

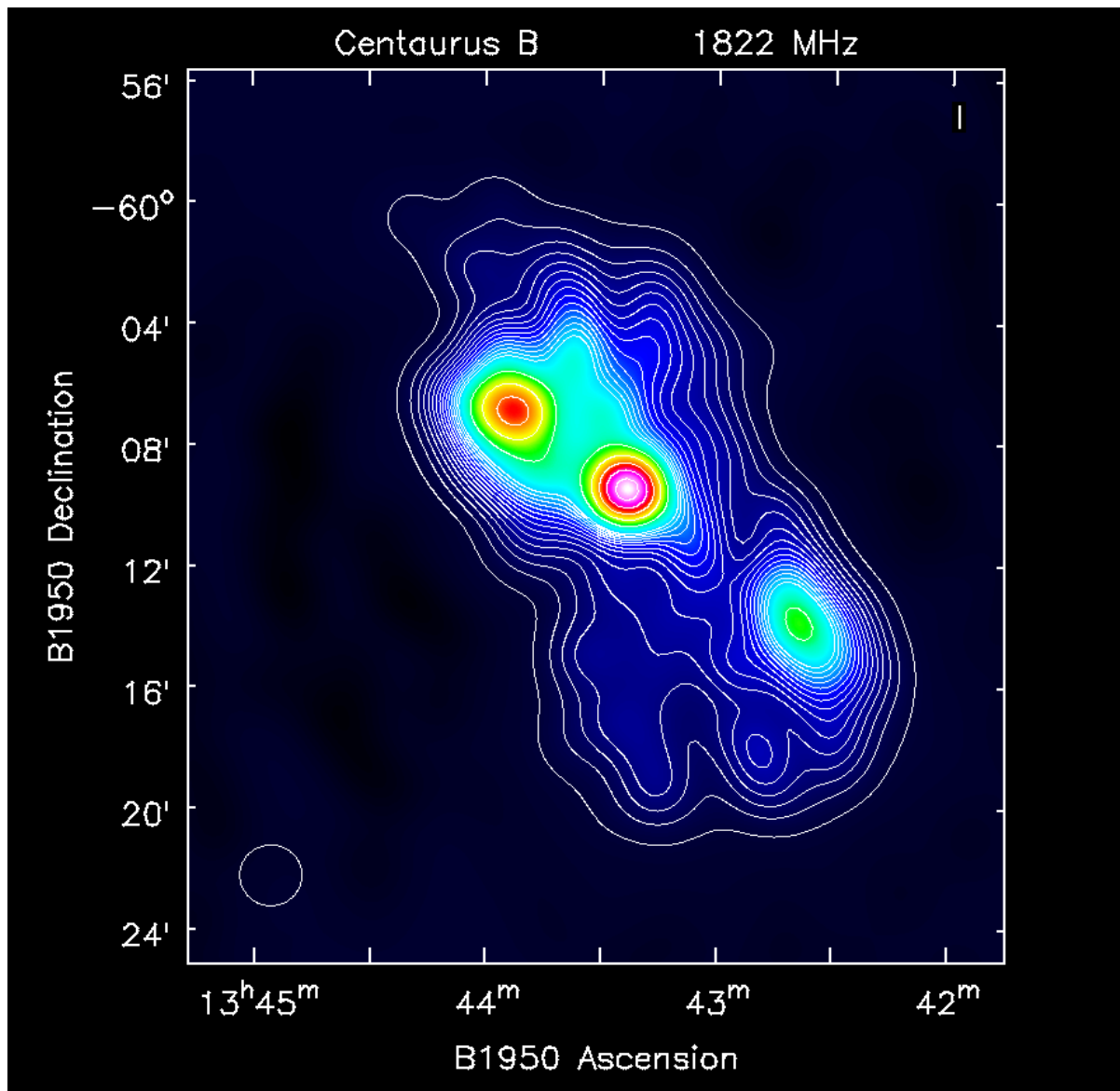
Physics Comment

A Southern African Physics Magazine

Vol. 3, Issue 4, December 2011

<http://www.saip.org.za/PhysicsComment>
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Science with KAT-7



Editor: Prof. Thomas Konrad

Physics Comment – Vol. 3, Issue 4 – December 2011

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Editor's Note

We are living in exciting times! First, in September, a message of measurements of neutrinos apparently travelling faster than the speed of light threatened the current paradigm and promised new physics to be discovered. Then, last Tuesday, CERN reported (<http://press.web.cern.ch/press/PressReleases/Releases2011/PR25.11E.html>) that they might have observed traces of the Higgs boson – the particle that gives mass to all other particles according to the Standard Model of elementary particle physics. Higgs particles have been searched for a long time and quite a few doubts about their existence were raised in the meantime. It would be great exciting news to find this piece of the puzzle, and certainly the real work will start when it is found and can be further investigated.

New physics may be showing up on the horizon and above it! In South Africa, the skies can now be monitored by the South African Large Telescope (SALT) and the radio telescope KAT-7. Both have become fully operationally within the last months. KAT-7, which was constructed in the Karoo as a testing bed for the larger MeerKAT to come, now produces fascinating science. In my opinion, the corresponding article of Simon Ratcliffe et al. (page 14-15) reads like a thriller. Our cover picture shows an image of the sixth brightest radio galaxy Centaurus B recorded by KAT-7, which has not been studied much before (most recently in 1996). If you wonder where South African Astronomy might be heading please read about the Astronomy Desk report (page 5-6). And there are many more interesting news inside of this edition of Physics Comment...

Seasonal greetings and I wish you a happy new year!

Prof Thomas Konrad

Caption for picture on title page: image of radio galaxy Centaurus B – recorded with KAT-7 (Karoo Array Telescope) near Carnarvon in South Africa.

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

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News from South Africa

SAIP2011 Proceedings

By Brian Masara (SAIP office, Pretoria)

Proceedings of SAIP2011, the 56th annual conference of the SAIP is now available in a compressed DJVU format on the SAIP website

<http://www.saip.org.za/index.php/news-and-events/saip-annual-conferences/152-saip2012-proceedings>

Please note:

1. The download file is 17MB and the original PDF 111MB with a total of 861 pages.
2. A CD-ROM with a copy of the original PDF file will be forwarded to SAIP2011 participants during next couple of weeks. Due to the festive season it might only reach participants during January 2012.

Synchrotron Science Community meet to craft a strategy

By Tshepo Ntsoane- Chairperson SRRIC



On December 1-2, the scientific and industrial user community of Synchrotron Radiation in South African gathered at the St Georges Hotel, Centurion, Pretoria, South Africa to develop a strategy for the future use of Synchrotron Radiation in South Africa. Organized by the South African Synchrotron Research Roadmap Implementation Committee (SRRIC) in conjunction with the Department of Science and Technology (DST) and National Research Foundation (NRF), the meeting brought together representatives of the South African synchrotron user community, policy makers and international experts to thrash out a

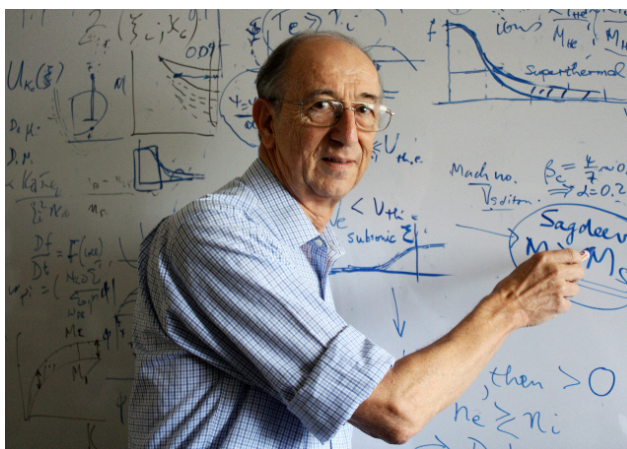
coherent strategy on the future use of synchrotron radiation in South Africa. The discussions of the meeting are currently being collated into a Strategy and Business Plan to guide government and the user community in mapping the road ahead on synchrotron radiation use in South Africa.

The meeting was attended by approximately 40 synchrotron radiation users, policy makers and representatives of a range of international synchrotrons. The cross-disciplinary nature of synchrotron light was documented by academic and industrial representatives from a wide range of disciplines including Materials Science, Life Sciences, Heritage Sciences and Paleontology, Geology and Environmental Sciences.

Tshepo Ntsoane is the chairperson of the South African Synchrotron Research Road Map Implementation Committee (SRRIC). He is a Senior Scientist at NECSA. Email: tshepo.ntsoane@necsa.co.za

Astronomy Desk Report

By Manfred Hellberg (UKZN, Durban)



Astronomy Desk Chair: Prof Manfred Hellberg

Background

South African astronomy stands at the threshold of very exciting times. We have a long history of optical astronomy, the forerunner of the SAAO having been established in 1820. Radio astronomy was started at Rhodes University in the 1950's, and the former NASA Deep Space Facility at Hartebeesthoek was converted into the radio astronomy observatory, HartRAO, in 1974.

In the last decade there has been an accelerating interest and investment in astronomy. The Southern African Large Telescope (SALT), the largest single optical telescope in the Southern Hemisphere, was constructed at Sutherland by an international consortium in which SA is the largest shareholder. It has recently been upgraded. The farsighted Astronomy Geographic Advantage Act of 2007 protects a large area of the Northern Cape Province from light and radio pollution, thereby safeguarding these areas for astronomy. South Africa and Australia have been shortlisted as possible hosts of the international Square Kilometre Array (SKA) radio telescope, which is slated to be one of the world's largest scientific facilities, with an estimated price tag of about \$2 billion. In the context of the SA bid for SKA Africa, the last few years have seen the building of the KAT-7 (Karoo Array Telescope) near Carnarvon, and the design of the 64-dish MeerKAT, construction of which is due to begin shortly. In addition, in neighbouring Namibia, there is a highly successful international gamma ray telescope, H.E.S.S. (High Energy Stereoscopic System), which includes participation from SA.

In the context of the growing internationalization and importance of astronomy in South Africa, and its perceived value in fostering development, the Minister, Mrs Naledi Pandor, established the Astronomy Desk in the Department of Science and Technology (DST) in October, 2010.

The Process

Prof Manfred Hellberg of UKZN was appointed to head the Desk on a part-time basis for 6 months. Supported by staff within DST, and advised by a Reference Group of eminent scientists, he was asked to prepare a report for the Minister, to advise her on substantive policy and strategic matters relating to the development of astronomy and related sciences, as well as matters related to South Africa's bid to host

the SKA radio telescope. The brief listed six topics that needed to be addressed.

The Reference Group was made up of Profs George Ellis (UCT), Renee Kraan-Korteweg (UCT), Sunil Maharaj (UKZN), George Miley (Leiden, and Vice-President of the International Astronomical Union), and Harm Moraal (NWU). In August 2010, George Miley had chaired the international panel that conducted a review of the National Astro-Geosciences Facilities as part of the 5-yearly NRF Review.

A wide-ranging process of consultation was carried out, including seeking the views of all sectors of the SA astronomy community, of key international astronomers with ties to the local community, and of other stakeholders in the national science and technology landscape.

The Astronomy Desk report was submitted to the Minister at the end of March, 2011.

The Minister and the DST considered the report, and on 19 October, 2011, the Minister made a presentation to the Parliamentary Portfolio Committee for Science and Technology, in which she summarized the key recommendations of the Report, and the official responses to them.

The Report

A copy of the Minister's powerpoint presentation, as well as unofficial minutes of that meeting (which also included other DST business) may be found on the website of the Parliamentary Monitoring Group, www.pmg.org.za/minutes/24. The full Astronomy Desk Report has recently been put on the DST website. It may be found at www.dst.gov.za/publications-policies/strategies-reports, under the title, "Report on Strategies and Policy for the Development of Astronomy in South Africa".

Recommendations and Outcomes

The key recommendations of the Astronomy Desk report are as follows:

1. The key to the future of astronomy in South Africa rests with human capital development. There is a need for an increased number of scientists and engineers (particularly Black South Africans) with the necessary expertise. Astronomy needs not only astronomers, but also engineers, ICT experts, technologists, technicians and artisans.

The Astronomy Desk report endorsed fully the recommendations of the 2009 NRF/DST report by Prof Krish Bharuth-Ram, as amended and brought up to date in 2010-11 by a representative Astronomy Working Group. The report, entitled "A Decadal Strategy for Human Capacity Development in Astronomy and Astrophysics in South Africa", was released by the NRF earlier this year. All aspects of the human resource pipeline (for instance, science awareness, growth of the university sector, career paths for young researchers, and support to senior astronomers) should be addressed.

The Minister has accepted that the HCD report would inform the work of DST.

2. With the recent rapid change and growth in astronomy in South Africa, and with more developments on the horizon, the existing fragmented governance and management structures are no longer appropriate for the complex and internationally-entwined nature of the discipline. Modern astronomy is typically multi-wavelength in nature, and it is proposed that the management of all aspects of astronomy should be brought under a single umbrella body through the establishment of a South African National Astronomy Agency (SANAA), reporting directly to DST. This agency should oversee the management of all facilities, funding for research and astronomy-related HCD, and outreach work, be governed by a Board with representation from universities, facilities, industry and international experts, and have a CEO who should be a scientist of stature. SANAA would take over the current roles and obligations of the NRF with regard to Astronomy once established.

This overarching recommendation has been accepted in principle, and DST will investigate the modalities required to give effect to this.

3. The directors of the optical and radio observatories should be experts in the field, and they should be supported by strong business managers. Advisory Boards should be appointed for the observatories.

The first recommendation is firmly supported by the Minister, and the process of developing the mandate and powers for these Boards is under way.

4. The South African SKA Project Office (SASPO) and HartRAO should merge into a single SA National Radio Observatory (SANRAO). However, the merger should be carried out with due deliberation, so as not to dissipate the energy required for the SKA bid process.

The Minister's response is that this supports a decision already taken to establish SANRAO. However, implementation of this will be addressed in the medium-to-long term, given the priority for SASPO to focus on the SKA bid process.

Further recommendations related to various aspects of astronomy may be found in the full Report. The Minister's presentation lists a number of these, and indicates support for them.

One of the recommendations relates to intensively exploring the possibility of making a South or Southern African site bid for the Cerenkov Telescope Array (CTA), the proposed successor to H.E.S.S.

DST has decided to support Namibia's bid for CTA since it is complementary to H.E.S.S.

Another recommendation is that the Astronomy Desk should be continued, to implement the proposals for new governance and management systems for astronomy.

The Minister announced that the Desk will be retained on the basis of a 3-year contract appointment.

In conjunction with the Desk, DST will work on the implementation plans to give effect to the recommendations.

Prof Ramesh Bharuthram (UWC) will head the Astronomy Desk, and he will be advised by a Reference Group of prominent SA astronomers.

Manfred Hellberg: A theoretical plasma physicist who studies linear and nonlinear waves in space plasmas, Manfred is Emeritus Professor and Senior Research Associate in the School of Physics, UKZN. He is a former President of SAIP and was Convenor of the 2004 International Panel "Shaping the Future of Physics in South Africa." He has taught on the National Astrophysics and Space Science Programme (NASSP) since its inception in 2003, and has served on the National Astronomical Facilities Board.

Obituary for Professor Sadha Pillay

Tribute prepared by the School of Physics, UKZN

31 December 1965 – 30 September 2011

Sadhasivan Rangan (Sadha) Pillay was cut down in his prime on Friday 30 September 2011, aged 45, after a year-long struggle with cancer. Sadha was an Associate Professor in the School of Physics at UKZN in Durban, and since his diagnosis in October 2010 he continued to be active in the School with research, lecturing and postgraduate supervision, and also found the strength to carry out duties for Umalusi, and run workshops for science teachers. Only in the last three weeks of his life did his illness prevent him from being on campus.

Sadha Pillay obtained a B. Paed. degree at UDW, graduating in 1987 with distinctions in both Physics and Physical Science Methods. He then taught Physical Science and Technica-Electronics at Merebank Secondary School for four years. While teaching, he completed his Honours degree in Physics through part-time study in 1991. He was then appointed at UDW as Academic Development Programme Coordinator for Physics and Mathematics. Doing his research on a part-time basis, he completed an MSc in theoretical particle physics in 1994 under Ahmed Bawa, and a PhD in theoretical plasma physics under Ramesh Bharuthram, graduating in 1999. During this time he was also deeply involved with colleagues in physics education studies, related to the school-university interface and to techniques for assisting disadvantaged students, and presented papers both nationally and internationally.

He was appointed as a Lecturer in Physics at UDW in 1996, earned promotion to Senior Lecturer in 2000, and was Chair of the Physics discipline during 2000-2001. In 2002-2003 he worked at the Hermanus Magnetic Observatory (HMO) as Research Physicist and Head of the Space Physics Group, before returning to UDW in 2003 as Associate Professor, while continuing to retain close ties with the HMO.



In 2005 Sadha Pillay was appointed as the first Head of School of Physics in the newly-merged UKZN, a position he held until 2010. He was responsible for successfully uniting three physics departments into a close-knit team in the new School, designing the refurbished Physics offices and laboratories on the Westville campus, and overseeing the consolidation of the Durban centre of the School there.

Sadly, Sadha had a relatively short research career. He was aged 28 when he was awarded his MSc, and over a period of 17 years he was co-author of about 20 peer-reviewed articles in international journals. In addition, he published articles in international conference proceedings, and also made presentations at both national and international conferences and workshops. His most-cited paper, published in 2008, has been cited more than 30 times.

Sadha's research activity was characterized by its breadth, and by collaborations with a range of people, both nationally and internationally. His main interest was the theoretical study of waves and nonlinear structures in space plasmas. In particular, he was involved in a series of papers on the occurrence and behaviour of solitons and double layers in space plasmas, with a specific emphasis on dusty plasmas. Such plasmas, known to occur in a number of space environments, are comprised not only of electrons and ions, but also include charged dust grains (typically, say, micron-sized). The charge, usually negative, may be as large as 10^4 electron charges. Having a very different charge-to-mass ratio from that of ions and electrons, dust particles have significant effects on waves in plasmas.

He collaborated with a number of UKZN colleagues and students, and continued to interact particularly with both Ramesh Bharuthram, now DVC at UWC, and Shimul Maharaj, who moved to HMO. For 8 years over the period 1997-2007, he was a member of a UND-UDW team involved in a Flanders-SA Cooperation project with Frank Verheest (Ghent University, Belgium), who is also an Honorary Professor in our School. Sadha made full use of the opportunity to pay a number of research visits to Ghent. This interaction was particularly fruitful, yielding ten peer-reviewed papers, including Sadha's three most-cited articles. For a number of years Sadha had also collaborated effectively and productively, via an NRF agreement with India, with Gurbax Lakhina and Satyavir Singh of the Indian Institute of Geomagnetism in Mumbai.

Recently, he broadened his research interests to include upper atmosphere physics, with colleagues at the HMO and the National Laser Centre of the CSIR, leading to a number of papers. As Head of School he was instrumental in involving staff of both the HMO and the NLC in teaching Honours modules at UKZN, thereby cementing valuable links with those two institutions. In addition, he took over responsibility for running the solar energy studies that had been initiated at UDW in collaboration with colleagues in Trondheim (Norway) a decade or more ago, and supervised a number of postgraduate students in that area.

Sadha was deeply involved in the development of space science nationally. With the recent establishment of SANSa (SA National Space Agency), and the incorporation of the erstwhile HMO into it as SANSa Space Science, he played an important role in helping to develop the latter's future strategic plans, and was asked to make a presentation to the SANSa Board. His contributions to the national space science effort have been lauded by both Sandile Malinga, CEO of SANSa, and Lee-Anne McKinnell, Director of SANSa Space Science.

Teaching was always very dear to Sadha's heart, and in particular, the teaching of students from a disadvantaged background. He developed interactive teaching materials for Introductory Physics, and also played central roles in the development of Physics Centres at both UDW and HMO, and, more recently, the Science Centre on the UKZN Westville campus.

As a young teacher, he acted as a sub-examiner of the Physics part of the then House of Delegates Matriculation Physical Science examinations in 1989-1992. After joining UDW, he continued to remain in close touch with school teachers and the matriculation examination process. In 1994-5 he took over as the Examiner, and in 1996-8 fulfilled that role for the common KZN provincial examinations of the merged education departments. From 2005 to 2011, Sadha acted as the Umalusi external moderator for the national Physical Science examinations. This involved setting national standards, vetting marking memoranda, moderating sample scripts from provinces, and moderating school-based assessments on a provincial basis.

Over the years, he prepared material and presented workshops for Physical Science teachers in all the provinces, especially for the Dinaledi schools from 2001 to 2011, and he played a significant role in the upgrading of Northern Cape teachers through UKZN. Earlier, he had also been closely involved with the SA Association of Teachers of Physical Science. One of its key activities was the development of tests in Mathematics, Physical Science and English, that were used by some of the HDI universities for the

placement of first year students in their institutions. Clearly, he made a valued contribution to human capacity development in the sciences.

Sadha was devoted to his children and family, and was a good and much-loved friend to many, both at UKZN and in the wider community. He had a keen interest in plants (particularly cycads and bromeliads), he loved hiking in the 'Berg (and even conquered Kilimanjaro in 2005), and was a great companion at any party.

Before his tragic and untimely death, Sadha Pillay made a large contribution to the community, and he could have contributed so much more. He will be painfully missed and at the same time warmly remembered by his family, friends and colleagues. He will be forever honoured in our thoughts.

SAIP to Register as a Professional Body with SAQA

By Brian Masara (SAIP office, Pretoria)

The South African Qualifications Authority (SAQA) is currently formulating a policy for the recognition and registration of professional bodies in South Africa. Draft policy on the recognition and registration of professional bodies can be found at: <http://www.saqa.org.za/docs/policy/draft/professionalbodies.pdf>

The registration of professional bodies with SAQA has the following objectives

- i. Advance the objectives of the National Qualifications Framework.
- ii. Promote public understanding of, and trust in, professions through the establishment of a nationally regulated system for the recognition of professional bodies and for registration of professional designations.
- iii. Encourage social responsibility and accountability within the professions relating to professional services communities and individuals.
- iv. Promote pride in association for all professions, including traditional trades and occupations.
- v. Promote the protection of the public by professional bodies from malpractice related to the fulfilment of the professional duties and responsibilities of professionals registered with them.
- vi. Encourage international best practice for all professions in South Africa, including continuing professional development.
- vii. Facilitate access to, and analysis of, data related to professions, including traditional trades and occupations for the purposes and use as prescribed by the NQF Act.
- viii. Support the development of a national career advice system

As part of developing the criteria for recognition of professional bodies 10 professional bodies have been selected to register during the pilot registration phase. SAIP is among the 10 bodies that were nominated to register with SAQA during the pilot phase.

SAIP will register MSAIP (member of SAIP) as a professional designation for professional physicists in South Africa.

The registration process may require introduction of one or two best practice professional bodies management systems to the way SAIP manages its membership system and what is required of members of SAIP. Further information will be communicated to members by council.

'Quantum Hanky Panky' at the University of KwaZulu-Natal

By Adriana Marais (UKZN, Durban)

NITheP and CQT host a workshop on quantum biology

The local KwaZulu-Natal (KZN) node for the National Institute for Theoretical Physics (NITheP) together

with the Centre for Quantum Technology (CQT) hosted a Quantum Biology workshop at the University of KwaZulu-Natal (UKZN) this month from the 7-11 November 2011. The workshop was organised by the head of the research centre, Francesco Petruccione, as well as CQT members Ilya Sinayskiy and Adriana Marais, and gathered 32 students and researchers from a range of institutions around the world. Andreas Buchleitner from the University of Freiburg, Gian Giacomo Guerreschi from Innsbruck University, Seth Lloyd from the Massachusetts Institute of Technology, Javier Prior from the Universidad Politecnica de Cartagena, Raymond Sparrow from the Council for Scientific and Industrial Research, Pretoria, Artur Ekert and Vlatko Vedral both from the National University of Singapore and Oxford University, and locals Ilya Sinayskiy and Adriana Marais, gave invited talks inspired by the recently detected 'quantum hanky panky' (to quote Prof. Lloyd) in biological systems. Topics including "Quantum cloning in a biological context", "The quantum goldilocks effect" and "Synthetic biology" inspired much discussion within the vibrant group of delegates.

Attendees also investigated aspects of local classical biology at Tala Game Reserve for the workshop dinner, where students from the University of Cape Town, the University of Pretoria, Witwatersrand University and the University of KwaZulu-Natal had time over and above the workshop's scheduled discussion times to ask questions and share ideas with top researchers in the field.

What is quantum biology?

Quantum theory accurately describes microscopic phenomena occurring in inanimate systems consisting of photons, electrons and atoms, while the life sciences deal with living systems on a macroscopic scale. Even as the foundations of quantum theory were being established in the early 1900s, there was speculation by some of the founders as to whether quantum effects could possibly play a role in living systems. Schrödinger questioned how the physical events taking place with living organisms could be accounted for by physics and chemistry [1], while Wigner considered the improbability of biological self-replication from a quantum mechanical perspective [2]. Recently, the regimes of applicability of these two areas of science are intersecting: quantum physicists are able to describe systems of increasing complexity, while life-scientists are able to give increasingly detailed explanations of macroscopic phenomena in terms of molecular structures and mechanisms. Now, at the turn of the 21st century, developments in ultrafast spectroscopic techniques have for the first time revealed surprisingly long-lasting quantum coherence in biological systems, including in the photosynthetic light-harvesting complexes of certain bacteria and marine algae [3].

Understanding the relevance of these effects is a fast-growing and fascinating direction of research. From a quantum computational perspective, it is surprising that quantum coherence, typically thought to be extremely fragile in the presence of heat and noise which are typical characteristics of biological environments, can prevail so much longer than expected. On the other hand, a fundamental and intriguing question is whether Nature has long-since made non-trivial use of quantum effects in living systems.

The many interesting projects and collaborations that have emerged from the Quantum Biology workshop, together with the 23rd Chris Engelbrecht Summer School to be held by NITheP together with CQT together in January 2012 at KZN's Salt Rock Hotel, is sure to put the cutting edge quantum biology research being done right here in Durban on the map!



References

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2. E. Wigner (1970), "Symmetries and Reflections: Scientific Essays". MIT Press.
3. G. S. Engel et al. (2007), Nature **446** 782, G. Panitchayangkoon et al. (2010), Proc. Natl. Acad. Sci. U. S. A. **107** 12766, H. Lee, Y.-C. Cheng and G. R. Fleming (2007), Science **316** 1462, E. Collini et al. (2010), Nature **463** 08811.

Author Biography: Adriana Marais is currently a PhD student at the Centre for Quantum Technology at the University of kwaZulu-Natal. Her research is in the area of quantum biology, focusing on biologically inspired transport phenomena in quantum systems. Email address: adrianamarais@gmail.com

Post Graduate Research Day at UKZN

By Abdul Mirza (UKZN, Durban)



The Faculty of Science and Agriculture hosted its annual Post Graduate Research Day on 31 October 2011 at the University of KwaZulu-Natal's Westville Campus. The event provides a platform for postgraduate students to present their research to the entire faculty and potential employers. The students of the School of Physics presented in the M-stream category and a number of them were awarded prizes for their contributions. Ms Sharmini Pillay, a MSc student of the Quantum Research Group, was awarded first prize for her oral presentation entitled "Polarisation encoded Quantum Key Distribution in Fibre". Ms Farran Henning, a PhD candidate of the Space and Plasma Physics group, was awarded second prize in the same category for her presentation entitled "Electrostatic Bernstein Waves in plasmas whose electrons have a dual Kappa distribution: Applications to the Saturnian Magnetosphere." Mr Reginald Abdul, a MSc student also of the Space and Plasma Physics group was awarded third prize in the poster category for his poster on "PIC simulations with Kappa distributions". The School of Physics is proud of the achievements of our students, and the display of the progressive nature of the research at the School of Physics at the University of KwaZulu-Natal.

Author Biography: Abdul R Mirza completed his MSc at the University of KwaZulu-Natal in Physics. Mr A Mirza is currently pursuing his PhD in quantum physics at the Centre for Quantum Technology at the University of KwaZulu-Natal. His work has been recognized by the Scientific American, Institute of Physics (UK), European Telecommunications Standards Institute, Siemens Global and the University of Geneva. Mr A Mirza is a lecturer at the University of KwaZulu-Natal and a co-founder and the Executive Director of QZN Technology (Pty) Ltd, a technology company focused on quantum innovation.

Unassigned deposits into SAIP account

By Japie Engelbrecht (SAIP Honorary Treasurer)

I have previously requested assistance in Physics Comment. I also recently requested the Secretary of the SAIP to forward the attached list to all HoD's and Directors of National Facilities. However, I have not had much success to date.

Basically, many institutions deposit members' annual fees into the SAIP account, but without the NAME/SURNAME or SAIP ACCOUNT number of the respective member. This leaves me with many members complaining when they annually receive the Reminders that their membership fees are in arrears. I fear that some members' membership of the SAIP may have been terminated on the basis of them being in arrears longer than 2 years (SAIP Constitution). And I have not yet mastered the skill of divining the respective member's name from entries in the bank statement of e.g. "Groblersdal" or "Name of University", despite taking lessons with Yoda of Star Wars.

PLEASE consider the list below, and inform me if any of these payments were made on YOUR behalf. I can be contacted at Japie.Engelbrecht@nmmu.ac.za.

<u>DATE OF DEPOSIT</u>	<u>INDICATED (Bank statement) AS</u>	<u>AMOUNT</u>
<u>2006</u>		
12 May	Foundationpay (UFH)	250.00
07 June	Foundationpay (UFH)	250.00
06 October	ILAB	250.00
16 October	Iris Gerber La Lucia	490.00
08 December	Foundationpay (UFH)	390.00
<u>2007</u>		
26 January	CSIR	250.00
23 March	Mafeking	445.00
22 August	NMMU	280.00
<u>2008</u>		
29 May	Ithemba	4,075.00
14 Aug	SAAO	300.00
06 Nov	Foundationpay (UFH)	830.00
22 Nov	UCT (cheque)	300.00
25 Nov	ILABS	1,290.00
29 Nov	Foundationpay (UFH)	145.00

2009

12 Jan	Cheque deposit	300.00
19 Jan	iThemba Labs	240.00
22 May	Sithole	1 400.00
9 Junie	UFH	390.00
9 July	US refund	435.00
22 Oct	UoJ	330.00

2010

30 April	Foundationpay (UFH)	1 050.00
4 May	UNIVEN	350.00
11 May	UWC	430.00
21 May	HMO	350.00
25 May	Wits	280.00
8 June	UWC	430.00
22 June	Wits	350.00
13 July	Ilabs	2 865.00
15 July	UoJ	350.00
23 Nov	UCT	1 900.00
23 Nov	CSIR	10 450.00

2011

29 March	Wits	330.00
12 May	iThemba Labs	720.00
13 May	SAAO	90.00
13 May	SAAO	90.00
13 May	SAAO	90.00
31 May	UWC	800.00
7 June	iThemba Labs	90.00
7 June	Foundation Pay (UFH)	330.00
9 June	NMISA	185.00
10 June	SAAO	90.00
20 July	SANSA	370.00
23 July	Groblersdal	150.00
23 August	Wits	370.00
15 September	UKZN	3 525.00
20 September	UoJ	370.00
28 October	Foundation Pay (UFH)	255.00

Science with KAT-7

By Simon Ratcliffe (SKA Africa), Faith Hungwe (Rhodes University) and Roy Booth (SKA Africa)



Introduction

Active Galactic Nuclei (AGN) are compact regions which exist at the centre of many galaxies and emit radiation across the electromagnetic spectrum. The radiation is believed to result from matter accreting onto a super-massive black-hole at the centre of the galaxy. Blazars are a subset of AGN and are variable sources, which are thought to have an intense, relativistically beamed component of emission directed along, or close to the line of sight to the Earth.

PKS 1510-089 is one such object and on October 19, PhD student Faith Hungwe working with Prof R. Booth in collaboration with Dr R. Ojha of NASA/GSFC, while doing her regular stint as Flare Advocate for the Large Area Telescope (LAT, the main instrument aboard the Fermi Gamma Ray Space Telescope), issued an Astronomer's Telegram together with R. Ojha and M. Dutka, reporting a record gamma-ray flux level for the source.

This is the highest gamma-ray flux ever reported for this source and the second highest flux ever recorded by the Fermi/LAT (ATel #3694). The Astronomer's Telegram alerted the astronomical community to this event, but more directly, Faith also alerted astronomers at HartRAO and in the SA KAT office who, for the first time, had access to a fully operational KAT-7 telescope and were able to bring it into operation with immediate effect.

Kat-7 Follow Up

Comprised of seven 12-m composite dishes, Kat-7 is a precursor instrument to the MeerKAT radio telescope currently under construction near Carnarvon in the Northern Cape. Although developed primarily as an engineering test bed, Kat-7 is showing itself capable of producing science quality output.

In fact, a science verification program, which is used to validate the instrument in an holistic way, will get underway early next year.

The Kat-7 team received notification of the PKS 1510-089 gamma-ray flare via ATel #3694 on the evening of October 20th. An initial 6-hour observation of the target was done on the morning of October 21st. The observation strategy used 3C 273 as a bandpass calibrator and PKS 1508-055 as a gain

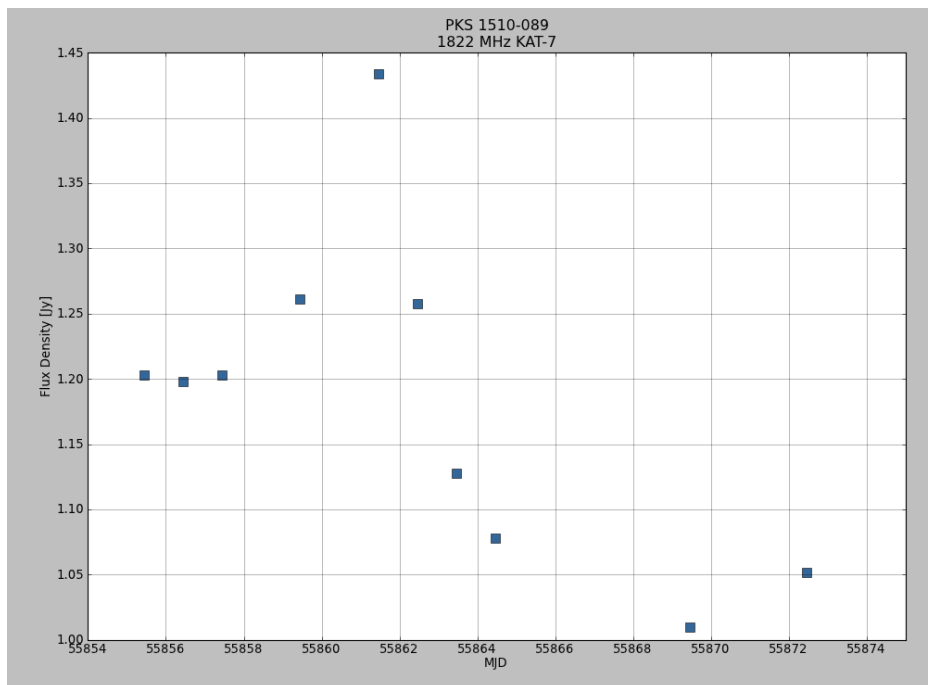


Figure 1: PKS 1510-089 flux density at 1.8GHz since October 22 2011

calibrator. The bandpass was visited hourly, and the gain calibrator every 5 minutes.

The Kat-7 correlator produces 1024-channel visibilities with a 1s dump rate, giving an observation size of around 20 GB for a six hour observation. This visibility data is written into an HDF5 based file format and augmented with a range of sensor data including antenna positioning and environmental factors.

Our reduction of the imaging runs used the CASA package released by the NRAO.

A total of 10 observations spaced over two weeks were made. Each of these was imaged separately and an estimate of the flux of PKS 1510-089, together with an uncertainty (10 mJy on average), was obtained.

The resultant data as shown in Figure 1, appear to capture the radio brightening of the source well, and show good correlation with radio data produced at other observatories, including those taken at HartRAO.

Author Biography:

Simon Ratcliffe – SKA Africa: Science processing architect. www.ska.ac.za

Faith Hungwe – Rhodes University PhD student based at Hartebeesthoek Radio Astronomy Observatory (HartRAO) www.hartrao.ac.za

Roy Booth - SKA Africa: Science Director. www.ska.ac.za

A user-powered hi-hat based on an NdFeB linear generator

By Joh Hansen (UKZN, Durban)

1. Introduction.

In a previous publication we discussed a user-powered synthesizer drum (or syndrum) based on a linear generator [1]. The fundamental frequency of the drum was set to be in the bass range of frequencies so that the sound would simulate that of a kick- or bass- drum. The fundamental frequency, or tuning, of the drum can be changed by adjusting one or more components in the synthesizer circuit. However, the most common configuration for a drummer when playing an acoustic drum kit is one where the one foot plays on-beats (mainly) using a bass-drum and the other foot plays off-beats using a hi-hat. The sound of a hi-hat is best described as shaped - or amplitude modulated - noise rather than any combination of tones.

A hi-hat is a pair of cymbals mounted in a vertical mechanism which clamps them together so that they can be muted as desired by depressing a foot pedal. The drummer would normally use his sticks or brushes to strike the cymbals of the hi-hat in the closed position. The drummer may also strike the hi-hat whilst the cymbals are separated and not muted, and then immediately press the pedal to mute the cymbals, creating a complex sound. The closed-hi-hat sound is most often used.

Figure 1: A typical acoustic hi hat

In this paper we discuss development of a synthesizer hi-hat (synhat). As in the case of the syndrum, the development is made possible by the application of the neodymium based (NdFeB) family of permanent magnets, which have a high flux density which allows for the design of a linear generator with a small displacement and yet a useful output power. As before this leads to a musical instrument where the physical effort of the musician can be used to power an electronic synthesizer long enough to produce a musical note or sound. The generator is pedal powered, as before, so that in combination with the bass syndrum [1] it can be used to play more interesting rhythmic patterns, whilst still keeping the hands free. We have noted that the leg muscles are powerful and capable of rapid reciprocating motion as is required when playing drums for an extended period of time, or running.

Mostly, we would like the magnitude and rate of transfer of kinetic energy to the generator of the drum to govern the response of the synhat. This should make it more playable as an instrument, by comparison with a trigger pad as is used with digital synthesizer drums.



2. Linear generator

Figure 2 shows (in section) the elements of the linear generator used in this design. a) nylon dome acts as target for beater of pedal, b) floating mute-plate with 2 sets of copper contacts and graphite studs (guide rods and springs not shown) c) generator coil 48 ohms and d) suspension of four adjustable tension springs. The battery of three 12 x 6 mm NdFeB cylinder magnets is shown in red.

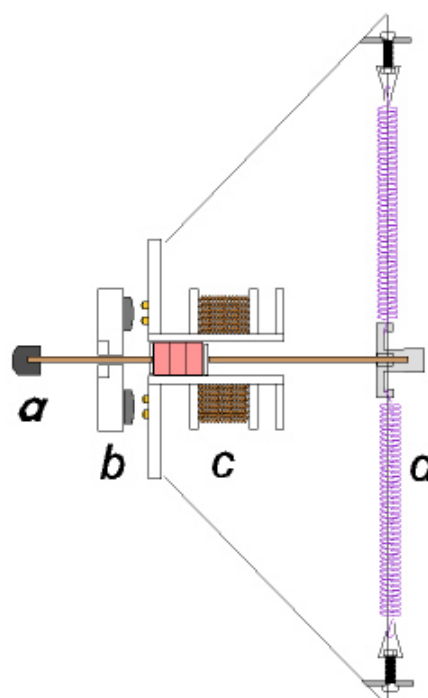


Fig 3 shows the embodiment in the prototype.



Figure 3 (left): Linear generator section of synhat showing adjustable springs . Two generator coils are present in this prototype although only one is in use.

The use of the tension springs in a spider arrangement allows for a greater range of adjustment of the return force and fundamental oscillation frequency of the generator. Also the instrument has a lighter feel when played, than one based on the compression-spring-based design used previously [1].

A major departure is the use of a mute plate as seen in Fig 4.

Figure 4 (right): Mute plate on linear generator. A hard or full stroke on the armature tip causes the plate to move in and close one or both micro-switches which sets a mute function. A light stroke causing travel of less than 10 mm does not enable the mute function.



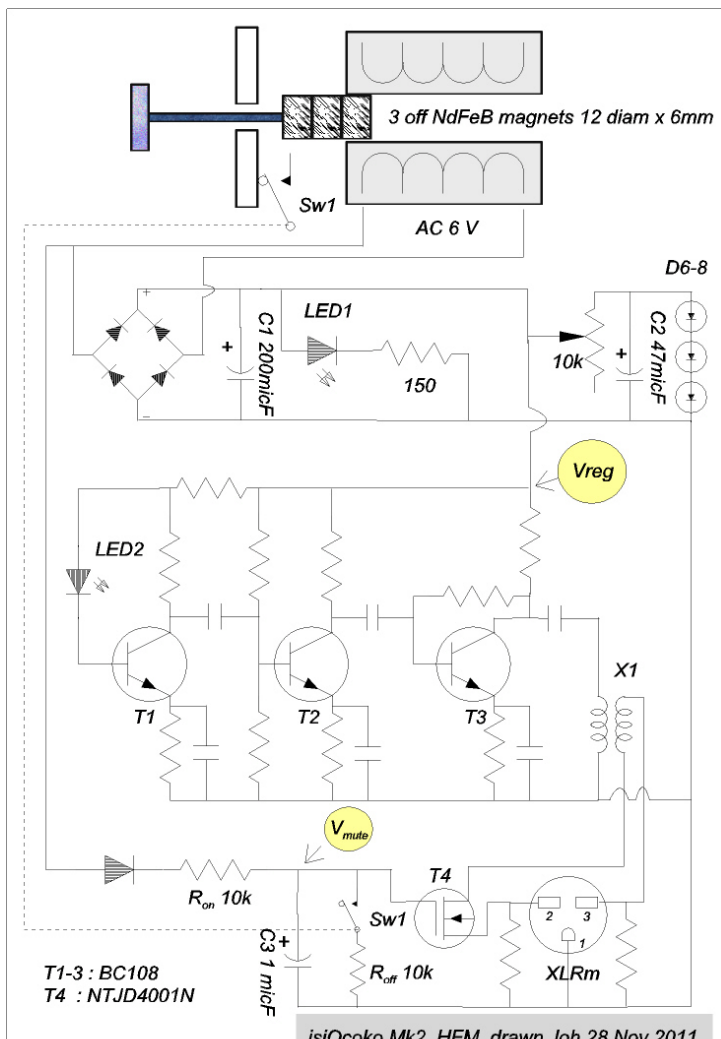
As before there is no magnetic yoke in this design. Any ferromagnetic material in the proximity of the neodymium magnet causes the action to be irregular or sticky. Experiments have shown that a length of travel of 10 mm is sufficient to generate the electrical energy required.

3. Description of analog synthesizer

Fig 5. Schematic diagram of synhat

Transistors T1 to T3 form a noise amplifier with the forward-biased red light-emitting-diode (LED2) acting as noise source, but at the level of microvolts. The gain at a supply voltage of 3V is 68dB giving a noise signal output at the collector of T3 of several millivolts. The amplitude modulation of the noise source takes place because the gain of the amplifier is strongly dependent upon the supply voltage and this is determined by the output of the linear generator in conjunction with the regulator circuit based on LED1 (blue) and the diode chain D6 to D8.

A typical drum-stroke will cause charging of capacitor C1 to 3 volts or more, at which point LED1 will light. Conduction to ground via LED1 and the 150 ohm resistor prevents V_{reg} , the voltage driving the noise source, from exceeding 2.5V and if there is no further generator output V_{reg} will decay towards the quiescent voltage set by the diode chain D6 to D8. This is typically 1.4V (two PN silicon diodes plus one Schottky diode). At this voltage the gain of the amplifier is small but sufficient to sustain a slight output, a more



natural effect than silence. The rate at which the signal output decays will depend upon the rate of decay of V_{reg} and this can be set via the 10k variable resistor. Appropriate selection of the bias resistors in the noise amplifier allows for very low quiescent current at minimum V_{reg} of 1.4 V so that the amplifier would be in effect on standby pending the next drum stroke. This is important to prevent turn-on clicks and thumps in the signal output. The light emitting diode (LED1) provides an additional function, as a go-nogo tester for the generator.

3.1. Hard mute

A hard-mute action is supplied by the voltage-controlled attenuator comprising Sw1 and T4, a signal-switching field effect transistor. With switch Sw1 open, as when playing strokes of less than 10mm, C1 charges via R_{on} to give a control voltage V_{mute} of 3V or more. At this voltage the drain-source resistance of the FET, which appears in series with the secondary winding of the output transformer, is only few ohms so that there is no attenuation. When switch Sw1 closes because of a stroke of more than 10mm (a hard stroke), V_{mute} decays typically in 10 milliseconds, to less than 1.2 V at which point the drain-source resistance of T4 is several kilohms and the output is attenuated by -12dB or more. As soon as switch Sw1 is opened again, and provided there is generator output, the signal output will rise again, in some ways similar to the effect of opening an acoustic hi-hat. By the same token, a slow release of the pedal, leading to switch Sw1 opening whilst the generator magnets are moving slowly, gives a silent de-muting. This represents a more natural response.

3.2. Output.

The output is a balanced line signal via an XLR male microphone socket at pins 2 and 3. This is compatible with conventions for sound reinforcement. There is an earth wire (no 1) but it carries no signal and is there for safety only. There is no mains connection and no battery power requirement. Phantom power, as required by some microphones, should not be activated when using this circuit since the voltage (48V) would appear at T4 as a control voltage.

Figure 6 (right): Synhat with pedal. Sustain control is via the slider at bottom left.

4. Oscillograms and spectra.

Oscillograms and spectra were obtained using the OscilloMeter 5.07 program [2].

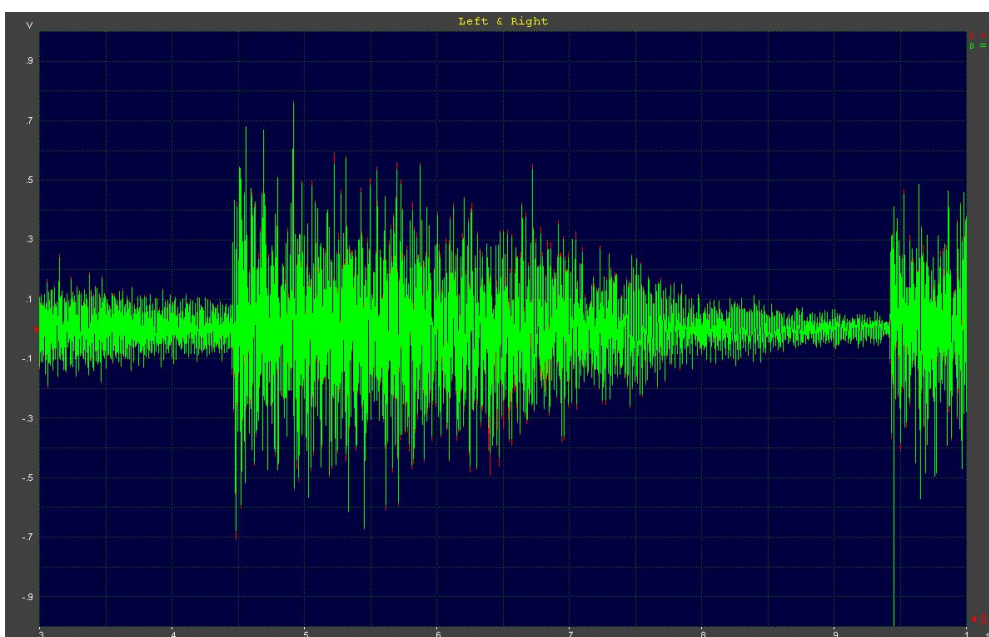
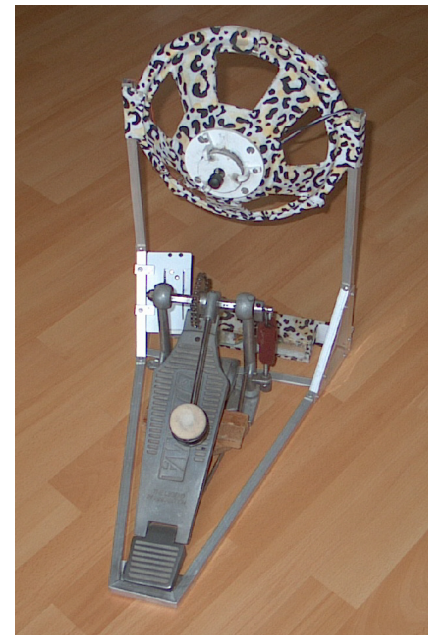


Figure 7 (left): Oscillogram from acoustic hi-hat (as in Fig 1) closed - x axis time intervals are 100 ms.

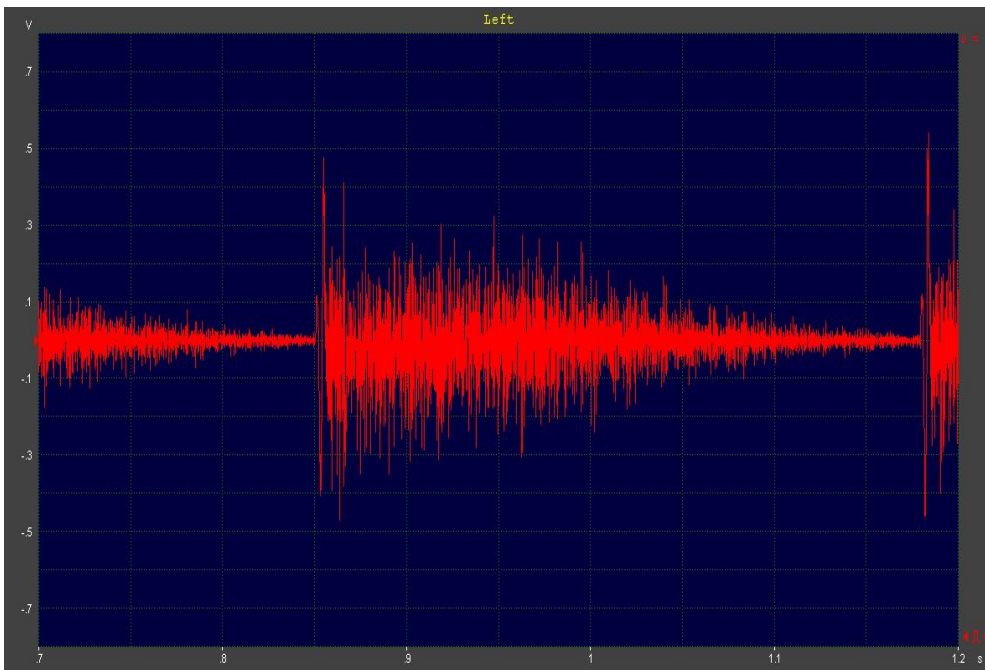


Figure 8: Oscilloscope from synhat. x-axis time intervals are 100 ms. Hard mute not engaged

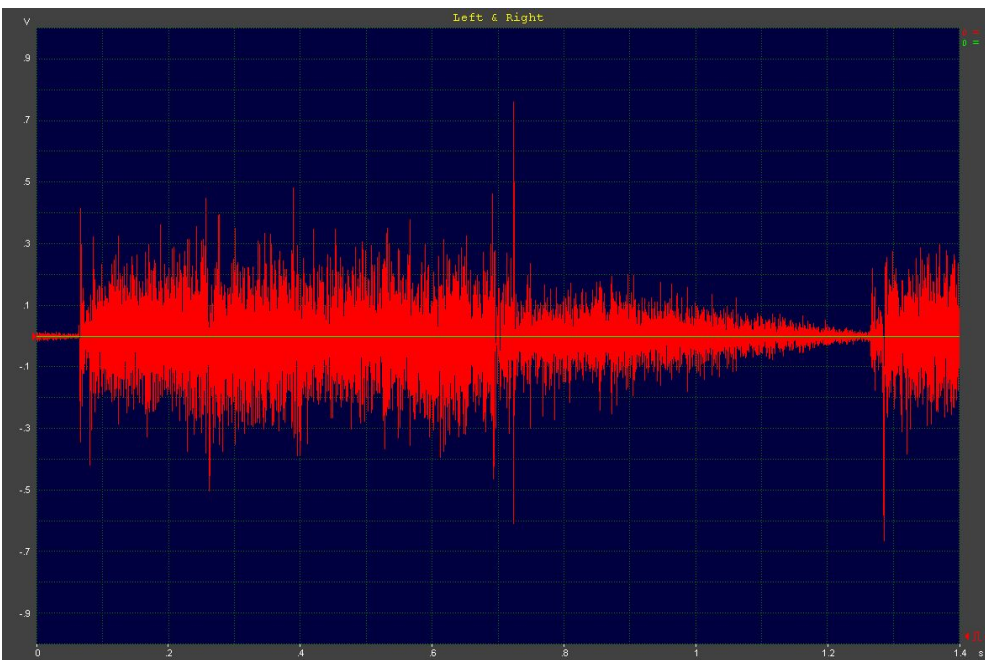


Figure 9: Oscilloscope from synhat. x-axis time units are 200ms. Hard mute applied at t = 0.7 s.

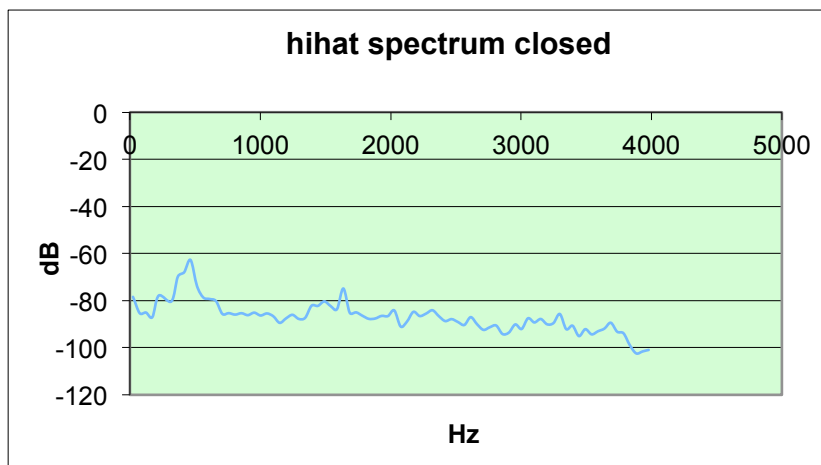


Fig. 10. Spectrum of acoustic hi-hat. Fundamental tone at 465 Hz. Signal taken directly from microphone

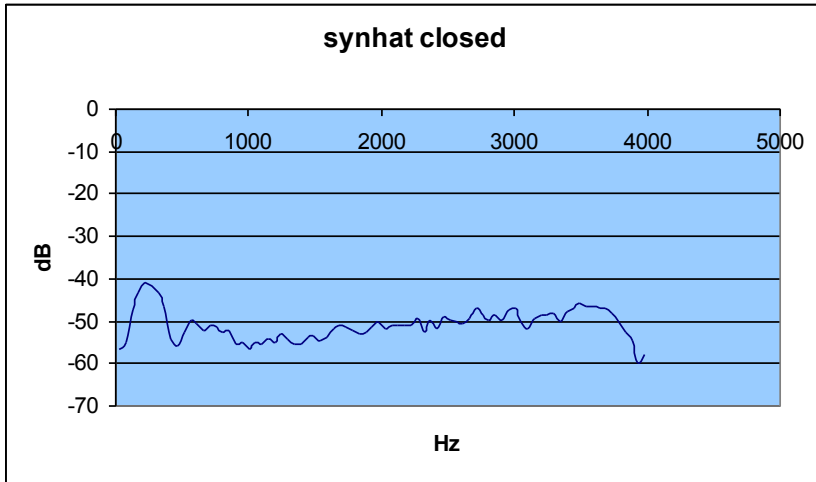


Fig 11. Spectrum of synhat. Fundamental tone at 220 Hz. Signal recorded via a pre-amplifier.

The slight positive slope of the synhat frequency response is not of great importance since it can be accommodated by the use of conventional tone controls.

5. Conclusion.

As partner to the bass syndrum discussed in this journal previously, we present a percussion instrument that emulates some of the features of a hi-hat, but is powered by the stroke of a drummer's pedal and needs no battery or mains connection.

It shows an intrinsic velocity sensitivity which might be 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. The decay of the signal, which in an acoustic instrument would be controlled by the pedal action which brings the two cymbals into contact, is regulated in two ways. Firstly there is an electronic adjustment of the rate of decay of the generator voltage and this provides the envelope for the amplitude of the synthesizer output. Secondly, there is a foot-actuated mute function which can be initiated by playing a hard or long stroke on the pedal.

Acknowledgments..

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

Lee and Dieter at Coastal Music provided Fig 1 and access to the Paiste acoustic instrument.

Joh Hansen lectures in Physics and also plays guitar and drums including the syndrums presented in this article. He is current involved in collaboration with the Physics groups at the University of Johannesburg and the University of KZN,

Email: scrdochansen@gmail.com ,address: P O Box 201872 Durban North 4016, tel 0823309652.

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[1] Hansen J.O., *A User-Powered Syndrum Based on a NdFeB Linear*

Generator

http://www.saip.org.za/images/stories/documents/PhysicsComment/2011/Volume_3_Issue_1_Match_2011.pdf

[2] Shmelyoff Oleg M. OscilloMeter 5.07. <http://shmelyoff.nm.ru>

Opportunities

News from IAU Office of Astronomy for Development

Kevin Govender

I would like to bring your attention once again to the IAU Office of Astronomy for Development (OAD), an effort that is meant to sustain the amazing momentum built during the International Year of Astronomy 2009. The simple vision is "Astronomy for a better world!" with a focus on 3 areas: school level education; university level education and research; and the public understanding of astronomy.

Please have a look at the website <http://www.astronomyfordevelopment.org> for more information and to participate in activities.

I would like to bring your attention especially to a few highlights:

1. There will be a workshop of stakeholders taking place 12-14 December 2011 and everyone is invited to provide input (<http://www.astro4dev.org/index.php/oadevents/oadworkshop>)
2. We have a space on the website where you can register as a volunteer for projects (<http://www.astro4dev.org/index.php/volunteers>)
3. There's also a space where you can submit your project ideas and proposals relevant to the goals of the OAD (<http://www.astro4dev.org/index.php/oadprojects>)

The objective is to set up regional nodes across the world which will coordinate activities locally, as well as 3 global Task Forces for the respective focus areas (school level education; university level education and research; and the public understanding of astronomy). If your organisation is interested in hosting a regional node then please submit your expression of interest on <http://www.astro4dev.org/index.php/regions> . Following the OAD stakeholders workshop in December a call for full regional proposals will be issued.

Right now there's a request out for input into the development of the OAD and I appeal to you to send us your ideas, either via the online form, Skype or email. I copy some text from the relevant webpage below. WE NEED YOUR INPUT!

Kevin Govender

Director: IAU Office of Astronomy for Development

Skype: kevindran | Twitter: @govender | Email: kg@astro4dev.org | Telephone: +27214609350

Lecturer/ Senior Lecturer - UFS

A post for a lecturer/senior lecturer is available at UFS

Duties: Teaching, research and participation in community service activities of the Department, as well as normal administrative duties.

Requirements: An MSc in Physics for a lecturer position or a PhD for a senior lecturer position, academic excellence and a commitment to actively do research in collaboration with Physics Department research group (solid state, astrophysics) at the University of the Free State, Bloemfontein Campus.

Assumption of duties: 1st February 2012 or as soon as possible thereafter.

Enquiries (Academic):

Prof H.C. Swart,
Department of Physics, UFS, P O Box 339, Bloemfontein, 9300
Fax: (051) 401 3507
Phone (051) 401 2926
Email: swarhc@ufs.ac.za

APS International Travel Grants for physicists from developing countries

The APS [American Physical Society] is now accepting proposals for the International Travel Grant Award Program (ITGAP), and we invite members of the APS units that sponsor the program to apply for these funds.

ITGAP promotes international scientific collaborations between APS members and physicists in developing countries. Grant recipients receive up to US\$2,000 to help support travel expenses associated with visiting a collaborator abroad.

Applications should be submitted by two co-applicants and propose a collaborative visit of at least one month. One co-applicant must be from a developing country and the other must be from a developed country. At least one co-applicant must be a member of one of the APS units that sponsors ITGAP.

For information on application guidelines and a list of units that sponsor ITGAP, please visit the ITGAP website at:

<http://www.aps.org/programs/international/programs/travel-grants.cfm>

The application deadline is Tuesday, 17 January 2012. Applications can be submitted online at: <http://ultron.aps.org/forms/aps1.cgi?ID=1068>

Upcoming Conferences & Schools

Exploring QCD Frontiers: from RHIC and LHC to EIC

A workshop on Exploring QCD Frontiers: from RHIC and LHC to EIC will be held from January 30 to February 3, 2012 at the Stellenbosch Institute for Advanced Studies, a brief thirty minute drive into the beautiful wine country surrounding sunny Cape Town, South Africa.

The topics covered will be saturation and its measurement; parton densities, nuclear spin and angular momentum, and generalized and transverse momentum parton distribution functions; and constraints on initial energy-density formation and connecting initial conditions to hydrodynamics in heavy ion collisions. We plan on long presentations with plenty of time for informal discussions, with the idea being to have maximum communication of physics amongst the participants.

Thanks to generous support from the South African National Institute for Theoretical Physics (NITheP) and the Brookhaven National Laboratory (BNL) and the Thomas Jefferson National Accelerator Facility (JLab) in the US, there is no registration fee but due to space limitations, the number of participants will be strictly limited. Please visit our web presence at

<http://www.phy.uct.ac.za/conf/cpteic/index.php>

For more information contact

Dr. W. A. Horowitz, Department of Physics, University of Cape Town, Phone: +27 21 650 5553

ISYA 2012 in South Africa 6 – 26 Feb 2012

The 34th International School for Young Astronomers will take place during 6 - 26 February 2012 in Cape Town, South Africa. The school is organized jointly by the International Astronomical Union (IAU), the South African Astronomical Observatory (SAAO) and the University of Cape Town (UCT).

Applications:

Students studying for an MSc or PhD degree in Astronomy or Physical sciences are encouraged to apply for the 34th ISYA. The theme of the school is "Observational astronomy in the optical and infrared".

Applications from all over Africa are especially encouraged. Application deadline is 31 October 2011.

Location:

The South African Astronomical Observatory (SAAO), home of the 11-m Southern African Large Telescope (SALT), is the premier optical and infrared astronomy facility in Africa and plays a leading role in the promotion of astronomy in the continent.

The school will be hosted at the prestigious University of Cape Town, and at SAAO, and part of it will be conducted at the SAAO/SALT observatory site at Sutherland, 400km from Cape Town, in the Karoo semi-desert. A number of well-known scientists are invited to lecture during the school on a range of topics in active astronomical fields.

For more information visit <http://isya2012.saa0.ac.za/>

4th NUR International Scientific Research Conference (ISRC) NATIONAL UNIVERSITY OF RWANDA

THEME ENERGY: Towards sustainable, green and affordable Energy

16th – 18th November 2011 Butare Main Campus, NUR

For More information about this conference contact

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Fax +250-252 530210

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Website: www.conference.nur.ac.rw

AFRICAN SCHOOL OF PHYSICS 2012 Ghana

We would like to inform you about the 2012 African School on Fundamental Physics and its Applications.

The school will be held on 15 July - 4 August 2012 at the Kwame Nkrumah University of Science and Technology (KNUST) Kumasi, Ghana

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

7th International Conference On Laser Induced Breakdown Spectroscopy Luxor - Egypt

The 7th International Conference on Laser Induced Breakdown Spectroscopy will be held in Egypt from 29 September - 4 October 2012

Registration and Call for papers: We are inviting oral/poster presentations and commercial exhibits
Deadline of abstracts submission is May 15, 2012

For more information, online registration and abstracts submission please visit LIBS 2012 website :
<http://libs2012-niles.org/>

Deadline for submissions for the March 2012 issue of Physics Comment is 28 February 2012.

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

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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.

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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.

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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.

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Submission of Articles

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

