for the Square Kilometre Array (SKA) worth 2 billionUS $ is expected in April 2012, KAT-7 a precursor of the larger radio telescope array MeerKAT and a testing ground for the SKA yields once again exciting science and thus recommends the South African solution for the SKA. This news (cp. article on page 8) and the strong performance of South Africa in the competition with Australia made headlines in national newspapers and inspired SAIP to an official statement on page 7. What spin-offs one might expect from SKA is discussed by David B. Davidson, an engineer from Stellenbosch (pp. 10).

Apart from the thriller of the SKA bid, the South African Institute of Physics also makes news by entering new territory. Well prepared by the Physics Benchmark statement, SAIP is currently undertaking a review of physics training in South Africa in order to improve the standards of physics education in this country and thus increase the reputation as well as the job chances of young physicists. In order to document the endeavor, PC publishes a report by Edmund Zingu and Simon Connell (pp. 14) . An important step in this context would be the registration of SAIP as a professional body with SAQA, about which Simon Connell is reporting (pp. 16). I believe that this development sparks discussion among the membership and would like to invite you to write comments and thus use PC as a forum to make your voice heard.

I wish you an exciting read with this issue of PC!

With best wishes

Prof Thomas Konrad

Caption of picture on Front page: Hydrogen Distributiojn of galaxy NGC 3109 as observed by KAT7.

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

News from South Africa

Statement of the President of SAIP

Prof Simon H. Connell

"The South African Institute of Physics is very pleased to see the announcement of the scientific commissioning of a new and exciting mode of KAT-7 radio telescope, the precursor to the more powerful MeerKAT telescope now under construction. The first images represent high-resolution velocity measurements of hydrogen gas clouds within a nearby galaxy, which is a remarkable early achievement. Such measurements contribute to the most fundamental questions in physics, related to the existence of Dark Matter and possible new models for gravity. These are exciting times for physics and astronomy in South Africa. With the Southern African Large Telescope, the KAT-7 and MeerKAT arrays, the HESS facility in Namibia, and with our colleagues on the continent and around the world, Southern Africa has already achieved a multi-wavelength capability in astronomy that is world-class. We are grateful for the support our government has given to these endeavors. This has lead to a massive growth in globally competitive research capacity, which is in fact spreading throughout Africa. We look boldly to the future not only for the scientific results that will be achieved, but the overall public benefits from spin-off innovation and high level capacity building that these projects will continue to bring."

Bruker FTIR/Raman instrument installed at NMMU

By Japie Engelbrecht, Physics Department, NMMUPort Elizabeth

Author Biography: Prof Japie Engelbrecht is currently HoD of Physics at the NMMU, and has been doing infrared analysis of semiconducting materials for the past more than 20 years. He also serves as Honorary Treasurer of the SAIP, and chair of the Division for Physics of Condensed Matter and Materials.

The Physics Department at the NMMU recently acquired a Bruker 80 V FTIR/Raman system, following a NNEP award of> R 5 million from the NRF to Prof Japie Engelbrecht. The instrument has the following specifications: the sample compartment can be evacuated, the wavenumber range is 10 – 50,000 cm^{-1} (1,000 – 0.2 μm), it possesses a resolution of 0.2 cm^{-1}, and has a closed-cycle helium cryostat capable of cooling samples down to < 10 K. The instrument has both micro-FTIR and micro-Raman facilities. With these specifications, the instrument is currently the only one of its kind in the world.

The instrument was installed in December 2011.

Apart from the ongoing optical characterization of semiconducting materials, other projects entail assessment of proteins (Biochemistry), natural and synthetic fibres (CSIR), geological samples (Geology) and animal feedstock (Game Range Management).

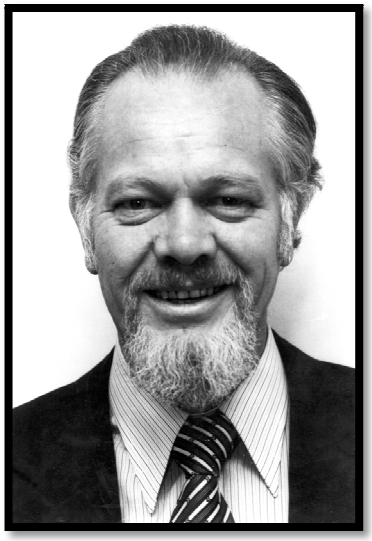
Prof Japie Engelbrecht and Ms Geneveve Deyzel busy analysing reflectance spectra of P-implanted SiC on the Bruker 80V instrument.

Caption: Cryostat fitted to sample compartment

For more information : Contact Prof Japie Engelbrecht (Japie.Engelbrecht@nmmu.ac.za) for more information about the Bruker 80 V FTIR/Raman system.

Orbituary – Dr John Vogel

By Siep Talma, Pretoria, South Africa and Ann Wintle, Cambridge, UK.



Johann Carl (John) Vogel (1932 – 2012)

The 1988 recipient of the SAIP de Beers gold medal, Dr John Vogel, passed away in January 2012 and with him South African science lost one of its great sons. He had the ability to adapt his knowledge of physics and chemistry to a wide range of environmental and archaeological problems.

John Vogel was born in Pretoria and studied at the University of Pretoria where he was professor in chemistry. He obtained a BSc in mathematics, applied mathematics, physics and chemistry and subsequently an MSc in chemistry, and an uncompleted MSc in physics as well, in 1955. He then moved to the University of Heidelberg, Germany, where he constructed a mass spectrometer for the analysis of the precise determinations of the isotope ratio of carbon dioxide. He obtained his doctorate in physics in 1959 with a thesis on the determination of carbon isotope fractionation factors. The study of isotope ratios in nature had taken off after World War II. At that time the emphasis was very much on the technology to do isotope analysis and on the development of the basic concepts of isotope fractionation in nature. In Heidelberg he also collaborated with K.O. Münnich on the development of the newly discovered technique of environmental radiocarbon. This required meticulous counting of CO_2 at extremely low backgrounds. Together they discovered the increase of ^{14}C in the atmosphere due to nuclear weapon testing in the 1950's and followed its effect into local vegetation. They also applied radiocarbon to the dating of groundwater and carbonate deposits and showed that realistic and useful information could be obtained.

In 1961 John was appointed to head of the radiocarbon dating laboratory in the physics department at the University of Groningen in the Netherlands. He upgraded the laboratory, built the special counters that were required and commissioned a (purchased) mass spectrometer. The ^{14}C activities were directed towards archaeological materials. He specialized in dating the Upper Palaeolithic period (older than 20 000 year) which required chemical purification methods and physical (low-level) analysis. The stable isotope research was directed to fractionation factors (the building blocks of the discipline), to hydrology for the identification of water types and to marine carbonates for source identification. When he left Groningen he was appointed to a chair in isotope geology for another six years to allow the university to use his services for another 6 years in order to prepare a successor.

In 1967 John relocated to South Africa in order to set up a brand-new laboratory at the CSIR in Pretoria.

A 25 m deep counting room was built to house ^{14}C and ^{3}H counters with very low backgrounds. Two mass spectrometers for ^{13}C, ^{18}O and D analysis were acquired and preparation lines constructed.

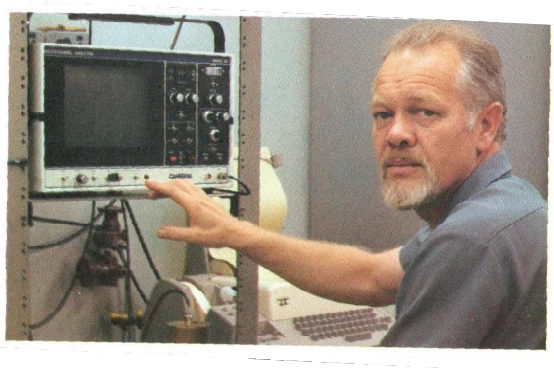
The main application of radiocarbon analysis was dating of archaeological material. John obtained the confidence of the local archaeologists. He visited their sites, discussed stratigraphy and sampling problems, and contributed intensively with the interpretation of the results. He meticulously maintained his three ^{14}C counters in Pretoria for this period and produced nearly 8000 high-precision, low-background ^{14}C results in the course of 30 years. Each of these required two days counting and many calibration samples in between. Virtually every ^{14}C date in southern Africa from this period was produced in John's laboratory and he developed an intimate knowledge of the local and worldwide archaeological scene, to such an extent that he was at various times part of the archaeological professional bodies, and, towards the end of his career, received various honours from them.

Already in 1972 the dates emanating from John's laboratory showed that modern man in southern Africa was much older (>40 000 years) than the same species in Europe and Asia. The paper announcing this in Nature could be called the first "Out of Africa" paper, a term which John had coined several years before it came into general usage. Since then, these results have been replicated from other sites and using other techniques. Since these great ages were beyond the range possible with ^{14}C, John investigated the local potential of other techniques that were being developed abroad. He set up small pilot laboratories in Pretoria for uranium series and luminescence dating and then encouraged visits from people with the relevant expertise to advise and to take samples to their own laboratories. The Middle Stone Age is now well dated through analyses done all over the world.

One of the briefs for the establishment of the isotope lab in Pretoria was to develop isotope applications for local groundwater. This proved to be particularly useful in arid areas as the Kalahari. Starting with surveys with ^{14}C and ^{18}O, he and others later unleashed a range of isotope techniques (chemistry, tritium, dissolved gases, radon, radium, uranium, etc.) on these aquifers and were able to show groundwater flow, arid zone recharge, denitrification, etc. Due to the efforts of the two isotope labs in Pretoria (CSIR) and Johannesburg (the former Schonland institute) isotope hydrology is now well established amongst local geohydrologists.

John has made a big impact on the use of ^{13}C and later ^{15}N in food chain studies. It all started with him growing maize in his German student room, to establish whether its ^{13}C fractionation was the same in Germany as in South Africa. He then grew C_3 and C_4 plants under variable carbon dioxide levels and produced a model that explained the carbon isotope fractionation during photosynthesis in 1980. In South Africa he followed this up with surveys of grasses across the entire sub-continent and isotope analysis of modern and old animal and human bone material. These studies led to publications in *Nature* in 1978, 1981, 1986 and 1990, and involved sites from all over southern Africa, as well as the Americas.The sub-continent is especially interesting for this purpose since both C_3 and C_4 grasses occur here and the wildlife consumes mixtures of grass and other plants. The variety of ^{13}C and ^{15}N signals that appear in archaeological material has been useful for palaeo-environmental reconstruction and these approaches have now become standard archaeological practice.

In the 1960 and 1970's John's laboratory got involved with some greenhouse issues. He surveyed (with collaborators) for ^{14}C in the southern Atlantic and Indian oceans surface water (and a few deep samples).



This team briefly set up an atmospheric CO_2 analysis system. These did not develop well. To run them effectively, collaboration with international programmes is essential and South African scientists were no longer popular abroad. John collaborations abroad were all on a personal basis.

By the time that he retired as head of QUADRU (Quaternary Dating Research Unit, CSIR) in 1997, John had published 212 papers in a wide range of international and national journals, where they have remained highly cited. After his retirement, he continued to write and a further 20 papers

appeared, with the latest in 2008. He also contributed to the activities of the University of the Third Age by presenting various courses on archaeology and arid zone geomorphology.

John Vogel's contributions to physics and archaeology have been recognised by a number of awards. He received the CSIR Merit award in 1986, the De Beers Gold Medal from the South African Institute of Physics in 1988, a medal of honour from the South African Academy of Arts and Science in 1988, a Certificate of Merit from the Southern African Association for the Advancement of Science in 2002and an honorary medal from the Association of South African Professional Archaeologists in 2009. He was a Fellow of the Royal Society of South Africa and an honorary member of the Southern Africa Society for Quaternary Studies, the Association of Southern African Professional Archaeologists and an honorary life fellow of the International Union for Quaternary Research. In 1998 he was awarded an honorary doctorate by the University of Cape Town.

John was a very private man, who sheltered behind an often prickly exterior. He was a born scientist and had many original ideas which he would fiercely defend. His pet hates were sloppy reasoning and bureaucracy, and those who practised it, crossed his path at their peril. However, those who got to know him and worked with him, felt privileged to have had the opportunity of being exposed to his breadth of knowledge and deep understanding of the physical processes behind the methods that he employed to build the bigger pictures in archaeology and environmental science. He was a very special man and will be missed by many, particularly by those who worked closely with him.

Physics 500

By Brian Masara (SAIP office, Pretoria)

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,
- Identify physicists working in South Africa,
- Use this information to promote physics,
- Promote collaboration between the SAIP and industry.

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

SA Physics Graduates Database

By Brian Masara (SAIP office, Pretoria)

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

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

http://graduates.saip.org.za/background.php

To register click here http://graduates.saip.org.za/register.php?action=new

For enquiries contact SAIP Office at info@saip.org.za

Extra-galactic milestones for South Africa's KAT-7 telescope

From Media release Issued by SKA South Africa Project Office

First atomic hydrogen spectral line images of a nearby galaxy

14 March 2012

South Africa's KAT-7 telescope, a seven-dish array which is a precursor to the much larger MeerKAT telescope in the Karoo and to the Square Kilometre Array, has reached another major milestone by observing the radio emission from the neutral hydrogen gas (HI) in a nearby galaxy. Hydrogen gas emits radio emission in a spectral line at a very specific frequency of 1420 MHz.

The astronomers pointed the telescope towards a galaxy called NGC 3109 - a small spiral galaxy, about 4.3 million light-years away from Earth, located in the constellation of Hydra. The observation allowed them to see the HI radio emission of this galaxy, as well as to see how this galaxy is moving. Where the gas is moving towards us, the frequency of the spectral line is Doppler-shifted upwards; where the gas is moving away, the frequency is shifted down. In this way, astronomers can map the way in which all of the gas in the galaxy is moving.

"These exciting results achieved by KAT-7 have given us confidence that we know how to build a cutting-edge radio telescope in Africa to answer some of the fundamental questions in radio astronomy", says Dr Bernie Fanaroff, director of SKA South Africa. "Our team in the SKA South Africa Project and universities has again shown that they can deliver cutting-edge technology and do excellent science on a very tight schedule."

"A large proportion of the science planned for the SKA - and MeerKAT - involves mapping of the universe using neutral hydrogen. Because of the ongoing expansion of the universe, distant galaxies are moving away from us. Measuring the frequency of the spectral line from neutral hydrogen in those galaxies allows us to work out how far away they are. By finding billions of distant galaxies, astronomers will be able to map the structure of the universe and how it has changed over time. This cosmic census of the neutral hydrogen in galaxies - far and near - is essential in understanding the deeper physics of the universe, by answering fundamental questions such as the nature of dark matter and dark energy."

"Observations of the neutral hydrogen content of galaxies also help to form a picture of how galaxies have evolved over cosmic time and show how our own galaxy, the spiral galaxy called the Milky Way, has developed," Fanaroff adds.

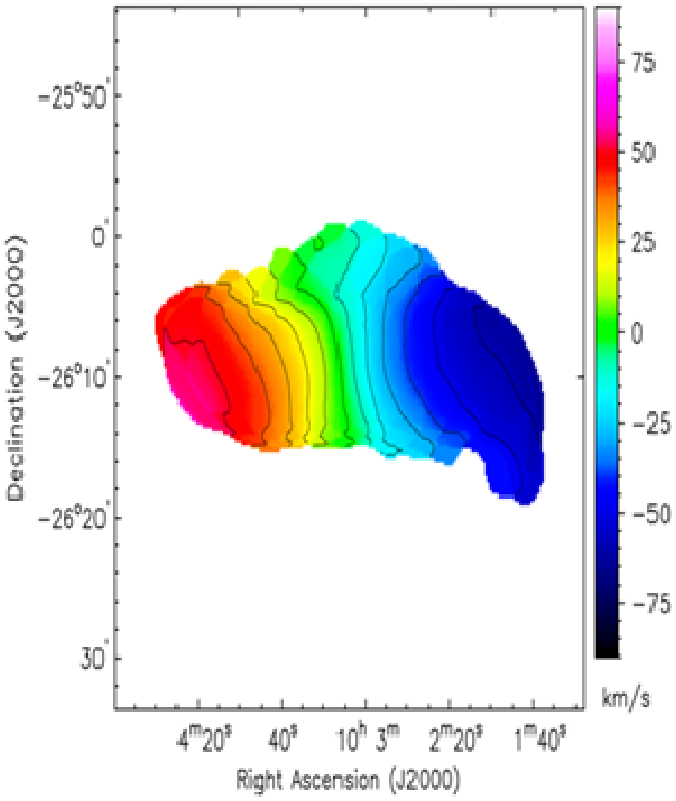
The radio waves which KAT-7 picks up from the galaxy were processed in the correlator, the first stage of computing. The correlator currently allows measurement of the gas velocity to an accuracy of 10 km/s. Further upgrades during 2012 will enable astronomers to study this galaxy with a velocity resolution of 1 km/s.

"Such a high velocity resolution will allow us to distinguish between the conventional models which suppose the presence of an important quantity of dark matter (matter that cannot be seen but that is detected by its gravitational influence) and the Modified Newtonian Dynamics (MOND) models which suppose that no dark matter is present but that it is instead the laws of gravity that change on galaxy scales," explains Prof Claude Carignan, South African SKA Research Chair in Multi-Wavelength Astronomy at the University of Cape Town (UCT).

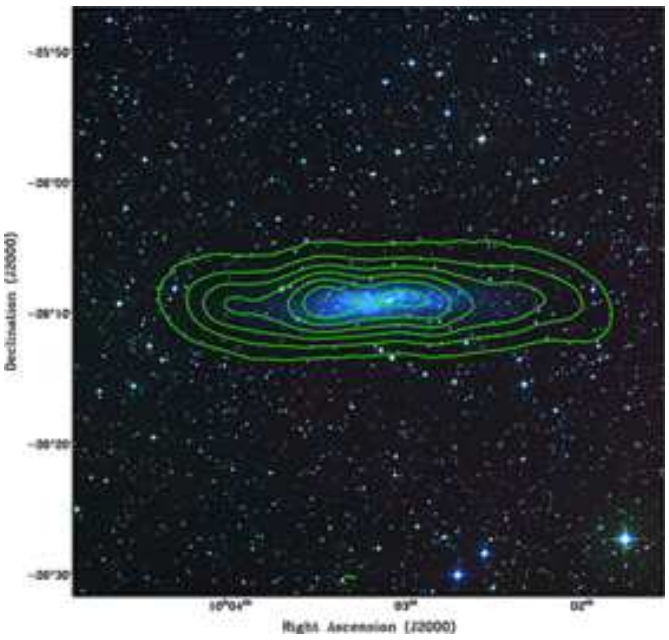
"We also speculate that an unusual warp in the disk of this galaxy could be caused by a tidal interaction with its dwarf companion galaxy known as Antlia," Carignan adds. "Future KAT-7

observations should reveal more information on this possible interaction."

"It is particularly exciting that we will soon be able to derive new scientific results with a relatively small precursor array," says Bradley Frank, PhD student at UCT and lead researcher for the HI imaging of nearby galaxies with KAT-7.



The green contours in this image show the distribution of the atomic hydrogen gas overlaid on an optical image of the same galaxy - showing clearly that the emissions from the hydrogen gas come from a much larger region than that seen by the optical image. (The Digital Sky Survey was produced at the Space Telescope Science Institute under US Government grant NAG W-2166. The images of these surveys are based on photographic data obtained using the Oschin Schmidt Telescope on Palomar Mountain and the UK Schmidt Telescope.) Download hi-res version



This image shows that the galaxy is rotating with the blue towards the viewer and the red away. The rotation is not uniform and the structure can be used by astronomers to model the distribution of matter in the galaxy. Current thinking is that most of the matter is actually dark matter, which can't be seen but whose presence can be confirmed by these kinds of observations. Download hi-res version

Notes for general understanding

Spectroscopy is one of the most important tools in astronomy. A spectral line is shifted in wavelength - by the Doppler Effect - by an amount which is proportional to the velocity of the emitting object. It shifts to a longer wavelength (lower frequency) if the emitting material is moving away from the observer and to a shorter wavelength if it is moving towards the observer. […]

Radio astronomers use a spectral line of atomic hydrogen, the simplest and most abundant element in the universe, to measure the rotation of galaxies and velocities. This line - with its rest wavelength at 21 cm - has given us important information on the expansion of the universe and on the motion of matter in some galaxies. This has led to the hypothesis that galaxies contain more matter than we can actually 'see' - termed 'dark matter'.

The spiral galaxy NGC 3109 was discovered by the English scientist John Herschel on March 24, 1835while he was doing astronomical research in South Africa.

Potential technological spin-offs from MeerKAT and the South African Square Kilometre Array bid

Commentary by David B. Davidson, Stellenbosch University

Reprinted with kind permission of the author from South African Journal of Sciences 2012;108(1/2), Art. #1050, 3 pages.

As this issue goes to press, the international Square Kilometre Array (SKA) Site Advisory Committee is considering South Africa and Australia's respective bids tohost the world's largest radio telescope, with an effective receiving area of one million square metres. First mooted in 1991,[1] the project is drawing increasingly close to realisation.

Following the 1996 White Paper on Science and Technology[2] which identified astronomy as an area of key geographical advantage (further reinforced in the 2002 National Research and Development Strategy), South Africa has been energetically pursuing major astronomy projects. The first such project was optical astronomy (SALT). Since the mid-2000s, the thrust has been in radio astronomy, initially with the KAT (Karoo Array Telescope) and now MeerKAT [3,4,5] ('more of KAT' inAfrikaans; also the name of the suricate, a member of the mongoose family found throughout the arid areas of southern Africa). The seven-dish KAT-7 array is in the science commissioning phase at present. Detailed technical plans for the 64-dish MeerKAT are almost finalised following successful completion of the concept design review in 2010 and preliminary design review in 2011. The budget has grown significantly – in 2006, R300 million was budgeted for the rest of the decade, afigure which has since increased several-fold as the project's scope has widened. (It should also be noted that building MeerKAT is independent of the success – or otherwise – of South Africa's bid to host the SKA).

MeerKAT (and South Africa's bid for the SKA) inevitably brings into question the continual conflict between 'big' and 'small' science. Although funding for especially applied research has increased significantly over the last few years, the South African science community is not lavishly funded by international standards, and the project (and indeed the favoured status of astronomy) has its critics.[5] Aside from the scientific aims of the project, it is important to understand that this forms part of the Department of Science and Technology's focus on mission-driven innovation, which was largely absent from South Africa during the 1990s. This followed the end of the key technology missions of the previous government, in particular military dominance of the sub-continent and energy self-sufficiency. The potential for technological spin-offs from South Africa's SKA project as a prime example of this form of innovation is the main thrust of this commentary.

It is instructive to consider previous technological spin-offs from earlier large technology-based missions around the world, noting that, at the time many of these were undertaken, these spin-

offs were serendipitous, rather than planned. As a first example, integrated circuits lie at the heart of almost all modern electronicdevices, from the ubiquitous cell phone and personal computer to most household entertainment devices and even 'white goods', such as refrigerators and washing machines. Integrated circuit technology was strongly driven by the US space and missile programmes of the 1960s; solder welds on discrete circuits (i.e. separate electronic components such as transistors and resistors) were a major source of failure in the harsh launch environment and fabricating all the components on asemiconductor substrate was a major advance, rapidly exploited commercially. More recently, the invention of the World Wide Web at CERN is an extraordinary example of how initially highly specialised technical requirements – in this case, making results of particle accelerator laboratories readily accessible to international team members – can ultimately revolutionise commerce in an entirely unplanned fashion. Presently, NASA's Jet Propulsion Laboratory is spinning off advances inrobotics pioneered for the exploration of other planets for medical projects such as robot-assisted microsurgery. Finally, it is interesting that Intel, the world's largest (by revenue) semiconductor chip maker, regards the SKA project as of particular importance in driving developments in very large scale computing.

In terms of MeerKAT, which is primarily an interferometric array, there are a number of technological challenges. (An interferometer is a device in which electromagnetic waves are superimposed in order to extract information about the waves. The earliest radio interferometers appeared just after World War II, in which interferometry was used to increase angular resolution of single targets. Subsequently, synthesis imaging was developed, whereby an array of antennas wasused to form high-resolution images of extended regions of the sky.) These challenges include: the design of the custom-made dishes and feeds themselves (which requires careful consideration of the interplay between electrical and mechanical design characteristics, as well as optimisation in a large design space); the design of reliable and power-efficient cryo-coolers for the cold 'front end' (the front end comprises the receiving element or feed, often a horn, and the low noise amplifier,which sit at the focus of the dish); the digital back end, in particular the correlators, which multiply and integrate the digitised signals from each baseline (pair of antennas) and which have to operate at very high data rates; the data reduction computers, which form images from the correlated data using sophisticated image processing algorithms; and mitigation of radio frequency interference, to ensure that the very weak cosmic radio signals are not drowned out by either interference-caused off-site (e.g. by farming activities) or by noisy electrical or electronic elements in the system itself. There are other major engineering challenges relating to the infrastructure: the provision of power to the remote locations of both the South African site and – even more so – the Australian site is a non-trivial problem, where 'green', non-noisy solutions could assist; and a significant part of MeerKAT's budget has been spent on upgrading roads, extending power lines and laying fibre-optic cables to the middle of the Karoo. The MeerKAT project has had to address all these topics.

Source: South African SKA project

The offset Gregorian MeerKAT antenna, including the four-receiver indexer that will permit different feeds to be rotated to the focal point, allowing different frequency bands to be covered.

In terms of the dishes and feeds, KAT-7 focused on a tried and tested antenna topology – a prime-focus parabolic dish – but the antenna used novel constructiontechniques. The basic dish is of composite resin

construction, and is moulded on-site in the Karoo. A metal mesh is embedded within the resin to make the dish electromagnetically reflective. MeerKAT uses a more ambitious offset Gregorian configuration, with a large main reflector, smaller sub-reflector and feed. Stellenbosch-based company EMSS Antennas are the main contractors on the electromagnetic design of the antenna, and the company has grown significantly aswork on the project has expanded, also developing expertise in cryogenics. This company has already demonstrated an ability to commercialise innovation via a project (not directly related to MeerKAT) to develop and market an electromagnetic field sensor; this sensor is readily being adopted by cellular providers to assist personnel servicing base stations to comply with safety standards. It should also be noted that computer simulation plays a major role in the design of modernantennas, and issues identified during simulation of KAT and MeerKAT have already fed back into research and development on future features for FEKO, a leading international computational electromagnetics code produced by sister company EMSS-SA. (FEKO was widely used in the design of the antennas.) Much of the work on both antennas and computational electromagnetics is undertaken in close collaboration with Stellenbosch University. The mechanical expertise on the KAT-7dishes has been sourced from two companies – BAE Systems Dynamics (SA) and MMS Technology, with the former being the prime contractor for all antenna construction and the latter undertaking all design and fabrication of the composite reflector structures. Techniques developed here may find application in areas where large dishes are needed in geographically remote areas.

Data processing is a major issue with such large interferometric arrays. In the planned 64-dish MeerKAT, the initial pre-correlator data rate of several Tbps (10^{12} bits per second) will be reduced to just over 100 Gbps (10^{9} bits per second) in the online system, before calibration and imaging reduces this to rates of sub-Gbps. These data rates can be handled with present technology. However, current indications are that SKA will require initial computation rates in the ExaFLOPs range (10^{18} floating point operations per second). The very high data rates are a result of the much larger number of baselines, which scale with the square of the number of antennas. The fastest existing computers worldwide are presently capable of peak operational performance in the order of several PetaFLOPs (10^{15} floating pointoperations per second). It is not presently clear whether an ExaFLOP system is technically feasible; nonetheless, research is already in progress towards this goal. (In particular, there are major and presently unsolved issues with thermal dissipation for such putative systems.) The current era in large-scale computing has been dubbed 'the era of big data' and solutions sought for SKA will have spin-offs in other fields where very large data sets must be processed, transmitted and thenmined for new science. The KAT office in Pinelands (the main engineering office of the SA-SKA project) has a particularly strong focus on digital signal processing (DSP) for the digital back-end (DBE). The workhorse is the ROACH (Reconfigurable Open Architecture Computing Hardware) board, developed locally in collaboration with internationalorganisations and also with the close involvement of the University of Cape Town. This board uses state-of-the-art computing for the high-speed real-time computations required in the DBE systems. The board is based on a field programmable gate array (FPGA). An FPGA provides high-speed parallel computation with moderate power usage. Embedded real-time DSP has many applications, for instance in radar systems such as ground penetrating radars used for the detection ofburied pipes during construction work, and collision avoidance radars under investigation for motor vehicles. ROACH-board technology may well be one of the first candidates for a new spin-off development.

As outlined above, processing of 'big data' requires very high speed computing, and, recently, grants for two research projects on high-performance computing in support of MeerKAT were awarded to groups at Stellenbosch University and University of Cape Town (the author is principal investigator on one of these).

The planning for MeerKAT has been characterised by paying particularly careful attention to the radio quietness of the site. Whilst the MeerKAT site has been lauded for its radio quietness (Vodacom has even engineered special antennas to place a deep null in the direction of the site for its base stations in the site's proximity), electromagnetic noise generated by the on-site electronics (power and switching systems, digitisers, cryocoolers, correlators, etc.) poses a

significant challenge, as doesprotection of the equipment from lightning. This general field is known as electromagnetic compatibility (EMC) and MESA Solutions, based in Stellenbosch, has been actively involved with the KAT office and subcontractors in developing both an understanding of the EMC issues and providing solutions based on an extensive on-site measurement campaign backed by careful laboratory and computer simulation work. EMC is a major issue in the design on contemporary electronics – productssold into the EU, for instance, have to pass stringent acceptance tests – and the massive open-air laboratory of the MeerKAT site has led to very advanced work in this field which can be expected to spill over almost immediately into industry.

It is important to note that right from the start, SA-SKA was not just conceived as an engineering project, but had a very strong human capital development programme; clearly lessons were learned from criticism of the SALT project which was perceived as focused almost entirely on building a telescope. To date, close on 400 students have been supported at tertiary level (including 22 postdoctoral fellows). At the top level of this pyramid, five earmarked SA-SKA research chairs are inplace.

Also noteworthy are new initiatives in radio astronomy which are not directly linked to the SKA site bid, but have resulted from the high level of activity in thisfield at present. In particular, there is a proposal to develop an African Very Long Baseline Interferometry (VLBI) Network. This network intends recycling recently decommissioned telecommunications dishes (many of which are quite large, 32-m diameters being common) across Africa. A pilot study is underway in Ghana at present. The potential for adding significant technical value locally is exceptionally attractive in the context of the African continent. Of the students supportedin the Human Capital Development programme, 48 (of a total of about 400) were from other African countries, so the required technical skills are already under development.

In conclusion, the South African SKA programme has the potential to be a compelling example of mission-driven technological innovation. This potential is in addition to the obvious excitement of building what will be one of the world's most sensitive radio telescopes in the shape of MeerKAT, with an excellent view of the southern skies, and the resulting new science one can expect. The SKA programme has already educated a new generation of highly skilled scientists and engineersin the science of radio astronomy and associated fields of engineering, and will continue to do so. As outlined in this commentary, there is every reason to expect significant technological spin-offs in the near, medium and long term and the project enjoys the strongest support at ministerial level. Special mention should be made of the plenary address by Minister Naledi Pandor at the July 2011 SKA Forum in Banff, where she not only very strongly supported the South African bid for SKA, butgave one of the most eloquent addresses at the conference in support of the entire SKA project. Whether South Africa eventually hosts all, some, or none of the SKA, thetechnical footprint of this project promises to be deep and long lasting.

Acknowledgements

This commentary has been influenced by many discussions with engineers and scientists in this field which have taken place over a number of years. I would specifically like to acknowledge Prof. H.C. Reader (SU), Francois Kapp (KAT office) and DrIsakTheron (EMSS Antennas) for their reviews of the draft and Willem Esterhuyse (KAT office) for the technical drawing of the MeerKAT antenna.

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Status on Review of Physics Training in South Africa

By Edmund Zingu, SAIP Chairperson Management and Policy Committee -*Review of Physics Training in SA* & Simon Connell, SAIP President

History of the Project:

This very important project was born during the Heads of Physics Departments meeting at the Polokwane SAIP Annual Conference on July 2008 out of the concerns for the poor quality of the entering students and their inability to master physics of an appropriate standard. After lengthy discussions, the meeting adopted a proposal for a high level evaluation of the tertiary Physics undergraduate programmes. The new review would exhibit the features of wide ranging and adequate consultation to maintain the unanimous commitment of all Universities. It was therefore extensively modelled on the very successful review "Shaping the Future of Physics".

Aims

1. To develop a set of standards for Physics training in South Africa. The set of standards will be known as the South African Physics Benchmark Statement.
2. To assess the levels of commonality and diversity of the Physics programmes.
3. To assess the range, scope and effectiveness of current teaching and learning practices in Physics at Universities with reference to the following:
    a. Student preparedness
    b. Student performance
    c. Student support
    d. Relevance of core curriculum to students and employers
    e. Effectiveness of internal processes for periodic curriculum review
    f. Staff teaching loads
    g. Quality and excellence in teaching, including innovative teaching
    h. Monitoring of student progress
4. To assess the impact of the high school training in physics and mathematics on the preparedness of students in physics at university
5. The process of reviewing the physics programmes will include a review by an International Panel of Physics Education experts to assess the physics curricula and teaching thereof.
6. To develop a set of recommendations which would have the effect of improving the effectiveness of physics teaching at the universities

Implementation – Development of the SA Physics Benchmark Statement

Following a process of continual consultation, a rather mature version of the SA Physics Benchmark Statement was developed. This version was discussed at a meeting of Heads of Department (or their representatives) on 21st September 2011. An amending version resulting from this meeting has been sent to all Heads of Department for written endorsement.

It has been decided by the Management and Policy Committee to delay the finalization of the SA Physics benchmark Statement until the review process to be conducted by the Council on Higher Education (CHE) has been endorsed and its scope clarified.

Implementation – Review Section

The details of the Assessment and Review processes which were originally envisaged in the History section above(Aims 2- 5) were initially not determined. However, concurrent to our development of the SA Physics Benchmark Statement, there have been several synchronous developments, which impact on the implementation of the review section of this project.

The HEQF Act in 2007, which was effected in 2009, took standard setting from the South African Qualifications Authority (SAQA) to the CHE which includes the HEQC and has essentially four responsibilities:

- To promote quality assurance in higher education
- To audit the quality assurance mechanisms of institutions of higher education
- To accredit programmes of higher education
- To generate and set standards for all higher education qualifications

Accordingly, the CHE are now engaged in a process (to finish in 2014)tore-accredit all qualifications. The new Quality Assurance (QA) process has already started.

The Review of Physics Training falls within the ambit of the CHE's responsibility and the CHE/HEQC has experience and infrastructure to undertake reviews and audits. National reviews are specialized type of accreditation exercises focusing on learning programmes in a particular disciplinary or subject area. Such exercises are usually carried out using specific criteria developed by specialists and peers, and commented on by stakeholders and institutions which offer the programmes. Examples of national reviews are the 2003 Master of Business Administration (MBA) programmes review and the 2006/7 review of various training programmes in Education.

It has already been mentioned above that the CHE was aware of and welcomed the SAIP initiative to develop of the SA Physics Benchmark Statement. There is already considerable progress towards this goal. The CHE has expressed its willingness to partner with the SAIP. Considering the special features of the BSc (Physics) program, the CHE sees this review as a pilot project. For example, the scope of the Physics profession is not defined by a particular career, as in the examples of the MBA and Education programmes discussed above. The CHE and the MPC have begun discussions on a review of physics in South Africa with emphasis on the undergraduate programmes that is similar (but somewhat) different. Unlike the national reviews which usually follow a strict set of generic criteria which had been developed for programme reviews, the proposed review of physics training requires that the scope, criteria and purpose of the review be well defined by the physics community and be guided by the benchmark statement for physics which has been developed by representatives of the physics community.

The CHE is conscious of the fact that the physics review is intended to be developmental and not punitive. Towards this end various consultations with the broader physics community will be held shortly.

The CHE usually acts as an independent entity and will be setting up new structures of physicists to undertake the various tasks. All physicists are encouraged to participate in the process to ensure that the objectives as defined by the physicists are achieved.

Our Benchmark Statement is helpful. The CHE are aware the UK system has a similar document. If the review process for Physics goes well, it will help the CHE with identifying a new process for the review of disciplines which are not defined by a well defined career. The CHE are developing a broad process document on how they would conduct such a review.

The possible registration of the SAIP as a Professional Body with SAQA and what is happening at the CHE with Physics is complimentary and important.

Consider that the Engineering Council of SA (ECSA) has been working closely with CHE in standard setting, and they are already Professional Body with a Professional Designation. In the case of Engineering, ECSA has acquired some delegated authority from the CHE (although the CHE still has the ultimate authority).

We appeal to physicists to continue to participate in this process.

SAIP – Quo Vadis?

Should we develop a significant new capacity ?

Embracing a new and enhanced role for the "Physicist" Profession

By Simon Connel, SAIP President for Council

On the 3rd of May, 2011, the Minister of Higher Education and Training (DHET), Dr Blade Nzimande, addressed a large gathering of the representatives of many Professional Bodies. He issued a challenge to us all, in respect of developing a partnership with his Department, to contribute in a fundamentally new way to the development of the health of our professions and to increase access, provisioning and success of training. It was clear to us that the foundations of this meeting were deeply laid a long time ago. There had been extensive research, planning, development of legislation, innovation and development of capacity to roll-out the new strategy - the time was now ripe to involve the Professional Bodies in an exciting new way.

The SAIP saw many advantages to this new partnership. At that stage, and indeed until very recently, it had not appeared that any change to our Institution would be required. We found that our thinking already resonated almost completely with the Minister's project. Our recent trajectory of growth since the successful exercise, "Shaping the Future of Physics", as well as the transformation of our Constitution and By-Laws has led to many new programmes and capabilities where we were already well placed for the requested partnership. We decided to put the SAIP forward as a "pilot" Professional Body for recognition with the South African Qualifications Authority (SAQA). It was clear this was the key that would unleash dramatic additional opportunities and roles in line with the direction our membership had embarked on for our Institute, following the "Shaping the Future of Physics" exercise and the Constitutional transformation projects.

The project will affect you

Please bear with Council and study how the process unfolds, and how it could develop, as we will need our full membership to apply their minds and participate in a decision, as to how we may take advantage of the possibilities that are now open for us. In what follows, the "members' area" of the SAIP www-site will carry a full archive of all documents discussed.

The recent history

Back to the beginning. We present a very selective summary of the many documents and discussions since the Minister's "game-changing" speech of the 3rd of May 2011.

The definition of a Professional Body is deliberately widened and specifically, the SAIP now falls solidly within this definition. A Professional Body (PB) is :

- a group of people in a specific regulated occupation, who, secondly,
- are entrusted with maintaining control or oversight of the legitimate practice of the occupation, and, thirdly,
- have a significant influence on education linked to the professions, and fourthly
- have the final say as to who it will register as one of its own and who it will reject, and fifthly,
- the definition includes non-statutory as well as statutory organizations, existing to further a particular profession and to protect members of the public as well as the interests of its own members (ref: Harvey and Mason in 1995).

The DHET seeks to partner with PBs as follows :

- promote a massive enhancement of the development of skills without compromising quality (contribute to the National Skills Development Strategy III)
- PBs would form a vital part of the data gathering on the supply of and demand for skills.
- PBs would play a role at broadening both access to and sites of training.
- PBs would acquire / develop their role in standard setting, programme accreditation and professional registration.

This means that PBs could have an enhanced role in contributing to delivery with regard to the National Skills Development Strategy III – in practice PBs would have more powers, responsibilities and relevance. They would attract funding and need therefore a recognition process and regulation.

SAQA has from now on a new role (NQF Act of 2008) to recognise Professional Bodies and register professional designations. This is an evolving area, and PBs are invited to partner with the DHET in exploring it.

SAQA conducted a National Roadshow to discuss implementation with the PBs. Their document, "Policy and Criteria for recognising a professional body and registering a professional designation for the purposes of the National Qualifications Framework Act of 2008" of 26 March 2011 explained the criteria for PB recognition and professional designation registration. Council discussed the matter on several occasions in late 2011. It was the consensus of the members of Council that the existing formally established properties of the SAIP (its Constitution, Mission, Vision, projects, etc.) fully qualified it as a PB in close congruence with the intentions of the Minister without requiring any changes. It was made clear that this was an important new direction, which was required in order to contribute in this area and remain relevant.

The indications are that the goals of the SAIP would be better served by developing this partnership. The increased amount of work to be done came with the promise of funding for increased capacity.

There was explicit reference to the opportunities for funding via the Sector Education and Training Authorities (SETAs), which, in some instances, have significant resources to support such initiatives. In fact, the partnership between the DHET and the PBs as regulated via recognition was an important mechanism that would enable the SETAs to properly participate in the funding in order to achieve the aims of the National Skills Development Strategy III. Ultimately, Council sees this as a potentially important aspect in its plan for long term financial sustainability in its capacity to deliver member benefits, protect the health of the discipline, build the profession and ultimately be the "Voice of Physics". A significant purpose of seeking PB recognition is to participate effectively in issues of quality within the NQF. Consequently, Council decided that it would go so far as to attempt to win a position as one of the PBs that would participate in the early recognition "pilot phase", which would assist in the development of the process itself.

The SAIP Executive Office took the lead in preparing the documentation, which was submitted by the deadline of 15th August 2011. Council is very pleased to report that the SAIP was selected as one of ten PBs from a field of seventy four. We are further pleased to report that the SAIP

Constitution was singled out for praise as being exceptionally well crafted and this was an important factor in this selection. The next phase involved regular consultation with a team of SAQA officials, as we discussed the process and honed our application together. Council valued the opportunity to participate in the project so closely. The SAIP was recommended for recognition as a PB in the Government Gazette number 34950 of the 20th January 2012 on page 12 as Notice 41.

Enter – The Professional Designation

The purpose of the "pilot phase" was to tease out areas for further attention, and indeed, attention was sharpened in the clarification of the "Designation" requirement for recognition as a PB. Initially, Council had posited its membership status "Mem. SAIP" as the SAIP designation. It now became clear that a membership category could not constitute a designation. Formal notification of this was sent from SAQA to SAIP on the 7th February 2012. A designation should exhibit a system of Continuous Professional Development (CPD). In more detail, the Designation:

- must be characterized by standards,
- must be related to the profession, be regularly scrutinized and have measurable performance indicators,
- must be acquired and retained or maintained - reflecting standards that one needs to comply with,
- is different to recognition of a supreme achievement,
- it must avoid generalities although these can be a voluntary aspect of membership,
- a designation can be removed, for example, if the individual is not sufficiently active whereas a membership category cannot be removed under this circumstance.

The SAIP considered the examples of its sister bodies in Canada and the UK, which exhibit a professional designation. There have also been discussions with the South African Chemistry Institute (SACI), which will soon be seeking PB recognition. The SAIP considered its relationship with the South African Council of Natural Scientific Professions (SACNASP). The SACNASP is the statutory regulatory body for all Natural Sciences. Several meetings were held to discuss these developments which have led to a closer relationship between the two organizations.

SAQA required the SAIP Council to submit a draft designation for registration in order to maintain its status as a participant in the pilot phase of recognition. SAQA have accepted that the issue of a designation is sufficiently new and significant that the SAIP Council now need to take the whole process, including the designation issue, back to its membership. Accordingly, the SAIP Council submitted the proposed provisional designation, Professional Physicist, to SAQA for consideration during the pilot phase. The full details of the designation are also in the SAIP "members area".

At the most recent SAQA Board Meeting in March, the Board resolved to first finalize amendments to the policy and criteria taking into account the insights gained during the pilot phase. The SAQA has now opened the process to all professional bodies applying for recognition for the purpose of the NQF Act, Act 67 of 2008.

According to our most recent discussions with SAQA officials the SAIP can have every expectation that its application to be recognised as a PB will be favourably considered as soon as the SAIP Professional Designation System is implemented. The idea of an initial registration with the provisional designation has been laid aside, and the SAIP can now follow due process and

consult with the membership, finalise the professional designation and submit this to SAQA.

We can all participate in the consultative debate process

Council proposes the following process, as the SAIP members debate the SAIP PB recognition and the professional designation registration.

1. Use of e-mail, Physics Comment and the Forum Area of the SAIP website to inform the membership of this process and to conduct part of the debate within the Institute electronically.
2. Further details to be made available on the SAIP web pages.
3. Opportunity for discussion by members in Physics Comment.
4. The matter to be aired at the AGM (SAIP 2012).
5. The matter to be discussed further by e-mail, Physics Comment and the Forum Area.
6. The matter to be finalized as an amendment to the Constitution in respect of the Professional Physicist designation, three months before the SAIP AGM of 2013.
7. The matter to be put to the vote at the SAIP AGM of 2013.

We begin this process with this Physics Comment article. Students should please feel welcome to participate in the consultative process. Although they do not have voting rights at the AGM, it is expected that they will normally soon become fully enfranchised SAIP members. They already have representation on Council, and these matters are crucial to their future too. We look forward to your participation.

Comment by the editor: **A discussion forum can also be found on the following SAIP website under members only section, click the link below**:

Step 1: Login on the SAIP website.

Step 2: Paste this link in your browser address:

https://www.saip.org.za/index.php/forum/9-membership-matters/14-saqa-registration-as-a-professional-body

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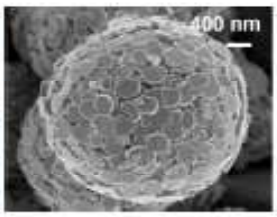

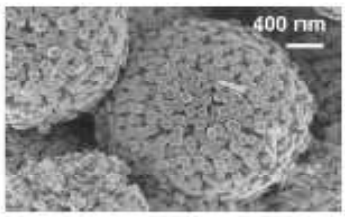

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Contact Prof. Pavel Selyshchev now at selyshchev@gmail.com

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A full-time Post-Doctoral Fellowship (bursary) is available for radio astronomy research, based at HartRAO. The term of the fellowship is one year, renewable for up to two further years subject to satisfactory performance, research output and the availability of funds. The value of the bursary is R250000 per annum. This is not taxable provided South African Revenue Service (SARS) criteria are met. The primary purpose of the fellowship is to support the Fellow's research, but up to 12 hours per week of support of facility activities may be required.

Click here for more details and how to apply
http://www.saip.org.za/images/stories/documents/Opportunities/Advert_Post_-doctoral_fellow

Upcoming Conferences & Schools

SAIP2012 Annual Conference

Abstract submission and registration is now open for the 57th Annual Conference of the SA Institute of Physics which will be held from 9 -13 July 2012. The 57th SAIP Conference will be hosted by the University of Pretoria on the main campus.

1) Donwload the Call for Abstracts at

http://indico.saip.org.za/getFile.py/access?resId=1&materialId=0&confId=14

2) To register and submit your abstract visit the SAIP 2012 website at
http://indico.saip.org.za/conferenceDisplay.py?confId=14

Gravitational Wave Astronomy Workshop May 2012

The South African Institute of Physics (SAIP) in collaboration with international partners will be hosting a workshop to promote Gravitational Wave Astronomy in Africa. **Travel and accommodation will be funded, limited places available hence register now!**

http://indico.saip.org.za/conferenceDisplay.py?confId=20

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We are pleased to organize the "6th International Conference on the Frontiers of Plasma Physics and Technology" in Gaborone, Botswanaduring 4-8 March 2013. This is the sixth conference in the series and the earlier conferences were held in India (Bangalore-2002 and Goa-2005), Thailand (Bangkok-2007), Nepal (Kathmandu-2009) and Singapore (2011). Success of the preceding conferences has given us a deeper satisfaction and encouraged us to move beyond the borders of Asia and establish an alliance with African countries.

Emphasis of the conference will be on all the frontiertopics of plasma physics and technologies, and classified in the following three categories but not limited to.

1. Fundamental plasmas: Advances in plasma sources, plasma diagnostics, astrophysical, cosmic and space plasmas, condensed and extreme state matter, high energy density matter, laboratory astrophysical, planetary, supernova, turbulent plasmas, etc.

2. Innovative trends in Applications and Technologies: Advances in particle /photon acceleration, Lasers, Nanotechnologies, Novel radiation sources and applications in Biology, Chemistry, Environment, Health, Industries, Safety, etc.

3. Advances in Nuclear Energy: Development of ultra-laser pulses, Laser-plasma interaction, Magnetically confined plasmas, Inertial fusion plasmas, Nuclear physics under transient state, Recent progress in Fusion studies, Target and reactor physics, Unconventional energy sources, Z pinch, Hybrid (fission plus fusion) reactors etc.

Some of the confirmed speakers include; Beg F. (USA), Borghesi M. (UK), Cvelbar U. (Slovenia), Deutsch C. (France), Fedosejevs R. (Canada), Fortov V. (Russia), Fryxell B. (USA), Gericke D. (UK), Hoffmann D. (Germany), Jain P.K.(Botswana), Jaroszynski D. (UK), Jean Paul-Perin (France), Kong H.J. (Korea), Malka V. (France), Mckenna P. (UK), Mendonca J.T. (Portugal), Mulser P. (Germany), Murakami M. (Japan), Neely D. (UK), Ozaki. T. (Canada), Patel P. (USA), Pegoraro F. (Italy), Perlado M. (Spain), Riconda C. (France), Sakagami H. (Japan), Sharkov B. (Germany), Soto L. (Chile), Stehle C. (France), Ulrich A. (Germany), Oost V. G. (Belgium), Varandas C. (Portugal), Walter R. (USA), Wintner E.(Austria), Zvorykin V. (Russia) etc.

We cordially invite all the researchers working in the above and related topics to participate in

the conference. For scientific information please contact Tara Desai on: fppt@fppt-series.com or P.K.Jain jainpk@mopipi.ub.bw

WorldWide Telescope (WWT) workshop at SAAO

South African Astronomical Observatory (SAAO) and the IAU Office of Astronomy for Development (OAD) welcome you to a novel astronomy experience using Microsoft Research's WorldWide Telescope (WWT). WWT is a virtual telescope that is designed to enhance your experience in astronomical research and science education.

This hands-on workshop will focus on using the WorldWide Telescope to review very large astronomical databases and image collections. One of WWTs unique feature is tour-making which can be trivially adapted to develop class curricula for universities and schools.

We will provide a hands-on environment to jump start new users, but also have enough for existing users in terms of possibilities in research and education. We would also like to learn from you about desired future improvements of WWT.
With astronomy data growing beyond terabytes and hundreds of millions of lines, astro-informatics has become an important component of modern astronomy. We will also introduce astro-informatics.
If you would like to attend please register via the online form and watch this space for updates. For further information contact Sudhanshu Barway or Kevin Govender.
Registration is free but will go through a selection process as spots are limited.

Workshop Venue - South African Astronomical Observatory (SAAO) auditorium
Workshop Date - 18-19 April 2012

For details please visit following url -
http://www.astronomyfordevelopment.org/index.php/oadprojects/wwtworkshop

World Conference on Physics Education 2012

The World Conference on Physics Education will be held in Istanbul, Turkey in July 2012. The conference is aimed at physics educators, teachers, researchers, and policy makers. For further information please visit their website at: http://www.wcpe2012.org/

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For more information visit http://africanschoolofphysics.web.cern.ch/africanschoolofphysics/

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For more information, online registration and abstracts submission please visit

Deadline for submissions for the June 2012 issue of Physics Comment is 31 May2012

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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.

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

Specification and Submission of Content

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

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

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

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

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

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

Categories of Content Contributions

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

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

Advertorials: Advertorials could be published when supplied by the client. We recommend a maximum of 500 words plus one or two pictures for maximum impact. A PDF file of the laid out advertorial should be emailed by the client along with an MS Word file of the text and separate image files

of the pictures. It is the client's responsibility to ensure that the advertorial is correct as it is in fact a paid for advert page.

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

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

Submission of Articles

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