Physics Comment

A Southern African Physics Magazine

Vol. 3, Issue 1, March 2011

http://www.saip.org.za/PhysicsComment
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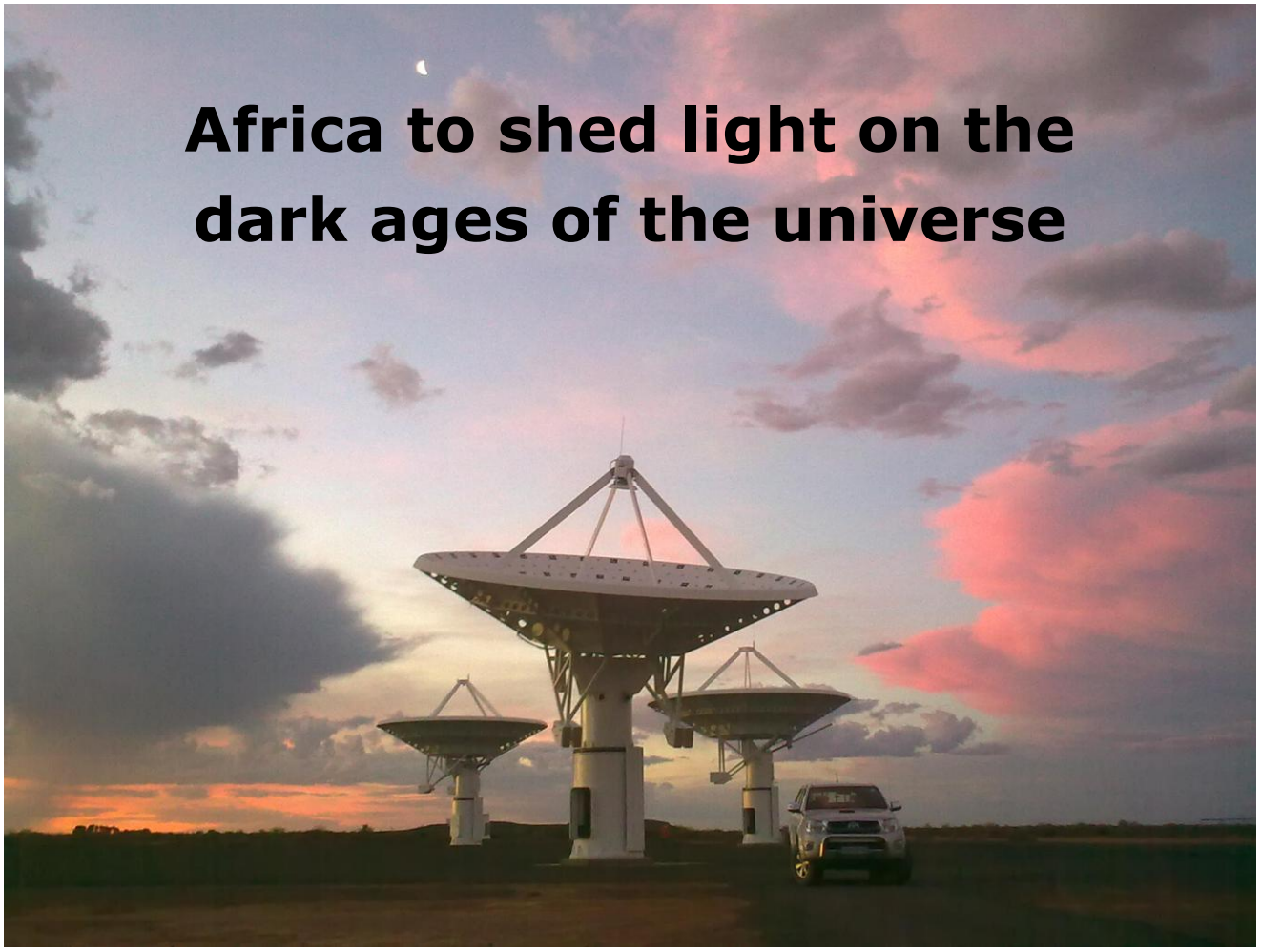

Image Credit: MeerKAT

Acting Editor: Prof. Thomas Konrad

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published by the South African Institute of Physics

Editor's Note

I am very pleased to be given the possibility to work as acting editor of Physics Comment (PC); let me take the opportunity to send my regards to the South African Physics community. SAIP is still looking to fill the position of the editor of PC, so please be encouraged to apply, if you wish to contribute to shaping South African Physics and want your voice to be heard. Talking about South African Physics, I think the contributions in this issue of Physics Comment show once more that there is a lot of innovative potential in this country. We report on South Africa's bid for the Square Kilometre Array (SKA) which goes into its hot phase - the decision whether this unique opportunity to advance technology and astronomy will come to South Africa or Australia and New Zealand, is expected at the end of 2011. The current issue of our journal contains a brief overview of the SKA project titled "Africa to shed light on the dark ages" on page 6 and a more detailed article on the subject under the title "*Mega Telescope on the African Horizon"* (pp. 14). An article by Dr Joh Hansen describes his invention of an electric drum, which uses the energy of the drummer to power a synthesiser. Dr Hansen is a musician himself and told me that it sounds fantastic. The article shows how versatile and applied Physics can be. I also would like to draw your attention to the section *Upcoming Conferences & Schools*, where you can find articles describing some fascinating meetings, among them "*Spotlight on Women in Physics*" which highlights the 4th International conference on Women in Physics to take place from the 5-8 April 2011 in Stellenbosch. I hope you enjoy this issue of PC as much as I do!

My thanks for invaluable help with the editing process go to Mr Brian Masara, Prof Peter Martinez, and Prof Andrew Forbes.

Prof Thomas Konrad

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

SAIP Adopts New Constitution

By Brian Masara (SAIP office, Pretoria)

SAIP Executive Officer Mr Brian Masara hands over the new constitution documents to SAIP President Elect Prof Simon Connell. From left to right: Prof Erasmus Rammutla, Dr Jackie Nel, Mr Brian Masara, Prof Nithaya Chetty, Prof Simon Connell, Prof Thomas Konrad, Mr Gurthwin Bosman and Prof Japie Engelbrecht.

The South African Institute of Physics has been has completed a long process of re-writing the Institute's constitution and by-laws. The new constitution and by-laws were voted on by the membership during November 2010. The ballots were unanimous in favour of changing the constitution and the by-laws. The New Constitution was adopted by SAIP Council on 25 February 2011.

For more information: http://www.saip.org.za/index.php/members/constitution.html

DOE Recognized SAIP2011 Proceedings

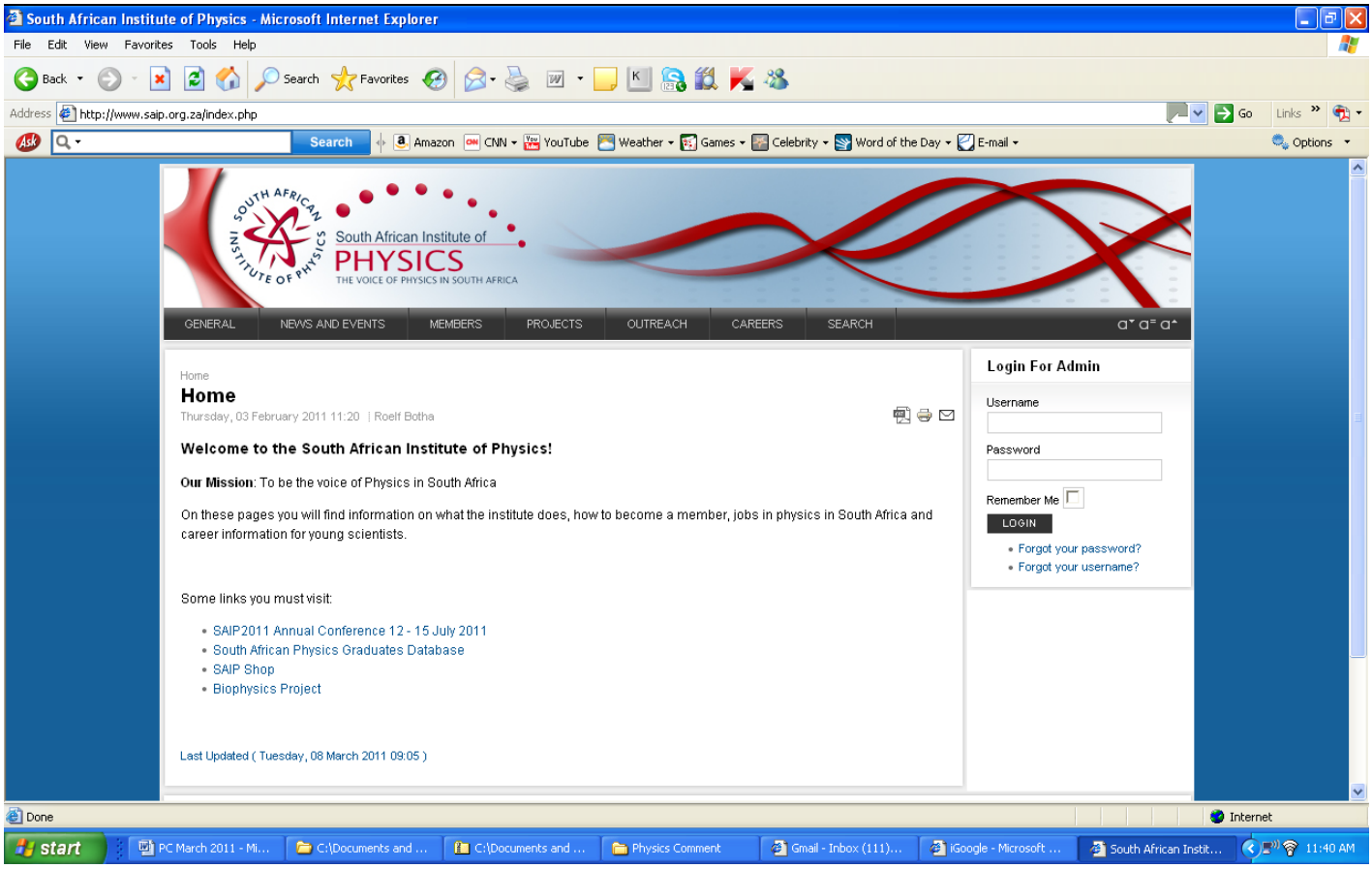
By Brian Masara (SAIP office, Pretoria)

This year delegates to SAIP2011 will have the option to choose if they want their papers presented at SAIP2011 to be published in the conference proceedings.

SAIP2011 will produce a conference proceedings that is Department of Education (DOE) recognized with each paper worth 1/2 unit. This means a single author paper for example receives the equivalent of half a subsidy unit from the DOE.

SAIP Launches New-Look WEBSITE

By Thomas Konrad (UKZN, Durban)



The South African Institute of Physics has launched its new website. It has been populated with information relevant for members, physicists as well as fans of physics. The main motivation behind the design of the new webpage was to create a modern, more intuitive and thus user-friendly webpage, which offers easy access for the SAIP office to add information and enables to integrate the membership data basis and an online financial system. The website can be found at http://www.saip.org.za/

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

Africa to shed light on the dark ages

By Alex de Koning

Africa's bid to build and host the Square Kilometre Array (SKA) telescope – which will for the first time provide mankind with detailed pictures of the "dark ages" 13.7 billion years back in time – is gaining momentum with significant scientific breakthroughs.

An important milestone was reached with the "detection of fringes" in a joint very long baseline interferometry (VLBI) observation. For the first time South Africa has completed the experiment without assistance from other countries. The 26m Hartebeesthoek Radio Astronomy Observatory (HartRAO) near Pretoria teamed up with one of the seven 12m dishes currently part of the Karoo Array Telescope (KAT-7) over 900 km away to jointly observe and record data from a distant radio source known as 3C273. The data was then correlated in Cape Town to produce the first ever African fringe detection at its first attempt.

"VLBI is significant as it's used for imaging distant cosmic radio sources, spacecraft tracking, and for applications in astrometry. However, it can also be used "in reverse" to perform earth rotation studies, map movements of tectonic plates very precisely (within millimetres), and other types of geodesy," says Dr Bernie Fanaroff, Director, South Africa SKA Project.

In addition to the fringe detection breakthrough, South African engineers have also built the building block for the next generation of digital processing systems. The reconfigurable open architecture computing hardware (ROACH) board is primarily a South African development and already in use in 300 high-tech facilities around the globe. However, ROACH-2 prototypes are much faster and more powerful.

Why the need for such computing speed and capacity in astronomy? "To put it in perspective SKA is expected to collect more data in one week than humankind has collected in its entire history," reveals Fanaroff. The leap forward in technology is largely thanks to advances in field-programmable gate array (FPGA) technology. The good news is that progress in FPGA is set to hold for another four generations, so future iterations of ROACH (3,4,5 and 6) are likely in the next few years. "This is all essential preparation for the SKA project," explains Fanaroff.

"SKA will revolutionise science. It will be the world's largest radio telescope and probably capable of answering questions that we haven't even thought to ask yet," elucidates Fanaroff. Expected scientific discoveries range from understanding the cosmic web of neutral gas, which will unravel how the first stars and black holes were formed. It will track galaxies to investigate the rate of expansion of the universe and hopefully identify the nature of dark energy. It will also produce three-dimensional galactic maps and detect what are lightly to be extremely weak extra-terrestrial signals and pinpoint planets capable of supporting life. It will also allow for the study of gravity, which could possibly lead to the theory of relativity being challenged. Pulsars, the collapsed spinning cores of dead stars, will also be monitored providing information on gravitational waves and black holes.

"In 2011 South Africa in conjunction with its eight African-partner countries bidding communally for the SKA will pull out all the stops to show the world that Africa is the future as far as science and technology are concerned," concludes Fanaroff.

South Africa's Square Kilometre Array Project is an initiative of the country's Department of Science and Technology. Find out more at www.ska.ac.za

Link to images: http://www.ska.ac.za/media/visuals.php

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A User-Powered Syndrum Based on a NdFeB Linear Generator

By Joh Hansen (*Hansen Future Materials, Durban)*

1. Introduction. The neodymium based (NdFeB) family of permanent magnets have sufficiently high flux that it is possible to conceive of a linear generator mounted in the sole of a shoe [1]. An interesting application is that of a musical instrument where the physical effort of the musician could conceivably be used to power an electronic synthesizer long enough to produce a musical note or sound. The bass drum is a good place to start for several reasons:

a) The leg is a powerful muscle and capable of rapid reciprocating motion as in running

b) The pedal used by a drummer to play the (floor mounted and horizontal) bass drum provides further mechanical advantage

c) A drum which provides an electronic output, but is otherwise silent, would be an attractive device for practicing in areas where high sound levels are undesirable.

Figure 1 shows a conventional acoustic drum with pedal and beater.

Fig. 1 Conventional acoustic drum showing pedal (kinetic energy source) and vellum (mechanical oscillator). Tuning is accomplished by adjusting the tension in the vellum using the outer ring and threaded rods.

Ironically, this kind of drum, which can be intrinsically very loud, is often muted with soft materials or even enclosed in a plexiglass booth in use in a performance environment. This is to allow its signal, once transformed by a microphone placed near to the front or back vellum (vibrating membrane), to be balanced with the other instruments before being reproduced through the front-of-house speakers. So-called feedback, which is an oscillation caused by signal leaking into the drum microphone from the speakers, can be a problem.

The chain of energy transformations used in this process is shown in Fig. 2 a.

The chain of energy transformations proposed for the case of the analog synthesizer drum or syndrum, is

shown in Fig. 2b.

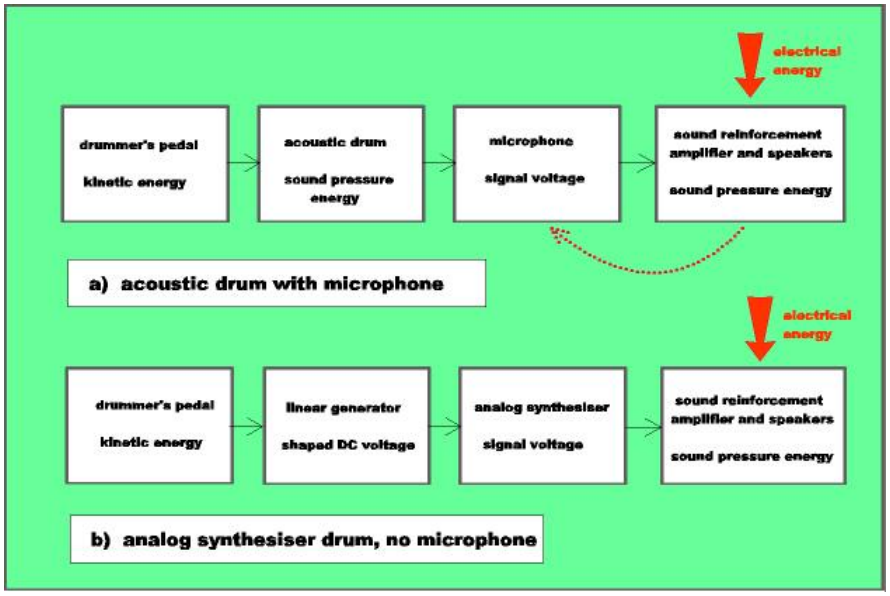


Fig. 2 Energy transformation processes in an acoustic drum + microphone (a), and in the proposed analog syndrum (b).

Supplementary energy is provided at the last stage via an audio amplifier and the possibility for feedback is indicated by the red arrow. Historically, it was this very problem that lead to the development of the electric guitar, where the microphone is replaced by a form of magnetic pick up that senses string velocity and is insensitive to ambient sound. An analog syndrum based on the scheme shown in Fig. 2 b) would be insensitive to ambient sound. Further, since it is clear that the magnitude and rate of transfer of kinetic energy would be important in governing the oscillation of the vellum in the acoustic drum, it may be possible to preserve some of this behaviour in the case of the syndrum. This might make it more playable as an instrument, by comparison with a trigger pad as is used with digital drums, for someone accustomed to the acoustic instrument.

2. Design of the linear generator.

Fig. 3 shows the elements of the linear generator used in this design.

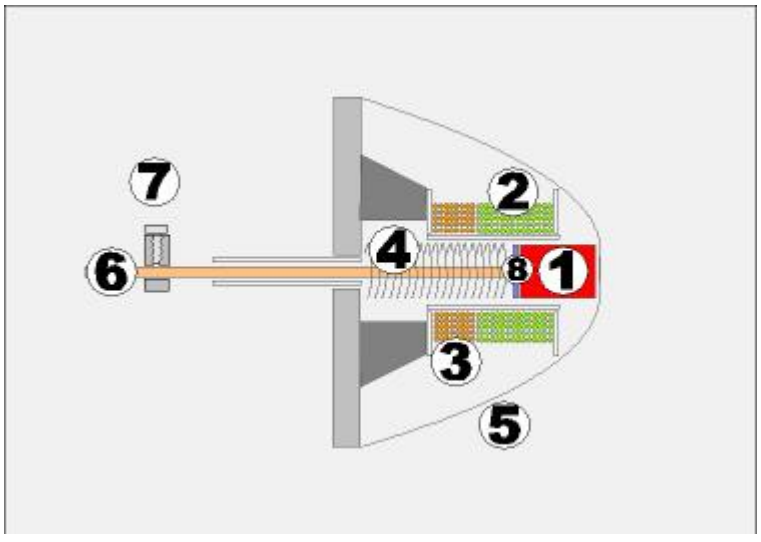


Fig. 3 Linear generator. Key: 1) neodymium boron iron magnet 14 mm diameter x 17 mm, nickel coated. 2) DC generator coil 19 mm ID 55 Ohms, 3) impact generator coil, 25 Ohms, 4) return spring, 5) flexible dust cover, 6) brass shaft, 2.4 mm x 80 mm, 7) adjustable stop. 8) Steel carrier plate.

There is no magnetic yoke in this design. It was found that any ferromagnetic material in the proximity of the neodymium magnet caused the action to be irregular or sticky. Experiments have shown that a length of travel of 20 to 30 mm is sufficient to generate the electrical energy required. This apparently simple design is made possible by the high energy density product, BH_{max} of the magnet material as shown in Table 1.

Table 1 Properties of some magnet materials (2)

Magnet material	Energy Product BH_{max} kJ/m^3	T_{Curie} ºC
Nd2Fe14B (sintered)	200–440	310–400
SmCo5 (sintered)	120–200	720
Alnico (sintered)	10–88	700–860

The lower Curie temperature is not likely to be important in this application.

Fig. 4 shows the output of the generator when struck by the pedal in a typical drum stroke.

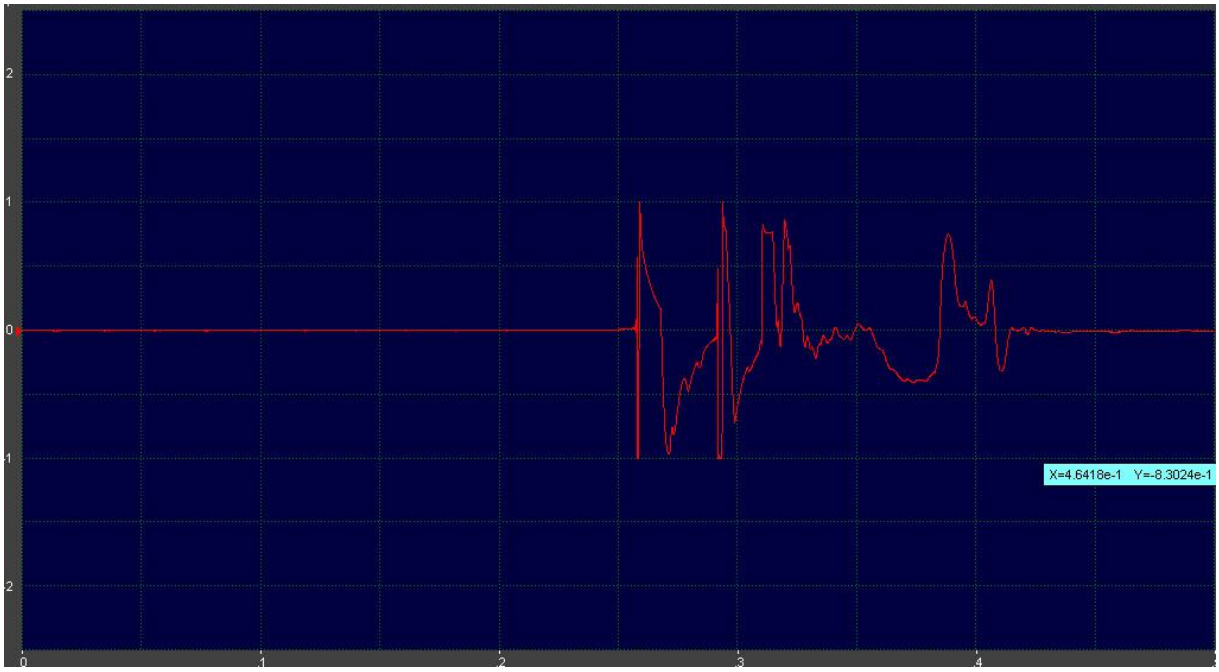


Fig. 4 Generator output under load. Vertical axis volts x 10. Horizontal axis time s.

The very steep features are thought to be impact events during the initial forward stroke. The smoother events at right are caused by motion under the action of the spring return. Peak to peak voltage approaches 20 V.

Clearly this supply needs considerable smoothing and regulation as will now be discussed.

3) Analog synthesizer

The following block diagram shows the operation of the analog synthesizer conceptually.

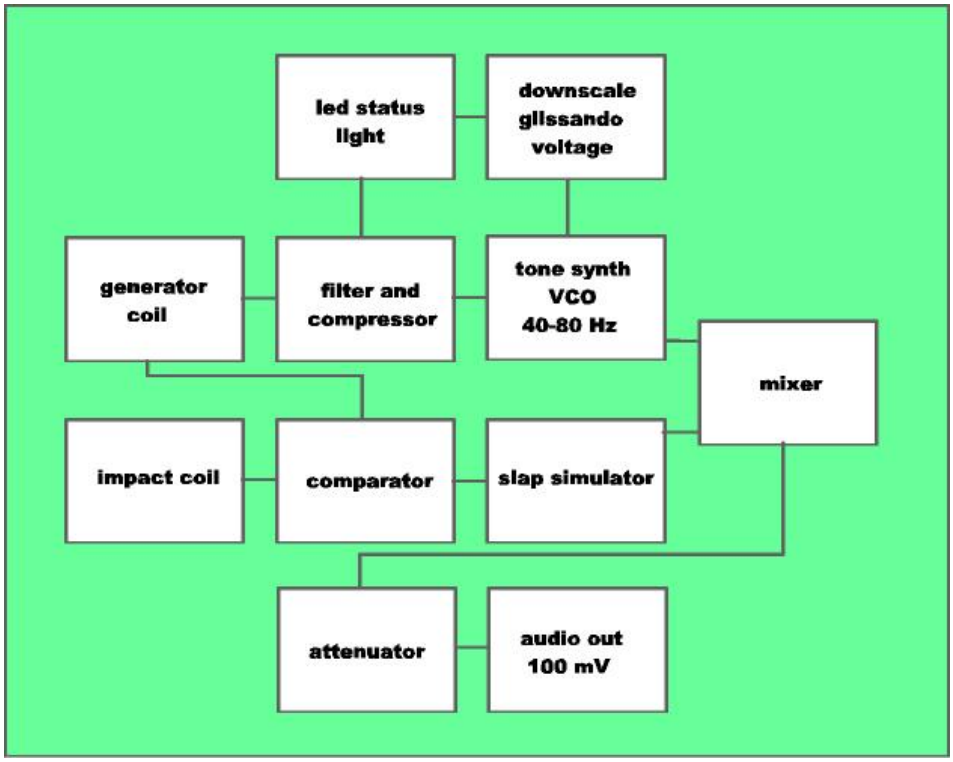


Fig. 5 Flow diagram for analog synthesizer.

The circuit design is a little unusual because of the fact that the power supply is absent except for 150 ms every second or so (when the drum is struck). A few interesting features are worth examining.

Filter and compressor:

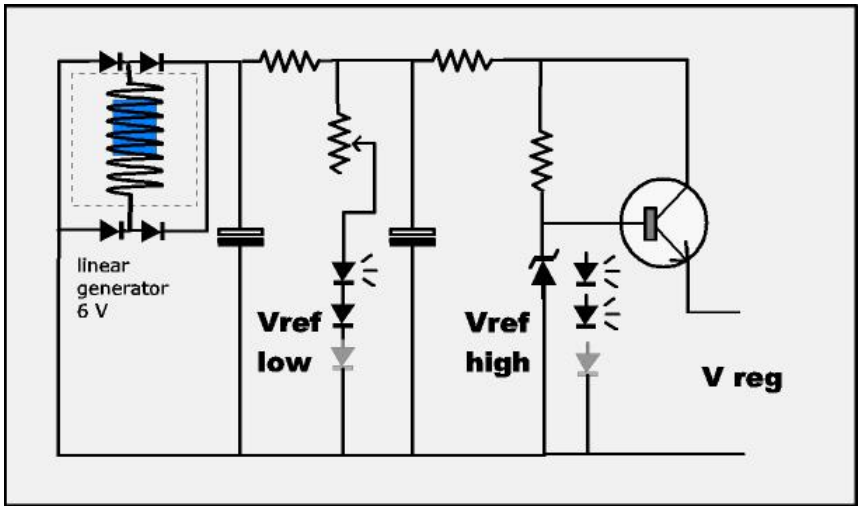


Fig. 6 Circuit for filtering and regulating the DC supply to the analog synthesizer.

Two stages of RC filtering are shown. Vref low is the voltage defined by an LED and diode chain which sets the voltage at which the synthesizer is quiescent and drawing very little current. Vref high is a voltage selected to give a suitable period of near-constant amplitude in the oscillator. This is typically 3 volts. The transistor is configured as a series regulator so that Vreg = Vref high – 0.6 V.

The light emitting diode (LED) shown in the Vref chain provides an additional function, as status monitor for the generator. As the drummer plays he will see a regular flash when the generator is functioning correctly.

Voltage controlled oscillator:

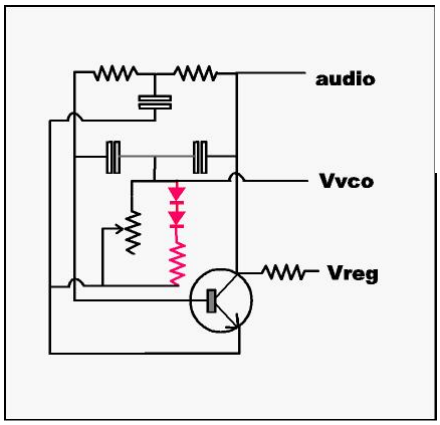


Fig. 7 Circuit for generating audio tones.

Although this is a conventional analog oscillator, sometimes called a twin-tee oscillator, it is operated with a supply voltage that will rise rapidly from the low limit, Vref low, to the regulated upper voltage Vref high and finally decay to Vref low., at which point oscillations are quenched. The amplitude of oscillation follows the supply voltage but the frequency is set by the resistors and capacitors shown in black. The resistor and diode chain shown in red is carrying a current proportional largely to Vvco . Because a diode is a non-linear device, this makes the dynamic resistance of the chain voltage dependent. When Vvco is allowed to change, there will be a small detuning, or glissando in the drum tone. The VCO voltage can be Vreg, the supply voltage or a fraction of it.

The impact generator coil is used to detect a powerful stroke. Normally the voltage generated in the further coil will be lower than the generator voltage or some fraction of it. However, when played hard, the magnet will cause a sufficient flux change in the impact coil to switch the state of the comparator and trigger a sharply rising voltage which is then differentiated and shaped to produce a second sound. The oscillator tone and the impact tone are mixed using a transistor buffer amplifier of unity gain and then attenuated. The audio signal can be made available either as an unbalanced signal on a ¼ inch socket, or via a balanced output as is preferred for microphone level signals.

It should be clear to the reader now that this circuit is self-powered in the sense that it needs no battery or mains connection but uses solely the impact from the drummer to power the synthesiser.

4. Physical embodiment

Fig. 8 shows the syndrum mounted in a maple head shell that contains the linear generator and analog synthesizer.

Fig. 8 photo of a syndrum mounted in a maple head.

5. Oscillograms and spectra

Fig. 9 shows the oscillogram for the syndrum, while Fig. 10 displays the oscillogram of an acoustic drum.

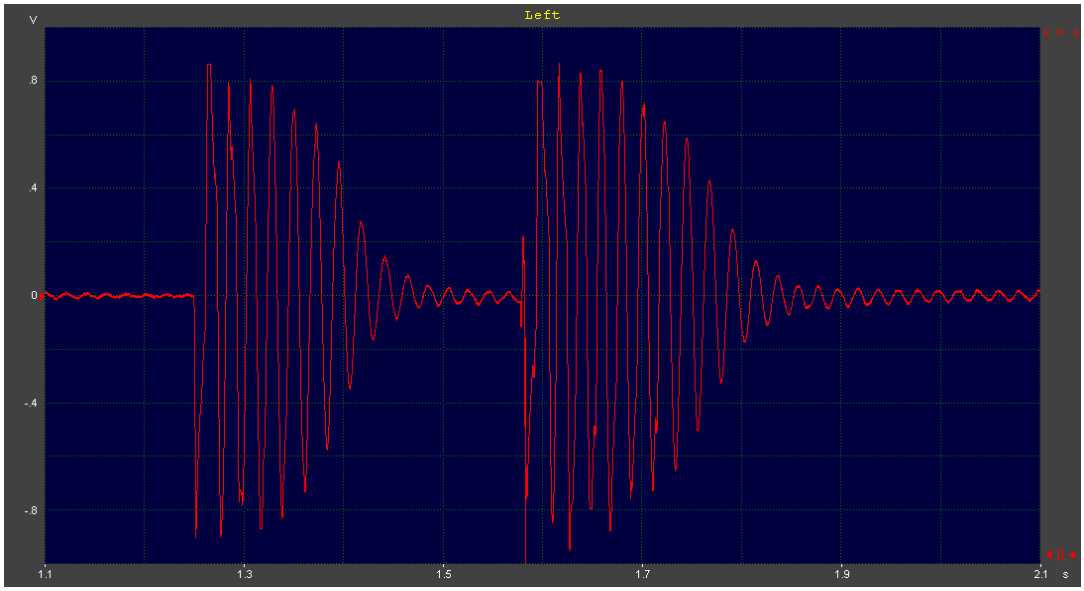


Fig. 9 Oscillogram for syndrum playing double beats.

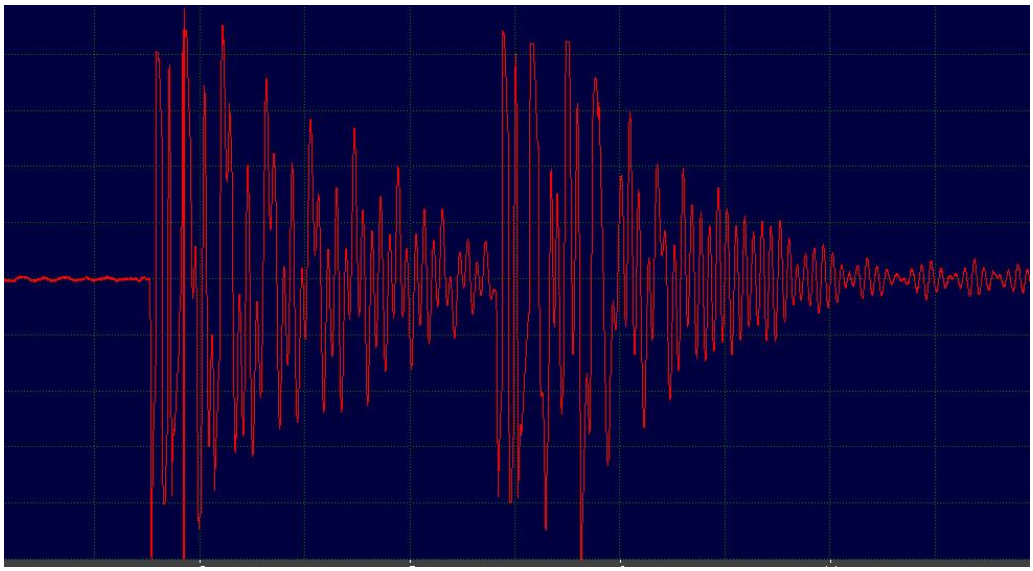
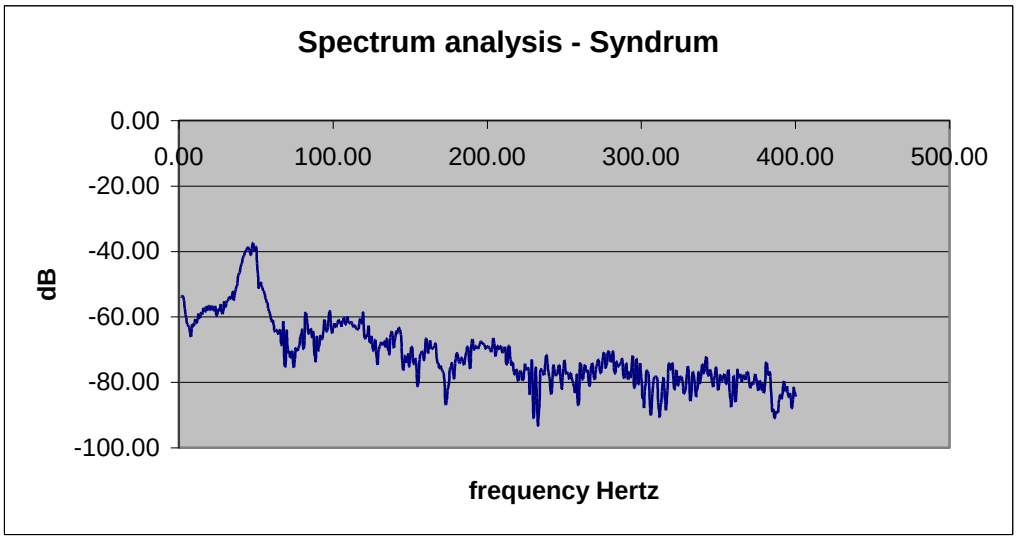


Fig. 10 Oscillogram for Tama acoustic drum playing double beats. Microphone = Shure 58 at rear vellum +100 mm. Flat equalisaton.

It appears from the oscillograms that the acoustic drum is richer in higher harmonics as might be expected of a vellum that can oscillate in various modes. Spectrum analysis shows that this is so.



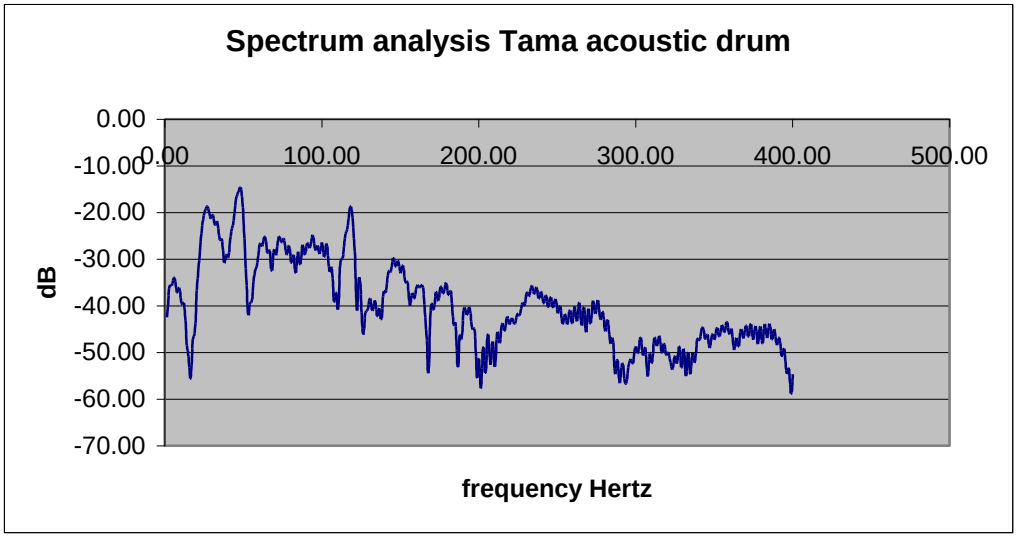


Fig. 11 Spectra of syndrum and acoustic drum.

The syndrum has a simpler spectrum as might be expected of an instrument based on a single oscillator. Conceptually, it is possible to add oscillators of differing frequencies in order to simulate the acoustic instrument more accurately. In practice, the drum is rarely played as a solo instrument and the lower notes of the other bass instruments would provide harmonic and melodic enrichment to the basic drum pattern.

6. Conclusion

Advances in materials science can be expected to create opportunities in many fields. In this paper we have discussed a permanent magnet material with a very high flux density. By using this material in a linear generator powered by the stroke of a drummer's pedal, it has become possible to build a syndrum (synthesized drum) that is self-powered in the sense that it needs no battery or mains connection but uses solely the impact from the drummer to power the synthesizer.

The synthesizer has the features that we might expect of an electronic instrument specifically that it can be turned down to zero volume, but in addition, it is

- tunable over a wide range of frequencies, governed only by the selection of the oscillator components,
- capable of a mix of impact, or “slap” and resonance, or “zoom” tones

- suitable for a downscale glissando and further vco (voltage controlled oscillator) effects not seen in acoustic instruments.

Beyond that, there is an intrinsic velocity sensitivity which is more appealing to drummers who are used to real drums. This follows because the amplitude of the output is related to the voltage generated (given that there is some compression in the smoothing circuits), and the voltage is in turn dependent on the velocity of the generator magnet and so also the force of the drummer's stroke.

Acknowledgments

Mytech Engineering of Glen Anil, and specifically Aldon Pretorius and Derek Northgreaves, have been of great help in the mechanical design and construction of a series of prototypes.

Glyn Craig of Techlyn (Pty) Ltd in Johannesburg made important suggestions relating to the electronic design.

Hansen Future Materials is a consultancy and agency for the supply of advanced materials for applications in optics and electronics. Current projects involve collaboration with the Physics groups at the University of Johannesburg and the University of KZN, specifically the Centre for Quantum Technology.

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1] Konotchick, J.A. US Patent 5818132, linear motion electric power generator (1997).

2] http://en.wikipedia.org/wiki/Neodymium_magnet

MEGA TELESCOPE ON THE AFRICAN HORIZON

By Marina Joubert, article prepared for SKA South Africa

The Square Kilometre Array (SKA) promises to revolutionise science by answering some of the most fundamental questions that remain about the origin, nature and evolution of the universe. With about 3 000 receptors linked together and a total collecting area of one square kilometre, the SKA will have 50 times the sensitivity and 10 000 times the survey speed of the best current-day radio telescopes.

With global investment supporting the project and astronomers and engineers around the world already working on its design, construction on the SKA is scheduled to start around 2016. The first astronomical observations are expected by 2019 and the telescope should be fully functional by 2024.

From the dark ages to extraterrestrial intelligence

"There is a strong science case for building the SKA, but, because there is so much about the universe that we simply don't know yet, the telescope will most likely be celebrated for discoveries that we can't even imagine now," explains Dr Bernie Fanaroff, Director of the SKA South Africa Project. "South Africa has a ringside seat for observing the universe, and we are doing our best to bring this mega science instrument to this continent."

By looking back in time approximately 13.7 billion years to the "dark ages" of the universe, the SKA will

be able to provide detailed pictures of the cosmic web of neutral gas to unravel how the very first black holes and stars were formed. It will track young galaxies to investigate the increasing rate of expansion of the universe, thereby helping to identify the nature of dark energy. By measuring the radio emissions of millions of distant galaxies, the SKA will create three-dimensional galactic maps, and thereby allow us to study the nature of cosmic magnets throughout the universe and reveal their role in its evolution. It will even be able to detect extremely weak extra-terrestrial signals and may pinpoint other planets capable of supporting life. Astrobiologists will use the SKA to search for amino acids, the building blocks of life, by identifying spectral lines at specific frequencies. The SKA will also explore the nature of gravity and challenge the theory of general relativity. Pulsars, the collapsed spinning cores of dead stars, will be monitored to study gravitational waves and black holes.

Taking new technologies to unprecedented levels

In addition to answering fundamental science questions, the SKA will also stimulate extraordinary advances in data processing and storage, high-performance computing and innovative industrial manufacturing techniques. "Astronomy always pushes the boundaries, because astronomers need the latest and most sensitive technologies, and then they typically advance it even further," Dr Fanaroff says. "We expect that the SKA will collect more data in a week than what humankind has collected in its entire history, while the amount of data that that will flow through the SKA will be about 250 times more than the total data traffic currently on the internet. This will add up to hundreds of terabits per second and will require supercomputers working at exaflop speeds – about a thousand times faster than today's most top-of-the-range supercomputers."

Producing the thousands of dishes required for the SKA within the project's time scales will also demand an entirely new way of building highly sophisticated and sensitive scientific instruments, he explains. "We will have to use industrial methods to produce and put up several dishes per week – something that has never been done before," Dr Fanaroff says.

The bid to bring the SKA to Africa

South Africa has partnered with eight more African countries in its bid to bring the SKA to Africa. Winning this bid will put Africa on the world stage of science and will ensure a sustained boost for expertise and infrastructure development across the continent. "This year – 2011 – we have to pull out all the stops to show the world that Africa is ready to host the SKA," Dr Fanaroff says.

Should the SKA come to Africa, its core will be located in a radio reserve in the Northern Cape Province – an area protected against future radio interference by the Astronomy Geographic Advantage Act, Act 21 of 2007. Remote stations – consisting of about 24 antennae each – will be spread out at distances of up to 3 000 km from the core in Namibia, Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique and Zambia. The African Union fully supports the continent's bid to host the SKA.

Competition for Africa's SKA ambitions comes from a collaborative bid between Australia and New Zealand. An international site selection committee must make a final recommendation on the best site for the SKA towards the end of 2011. An SKA Council will be constituted to make and announce the final decision in 2012.

From KAT-7 to MeerKAT…. to the SKA

South Africa is currently building the Karoo Array Telescope, or MeerKAT, a mid-frequency 'pathfinder' or demonstrator radio telescope, alongside the proposed SKA core site. Once completed, the 64-dish MeerKAT will be the southern hemisphere's largest radio telescope and one of the world's biggest and most powerful telescopes. The Australians are also building a precursor instrument, called ASKAP (Australian SKA Pathfinder).

The first seven dishes of the local precursor instrument – known as KAT-7 – were completed by December 2010 and are now being commissioned. It is the world's first radio telescope with dishes made of fibre

glass. "We built KAT-7 as an engineering prototype, but the world's scientists see it as a useful instrument in its own right, and they are keen to switch it on for doing science as soon as possible," Dr Fanaroff explains. KAT-7 has already delivered images of the Centaurus A, a galaxy 14-million light years away. The commissioning of KAT-7 is led by Dr Debra Shepherd, currently on secondment to the SKA South Africa Project from the National Radio Astronomy Observatory in the USA.

A new-look MeerKAT

Following an extensive review process, the design of the MeerKAT's dishes has been finalised. It will consist of 64 Gregorian offset dishes, each with an effective diameter of 13.5 metres. An offset dish configuration has been chosen because its unblocked aperture provides uncompromised optical performance and sensitivity, excellent imaging quality, and good rejection of unwanted radio frequency interference from satellites and terrestrial transmitters. The offset optical configuration also facilitates the installation of multiple receiver systems in the primary and secondary focal areas, and is the reference design for the mid-band SKA concept.

"The offset dish design not only produces better science, but is also much closer to what the SKA dishes are likely to look like," Dr Fanaroff adds. "We want to make sure that we design, build and test dishes that are as close as possible to what the SKA is going to use, so that South Africa's industry will be well placed and thoroughly prepared to bid for major SKA contracts as soon as tender opportunities are announced."

The next step of the MeerKAT project is to build a single prototype dish of the new design on site in the Karoo. This first dish will be built close to KAT-7 to allow extensive testing of the performance of the new design against the existing array. This work will also feed into the international SKA Dish Verification Programme (DVP), an important component of the international SKA pre-construction phase.

The MeerKAT sub-systems also employ a number of novel technologies that are in the mainstream of SKA development. The design process will provide important deliverables for the SKA project, as expected from the precursor instruments. In addition to the pioneering use of fibre glass for the dish reflector surfaces, design challenges include the development of very wide band waveguide feeds and receivers, low-cost cryogenic systems for cooling the receivers, direct digital sampling systems, high speed digital signal processing systems, algorithms for astronomy data processing, high performance computing platforms that match the algorithms, and very fast data transport networks.

Getting ready for science with MeerKAT

The MeerKAT will only be operational by around 2015, but the world's radio astronomers are already preparing to start using this novel radio telescope. In 2009 the SKA South Africa Project invited the international astronomy community to submit proposals for doing science with MeerKAT. Twenty-one proposals for large survey projects, involving more than 500 scientists (60 of them from South Africa), were received. These proposals were reviewed, refined, and about 43 000 hours of observing time (about five years) have been allocated to ten teams. They will use MeerKAT to survey the distant universe, study pulsars and the nature of cosmic magnetic fields and test Einstein's theory of gravity – all topics that are in line with the science goals of the SKA. "We are already starting to work with these teams of top scientists who will use the MeerKAT by involving them in the design of the telescope," says Dr Fanaroff.

Skills for the future

Developing new skills and expertise is a key part of the MeerKAT project. "You can't develop new expertise without a cutting edge project to work on," Dr Fanaroff believes. "MeerKAT attracts and excites young scientists and engineers because it is something entirely new and extremely ambitious."

"We've never before built an interferometer combining lots of extremely sensitive dishes," he explains. "MeerKAT is a platform for developing totally new skills and capabilities in South Africa and on the continent." He points out that the technologies, techniques and networks that are being developed for the MeerKAT and SKA will find worldwide commercial applications in the next 10 – 20 years. "The young

people working on this project are destined to become experts in future technologies that will be in high demand around the globe."

Through its human capacity development programme, the SKA South Africa Project funds students across a wide range of study levels, starting from young artisans, technicians and undergraduates all the way up to advanced post-doctoral studies. To date nearly 300 students have benefited from SKA South Africa bursaries and scholarships, including many students from other African countries. Most bursaries go to physics and engineering students and a special effort is made to attract women and black students to these fields through the undergraduate programme. Support for artisan training focuses on promising students from the Northern Cape studying at the Northern Cape Further Education and Training Urban College in Kimberley. Throughout their studies, students are involved in workshops and site visits, often accompanied by foreign collaborators. They all participate in an annual bursar's conference where they get the opportunity to interact with the world's leaders in the development of the SKA. During site visits to the Northern Cape, the students also get the opportunity to participate in educational outreach activities designed to excite the learners of the Northern Cape about the leading role that their province is playing in the future of astronomy – in South Africa, Africa and the world.

RADIO QUIETNESS IS KEY

The radio quietness of a proposed site for a radio telescope – in other words, the absence of interfering radio signals from mobile phones, televisions, radios and other electrical devices – will be one of the key considerations in selecting whether the core array of the Square Kilometre Array (SKA) will be built in South Africa or Australia. The ability of the SKA to study very weak radio signals that come from the early universe is impacted by the presence of radio interference. For this reason, the international SKA Project Development Office commissioned a new series of ultra-sensitive RFI (radio frequency interference) measurements at the two sites towards the end of 2010. Two sets of equipment were developed in the months leading up to the measurement campaign to ensure that the RFI data collected were comparable and that the measurements could be undertaken simultaneously at the proposed South African and Australian SKA core sites. An external advisory committee will review the data and make recommendations to the SKA Science and Engineering Committee and a committee of governments and international science-funding agencies.

"The equipment was developed jointly by the South African and Australian teams, and is a significant improvement in sensitivity and performance on the equipment we used for the initial RFI measurements five years ago" explains Dr Adrian Tiplady, who is leading the SKA RFI project in Africa.

Besides the levels of RFI, the cost of building and operating the telescope will play an important role in the ultimate selection of the most suitable site. Construction costs are expected to be considerably lower in South Africa than in Australia.

The SKA South Africa Project is funded by South Africa's Department of Science and Technology, via the National Research Foundation.

Images available at http://www.ska.ac.za/media/visuals.php

Opportunities

Operations Manager for GEM-Africa

A position has arisen for an Operations Manager for Global Earthquake Monitoring in Africa.

Click the link below to for additional information

http://www.saip.org.za/images/stories/documents/Vacancies/GEM_-_Africa_Operational_Manager.pdf

SKA Africa Electronic Engineering Technicians Training Programme

Opportunities to train as Electronic Engineering Technicians is available at the SKA South Africa

Click the link below to for additional information

http://www.saip.org.za/images/stories/documents/Vacancies/Africa_Technician_TrainingProgramme_2011_-_Call_document.pdf

Master's/Doctoral Studentships in ion trapping and cooling for quantum technologies

The CSIR National Laser Centre (NLC) is embarking on a project to develop an ion trapping and laser-cooling laboratory. Promising candidates with an interest in fundamentals and applications of quantum mechanics – both experimental and theoretical – are encouraged to apply. Research positions exist for students seeking either a Master's/doctoral degrees.

Click the link below to for additional information

http://www.saip.org.za/images/stories/documents/Vacancies/20110308_nlc.pdf

Upcoming Conferences & Schools

SAIP2011 Annual Conference

56th Annual Conference of the SAIP

The Department of Physics at the University of South Africa (UNISA) invites you to the annual SAIP conference during the winter of 2011. Participants will be warmly welcomed to SAIP2011, where we will provide a platform for sharing the latest developments in Physics. The call for abstracts is open: http://indico.saip.org.za/getFile.py/access?resId=3&materialId=0&confId=7 .

Date: 12-15 July 2011, Venue: St Georges Hotel and Convention Centre, Pretoria
Web address: http://indico.saip.org.za/conferenceDisplay.py?confId=7

South African Biophysics Initiative

We would like to inform the community that the SAIP has agreed to hold a session on the growing research field of Biophysics. This session will be held under the Applied Physics B area of the 56th annual SAIP conference . There is also a workshop that is being planned to take place in close association with the conference. Professor Gyozo Garab has agreed to be a plenary speaker at the 2011 conference. It is hoped he will chair the workshop as well as present a seminar at the CSIR during his visit.

Professor Garab is the Head of the Laboratory of the Photosynthetic Membranes research group at the Hungarian Academy of Sciences Biological Research Centre (BRC) in Szeged, Hungary. He joined the BRC in 1971 and undertook his PhD in Biophysics and plant physiology which he obtained from Szeged University in 1974. He has being conducting research in photosynthesis and photosynthetic energy transfer ever since. In 1988 Professor Garab became Head of the Laboratory for Membrane Energization.
http://www.szbk.hu/plant_laboratory_of_photosynthetic_membranes.php

The aim of the Biophysics session and the associated workshop is to stimulate awareness of Biophysics and bring together individuals who can contribute to this scientific discipline. Then, plan and co-ordinate the growth of Biophysics into the main stream scientific arena and funding streams within Africa. The local organising committee consists of Professors Trevor Sewell, Johan Malherbe, Colin Kenyon and Dr's Martin Myer, Rob Smith and Raymond Sparrow. Please find below a link to the conference website:

http://newsite.saip.org.za/index.php/news-and-events/saip-annual-conferences/85-saip2011-annual-conference.html

For additional Information please contact – Chairperson SA Biophysics Working Group

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Spotlight on Women in Physics

The worldwide shortage of women in physics will come under the spotlight at the 4th International Conference on Women in Physics (ICWIP) to be held from 5–8 April 2011 in Stellenbosch. The conference will also celebrate the diverse contribution of women around the globe to this field. More than 200 physicists from about 50 countries will attend this event. South Africa's Minister for Science and Technology, Ms Naledi Pandor, will open the conference on 5 April 2011.

"Physics is a wonderfully stimulating profession – it needs women – and women need physics, " says Professor Diane Grayson of the University of Pretoria, programme chair for the conference. "We must use this conference to highlight the exciting career paths that physics offers to women and remind people of the key role that physics play in our everyday lives and in many other professions – including engineering, medicine, telecommunications, environmental sciences and more!"

Professor Grayson points out that there is still a huge gender gap in physics in South Africa. "Far fewer women than men qualify as physicists and even fewer fill top academic positions in the field." In 2010, all heads of university physics departments in South Africa were men, and only 24% of all the physics graduates were women. "This conference is an opportunity to explore

why South Africa has so few women physicists and to look for solutions, drawing on the perspectives of participants from dozens of countries," she adds.

Women from around the globe, including many from African countries, will debate the impact and success rate of different educational models, role model initiatives and out-of-school activities in attracting girls to physics. Another key topic on the agenda will be how to recruit and retain female physicists via a supportive culture – which often turns out to be more acceptable to all staff, regardless of gender. Delegates will share best practice examples of the kind of professional development that will significantly help female physicists to overcome obstacles in their careers.

"We believe in starting young by making physics appealing to girls at school," says Dr Mmantsae Diale, a physics lecturer at the University of Pretoria and chair of Women in Physics in South Africa (WiPiSA) – an organisation that works to attract girls to physics by providing role models and mentors for girls and female students.

"It is also vitally important that teachers must give a clear message to girls that physics is relevant and accessible to them, and that it is not only for boys," Diale adds.

There are several renowned female physicists on the ICWIP 2011 programme, including:

1. Dame Jocelyn Bell-Burnell, the British astrophysicist who first discovered pulsars (rapidly rotating stars) in 1967. Her talk at the conference will focus on pulsars and extreme physics.

2. Professor Cecilia Jarlskog, a Swedish scientist who found a relationship between the mass of an electron and the mass of a quark (the most fundamental particles of matter). She chaired the Nobel Committee for Physics from 1989 to 2000. At the conference in April, she will talk about the universe and its smallest constituents – mysteries in particle physics.

3. Professor YanLai Yan, a physicist from the People's Republic of China, and winner of the prestigious Xie Xi-De Prize for physics. Her talk will be about how physics is involved in ancient Chinese chime-bells.

Another highlight of the conference will be a fun presentation by UK physicist Ann Marks, MBE, who is recognised for her contribution to physics education and outreach. In 2007, she was awarded Membership of the Order of the British Empire for her services to physics. She will demonstrate singing rods, straw oboes and other physics activities using items commonly found around the home – from coat hangers to musical boxes.

ABOUT THE CONFERENCE

The conference is hosted by Women in Physics in South Africa, in partnership with the South African Institute of Physics. It takes place under the auspices of the international Working Group on Women in Physics (WiPiSA), which falls under the International Union of Pure and Applied Physics. South Africa's Department of Science and Technology is the main funder of the event.

MEDIA REGISTRATION

Members of the media interested to attend the conference, or any specific lecture at the conference: Please contact Regina Maphanga on 072 577 5972 or email Rr.Maphanga@ul.ac.za

MEDIA ENQUIRIES – PRE-CONFERENCE INTERVIEWS AND COMMENTS

Marina Joubert: marina@southernscience.co.za / 083 409 4254

Interviews can be set up with:

- Professor Diane Grayson, email: diane.grayson@up.ac.za
- Dr Mmantsae Diale, email: Mmantsae.Diale@up.ac.za
- Dr Igle Gledhill, email: IGledhil@csir.co.za

ICWIP2011 web site: http://www.acitravel.co.za/event/index.php?eventID=20 Click on "Speakers" for profiles of invited speakers.

Issued by Marina Joubert, Southern Science, on behalf of the organisers of the 4th International Conference on Women in Physics.

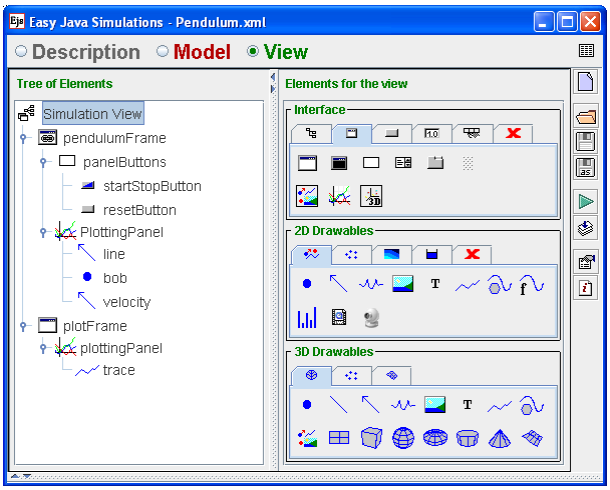
4th IUPAP International Conference on Women in Physics, Stellenbosch, South Africa, 5 to 8 April 2011

The 4th IUPAP International Conference on Women in Physics (ICWIP 2011) will be held in April 2011 in Stellenbosch. This triennial meeting is organized under the auspices of the International Union of Pure and Applied Physics and will be hosted by the South African Institute of Physics and Women in Physics in South Africa.

ICWIP 2011 will provide a forum for both scientific presentations and for discussion of issues related to attracting, retaining and improving the status of women in physics.

If you have not registered to attend, please go to www.acitravel.co.za/icwip2011 and register online as soon as possible

Computational Modelling with Open Source Physics and Easy Java Simulations



NITheP Computational Physics Workshop
University of Pretoria, South Africa
July 4-6, 2011

Leaders: Wolfgang Christian (Davidson College, North Carolina, USA and Francisco Esquembre (University of Murcia, Spain)

Local Organising Committee: Nithaya Chetty (Chair), Trisha Salagaram, Walter Meyer, Quintin Odendaal and Ilsa Basson

This workshop provides a hands-on introduction to Open Source Physics (OSP) and Easy Java Simulations (EJS) to model physical systems. It combines short expositions with practical sessions where participants will work in teams on computers provided by the organizers. There will be morning and afternoon sessions with a break for lunch. Participants will study and explore, step by step, important computational examples, such as the gravitational N-body and the Ising models, to learn how they have been implemented, and then modify these examples to add new capabilities. Assistance will be provided during the sessions.

The goal of the Open Source Physics (OSP) project is to make a large number of simulations together with source code available for education using the GNU GPL open-source model. OSP provides both high-level modeling tools and a lower-level computational physics library to create computer simulations through the use of a consistent object-oriented framework. The Java-based OSP library defines objects to build interactive user interfaces, draw 2D and 3D objects, numerically solve ordinary differential equations using different algorithms, and represent data using tables and graphs.

Although the OSP library allows scientists and engineers who are familiar with Java to create programs, the implementation of a computational modelling-based pedagogy requires a Java programming effort for teachers and students. The Easy Java Simulations (EJS) modelling and authoring tool minimizes this effort while teaching good computational techniques. EJS is a free open-source program developed to create dynamic simulations using the underlying OSP library. EJS was originally created for interactive learning under the supervision of educators but is well suited for use by researchers to prototype applications and by authors to develop and distribute Java-based curricular materials. While some programming knowledge is assumed, EJS users are encouraged to focus on modelling rather than on programming.

This workshop will benefit anyone teaching computer-based modelling as well as computational physicists wishing to adopt OSP and EJS for their own teaching and research. During the workshop we will discuss the general pedagogical and technical issues in the design of interactive computer-based tutorials as well as how existing models can be adapted to your local situation. All workshop material will be made available through the Open Source Physics Collection on the ComPADRE National Science Digital Library http://www.compadre.org/OSP/.

IMPORTANT

The maximum number of participants is restricted to 25. Those wishing to attend should write to Nithaya.Chetty@up.ac.za before 30 April 2011 with a brief motivation for wanting to attend the workshop. Participation is free. Those applying early will be given priority. You will be notified by email whether you have been selected to attend. Morning and afternoon tea and refreshments will be provided for free, but participants are responsible for their own lunches. There are ample eating facilities on the university campus and in the Hatfield town centre. Participants are requested to arrange their own transport and accommodation in Pretoria. There are many B&B places close to the University of Pretoria campus. The workshop programme and venue details will be sent to all confirmed participants.

CPS 8th International School of Planetary Sciences, will take place in Japan, from 26 September to 1 October 2011.

First Circular

https://www.cps-jp.org/~pschool/pub/2011-09-26/index.html

3rd Announcement of MEARIM-II: the 2nd Middle-East and Africa Regional IAU Meeting

MEARIM II, the second Middle-East and Africa IAU Regional Meeting will be held at the Cape Town Ritz Hotel in South Africa, 10 - 15 April 2011.

More information can be found at

http://mearim2.saao.ac.za

2nd Announcement of the 62nd International Astronautical Congress

Cape Town, 3-7 October 2011

The International Astronautical Congress is the premier annual international meeting of the space arena. This event is attended by all the top executives of the worlds leading space agencies and aerospace companies and is accompanied by a major industrial space exhibition. For the first time in its 62-year history, this event will be held on the African continent in October 2011, making this a milestone in the development of the African space arena. Registrations are now open. African participants qualify for a 50% reduction in the registration fee in all registration categories.

For more details, visit www.iac2011.com

International Workshop on Nuclear Physics

Please take note of the upcoming International Workshop on Nuclear Physics. It will take place at STIAS from 16 to 27 May 2011.

For more information please visit http://www.nithep.ac.za/35k.htm

Second SMARTER Crystallography Workshop

We cordially invite you to the Second SMARTER Crystallography Workshop (Structure elucidation by coMbining magnetic Resonance, computation modelling and diffractions), which will be held on 23-27 May 2011 at the University of Aveiro, Portugal.

The aim of this workshop is to bring together specialists from the different areas of materials science, such as materials chemists and processing engineers, diffraction and spectroscopy scientists, and computational structuralists, that may contribute to the development of a common language for a SMARTER approach to structure solving, using Geometrical, Diffraction Modelling and NMR Crystallographies

The deadline for abstract submission is March 15, 2011

Registration fees (All lunches and dinners from the programme are included):

Full Registration, €450 (EUR) + €50 late registration fee

Student Registration, €350 (EUR) + €50 late registration fee

Deadlines:

Abstract submission: March 15, 2011

Notification of acceptance of the talks/posters: April 7, 2011

Early registration: April 18, 2011

Late abstract submission (poster only): April 18, 2011 (registration fee increased by 50 €)

Late registration: May 6, 2011 (registration fee increased by 50 €)

Deadline for submissions for the June 2011 issue of Physics Comment is 31 May 2011.

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.

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

Publication Deadlines

Physics Comment is published four times a year.

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

Specification and Submission of Content

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

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

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

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

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

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

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

Categories of Content Contributions

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

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

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

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

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

Submission of Articles

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