

News



Faculty of Science Newsletter

NSW 2018: A Celebration of Science!

From the 18th of July to the 4th of August, Nelson Mandela University hosted its annual National Science Week events. National Science Week is an initiative of the department of Science and Technology (DST) together with the South African Agency for Science and Technology Advancement (SAASTA). National Science Week is a nationwide celebration of science, with the primary goal of contributing to the development of a society that is knowledgeable about science, critically engaged and scientifically literate!

The Faculty of Science kicked off National Science Week: Road to Mvezo activities on the 18th of July, which is on the day of Nelson Mandela's centenary. The theme of the symposium, Deepening our Democracy through Science, was inspired by this year's National Science Week theme and the Nelson Mandela centenary.

The Symposium panel was made up of science lecturers, researchers and students who explored topics such as: How does cutting edge science enhance participation in a democracy?, Speaking up for science: the value(s) of science, A paradigm shift towards socio-ecological studies in the natural sciences and how this shift can help the voices of people to be heard and uplift communities and To science or not to science, Is democratized science really the future for women?

The NSW programme included activities for primary and high school learners from Port Elizabeth and surrounding areas. These activities included an Innovention campus tour, Physics Rocket Build, a virtual tour of SA CERN, organic chemistry lab tour and physiology's Journey through the Human Body.

The various symposiums, public lectures and seminars included compelling presentations from special guests such as Prof Amos Saurombe from UNISA, Prof Jean Cleymans from UCT, DST's Dr Daniel Adams and Chief Analytics Officer at FNB, Dr Mark Nasila. The Dean of Science, Prof Muronga, also hosted a series of public lectures in George on Science, Society and Democracy to keep with the NSW 2018 theme.

The Nelson Mandela University students were given the opportunity to get involved through participation in workshops such as the ESKOM Young Scientist Expo, the SAASTA Science Communication Workshop and the Women in Science motivational talk.

The highlight of NSW 2018 was the Faculty's visit to the Mandela School of Science and Technology in Mvezo, Mandela's birthplace, where in honour of his centenary we hosted a science exhibitions and workshops for school learners from the surrounding districts. The activities in Mvezo included interactive stall displays from our various departments, a chemistry show, computer coding boot camp, role model talks and physics rocket building activity.

The Faculty's NSW programme reached a total of 2499 participants with 1774 of them being from the Mvezo activities. The NSW 2018 was a great success and we look forward to reaching greater heights in 2019.



NSW: From the Students

By: Simphiwe Mgwenya (3rd year BSc Biological and Environmental sciences)



The Faculty of Science celebrated the annual National Science Week (NSW) from 18 July to 4 August 2018 and is the main event on the calendar for the science community. The programme featured multiple platforms for current science students, researchers and aspiring young scientists to showcase their research work and promote scientific awareness to the public, while addressing major burning issues facing the scientific community.

The events this year included: A Woman in Science talk, the Eskom Young Scientists Expo, a science communication workshop, various symposiums, seminars and a public lecture from SAEON by Dr James and Dr Parker-Nance. The events are aimed at highlighting the general challenges posed to young scientists in the industry and educating the public about the future of science and

the potential benefits the industry holds for local and national communities.

Various departments within the Faculty of Science teamed up with government's Department of Science and Technology (DST) and the South African Agency for Science and Technology (SASTA) as grant holders to provide in-depth research and information on what graduating science students can expect in the field and industries such as radio astronomy, national funded research projects, and banking.

One of the major highlights from this year's NSW was the Women in Science motivational talk. The talk took place on 3 August 2018 at South Campus and featured a duo of highly inspirational women talking about their respective fields. Dr Buyiswa Hlangothi, an Investec Regional Awards winner and Puleng Molleko-Boyce, a final year chemistry doctoral candidate and Nelson Mandela University Fame Lab winner. Their talk was based on creating awareness of the 21st century struggles that women face in a male dominated field and inspired and encouraged women from all backgrounds and struggles to pursue their passion and love for science. "The basis of my talk was to emphasise that your background should not limit nor discourage you but rather use the background as a source of strength and motivation to achieve your goals," said Puleng. The timing of the talk coincided with the month of August which is a month nationally celebrated as Women's Month.

The NSW wrapped up with two final events which featured a public lecture from the Dean of Science, Prof Muronga, on the importance of science co-existing with democracy and a symposium on science, society and democracy, which took place at George Campus and George High School respectively.

The theme for this year was "Deepening Our Democracy through Science" which was in collaboration with The University's rhetoric of honouring and celebrating the life and legacy of the late great Nelson Rolihlahla Mandela. The events were well-attended and growing support will ensure sustained growth and cultivate a conducive environment for grooming the next generation of driven, educated and solution-based thinking scientists to help elevate the nation and the continent to greater heights.

Reasons to be Proud

Dr George Isoe receives award for best paper at annual SATNAC

Dr George Isoe of the Physics Department, has received a prestigious award for the Best Paper at the annual Southern Africa Telecommunication Networks and Applications Conference (SATNAC) held in September 2018. The conference is attended by leading researchers from universities and industry across Southern Africa. George's research, based on his PhD work focuses, on developing novel technologies for connecting high-speed data centres such as Google hubs. Prof Tim Gibbon, Director of the Centre for Broadband Communication (CBC) had to say: "We are extremely proud of George and his achievement. Innovations such as these places our university at the forefront of cutting edge research in the area of broadband communication".



Forestry Student Wins International Junior Forest Contest in Russia



Miss Ntsako Shikwambana, final year of the Diploma Forestry (School of Natural Resource Management – George Campus) has achieved international fame when she was crowned as the winner of the 15th International Junior Forest Contest in Russia.

This annual International congress brings Forestry students from all over the world together to compete for the prize for the best Forestry paper. Although students from the NMU Forestry programme have constantly ended amongst the top 10 performers in the contest, this is the first time that we win and also a first time for Africa!

Govan Mbeki Mathematics Development Centre

Touch Tutor Quiz gets a makeover

By Kauthar Gool

The Govan Mbeki Mathematics Development Centre (GMMDC) launch[ed] an updated version of its learning app, TouchTutor Quiz, a spinoff from the original TouchTutor app introduced in 2012. The updated app contains new features, including a range of reference material in maths and science, as well as online competitions and assessments. It also uses minimal data.

This is according to Phil Collett, mathematics project manager of the GMMDC at Nelson Mandela University (NMU). "TouchTutor Quiz was developed by the GMMDC at NMU in collaboration with IT company AvoChoc, and was created with the desire to make learning material, language support, assessment and practise for maths and science freely available to all learners on their own mobile devices." It is primarily aimed at high school learners and teachers, but can cater for any subject at any level. Loading primary school content can be done, but may require partnership with interested teachers

or schools. "The app was previously only available on tablets and desktops for pupils in GMMDC project schools, with a laptop-based teaching resource for educators to make use of, notes GMMDC director Werner Olivier. "The updated app can be used by pupils, teachers and schools anywhere in SA and builds on our existing programmes, which have led to improved understanding and real results in the classroom."

The user downloads the app and then registers on the platform, explains Collett. "The app then has options for practise tests, assigned tests which are scheduled for specific times and accessing reference material and language dictionaries in eight South African languages. The user's record of test performance and their profile are always visible.

"Users must be online to register and download tests, but may use downloaded material offline. Results are uploaded when the user is online again. All material is accessed by simply touching the options available. Question types include multiple choice, matching, sequencing, true or false, numerical and text answers. "Collett notes the app is primarily aimed at high school learners, but college and university students will find it useful as revision. The app can potentially be used by anyone who wants to implement assessment and access content for reference purposes.

In future, GMMDC plans to expand participation in its annual online maths and science competitions, says Collett. "We intend to add game elements to the app and host regular challenges. We will continually expand the range of questions and tests available. We also intend to offer a commercial service for customised assessment."

The updated TouchTutor Quiz can be downloaded from the Google Play store on any mobile device. A similar initiative aiming to remove barriers to learning is video education firm Paper Video, which gives learners access to teaching offline using their mobile devices without needing any Internet connection or data.



Computing Science

'TANKS' app firing up future programmers

By Odette Parfitt – The Herald



Less than a year after its launch, a locally developed app aimed at sparking an interest in programming has been introduced to more than 1,000 young users across the world. The educational mobile application TANKS, designed by former Nelson Mandela University (NMU) postgraduate student Byron Batterson, celebrated this milestone after its launch in November 2017.

The promotion of TANKS, which teaches basic computer programming principles through a game, is now led by NMU's Professor Jean Greyling, who supervised Batterson's creation. According to Greyling, the app and the workshops built around it have been taken across Africa and to some European countries. The app, which is designed primarily for pupils aged 10 to 14, has a tank moving through a maze, following directions provided in the form of physical tokens that form a puzzle and

direct the tank when they are photographed.

"A friend who travelled to seven African countries as part of an educational outreach took the material and showed it at different schools along the way," Greyling said. Greyling himself took the workshop to Norway as well during a recent trip – though under a different title. "The concept of using tanks is too military for European countries, so we needed the alternative theme of plastics in the ocean." The workshop was therefore introduced as the board game BOATS, which will be launched locally in app form at the end of the month as well.

Meanwhile, the local reception of TANKS has been favourable, with several schools showing interest in implementing it in their curriculum and after-school programmes. "We had a workshop in Mvezo and had difficulty getting the children to stop playing. The energy is always there - and the enthusiasm in Mvezo and Port Elizabeth is exactly the same."

Greyling hopes to reach 100 000 pupils by the time TANKS reaches its fifth birthday, and to bring sponsors on board. "We've partnered with the Leva Foundation, which empowers us to negotiate with sponsors. "I want to have teams of interns facilitating the workshops and encouraging learners to think about coding. "My biggest dream for the app is that in three or four years we'll have graduates in the computing science department who will say their first experience with coding was through TANKS."

On 10 September 2018, the South African (SA) governing body of the SA-CERN programme held its quarterly management meeting at the Nelson Mandela University. The governing body is currently chaired by Prof Jean Cleymans, emeritus professor of High Energy Physics at UCT. The Dean of Science, Prof Muronga is also a member of the SA CERN programme. This was the first time the management team met outside of IThemba labs, the “headquarters” of Nuclear Physics research in South Africa. CERN (European Centre for Nuclear Research) is situated in Geneva, Switzerland and is home to the largest particle accelerator in the world. This international facility at present provides nuclear research opportunities to 90 countries and approximately 7000 researchers. The SA CERN programme consists of four international collaborations or sub-programmes namely:

The Large Ion Collider experiment: SA-ALICE

A toroidal large hadron collider experiment: SA-ATLAS (for the less informed, a toroid is a special solenoid that supplies a constant circular magnetic field)

An experiment involving the production and separation of isotopes: SA-ISOLDE and then,

A group that collaborates on the theory of high energy physics and Nuclear physics: SA-THEORY,

A particle accelerator is a device used to accelerate charged particles, such as electrons or protons, by means of electric and magnetic fields. The high energy particles (typically protons, accelerated to a fraction of the speed of light) are then focussed, using magnetic “lenses”, onto the nuclei of atoms in order to achieve high energy collisions. The result of this impact is the disintegration of the nucleus into its minor constituents, and consequently the more fundamental building blocks of matter (quarks etc.) can be studied. In addition to fundamental nuclear research, particle accelerators are used to, amongst other applications, manufacture radioactive isotopes for medical treatment.

The meeting was concluded by a very well received short colloquium, hosted in the Physics department. The meeting was open to all academics and students at the Nelson Mandela University. The speakers at the occasion, all SA-CERN collaborators, gave short presentations of the activities and latest research results of the various subgroups. They were Prof Tom Dietel (UCT – SA ALICE), Dr Sahaal Yacoob (UCT SA-ATLAS) Prof Nico Orca (SA-ISOLDE) and Dr Will Horowitz (SA-Theory). Similar meetings focussed at SA CERN student involvement are planned in the near future.

Student Engagements

The Dean engages with science undergrads

From the 21st to the 23rd of August, the Dean of Science, Prof Azwinndini Muronga, hosted a series of student engagements to discuss student concerns and possible recommendations for the future.

The engagement sessions, which took place at the Faculty of Science Auditorium in Building 127, allowed students the opportunity to voice their opinions and concerns. In the first of the sessions, the Dean met with third year science students who expressed their concerns regarding their readiness for research-based learning. The students proposed that support be provided from science academia and that they be given opportunities to engage with industry leaders and academics through experiential-based learning and training.

During the session for second years, the Dean encouraged students to build working experience through participation as tutors and lab demonstrators. He also highlighted the possible opportunities for internships at the Department of Science and Technology and NRF/SAASTA, which can be found on their respective websites. The importance of developing a strong scientific portfolio during one's time as an undergraduate student was also encouraged, to show research experience and scientific ability.

When meeting with the first years, the Dean inspired students to constantly seek other avenues through which they can use their science education for entrepreneurship, through innovative ideas and solutions. This being that science students should use their knowledge to try and solve everyday problems and through this create career and employment opportunities for themselves.

The Dean also met with George undergraduate students on Saasveld campus on 6 and 7 September, as a means of extending his student engagements to our science students on George campus.

A common theme throughout all of the sessions was the need for individual faculties to assist the students in learning about the various research fields and topics available for post-graduate studies. Prof Muronga also encouraged students to look at alternative bursary opportunities other than NSFAS such as those provided by SKA, NRF and CSIR.

The dean also highlighted opportunities for students such as the Undergraduate Awards and FameLab Science Communication competition, which allow students to show case their work on a global platform.

The undergraduate students' engagement sessions was a great success allowing students the opportunity to voice their opinions and concerns.

The post-graduate student engagement sessions are to follow.

Reasons to be Proud

Dean speaks at ASP/ACP in Namibia

The Dean of Science, Prof Azwinndini Muronga, was invited as a speaker at the fifth addition of the Africa School of Fundamental Physics and Application, ASP 2018 which was hosted at the University of Namibia (UNAM) and the Namibia University of Science and Technology (NUST).

Prof Muronga hosted a one-hour lecture on a *Theoretical Introduction to Heavy Ions Collisions* on the 27th of June 2018 as part of the ASP/ACP 2018 programme.

The programme included seminars and lectures, which took place in Windhoek from the 24th of June to the 14th of July 2018. The primary objective of ASP 2018 is to increase capacity development in fundamental physics and related applications in Africa. The programme included a professional physics conference, a workshop for high school teachers, an outreach to high school learners, a graduate school for university students and a forum to discuss capacity development in physics and applications.



This year's African Conference on Fundamental Physics and Applications, ACP 2018, hosted by the African School of Fundamental Physics and Application's organizing committee included both national and international delegates from ICTP and King's College, London; CERN; University of Witwatersrand; INFN and University of Milan; University of Rwanda; University of Birmingham and University of Chicago, to name a few.

The scientific program at ACP 2018 consisted of all the scientific tracks taught at ASP such as:

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| Astroparticle physics and cosmology; | Material physics; |
| Nuclear and particle physics; | Physics education; |
| Event generator, detectors, simulation, statistical and data analyses; | Physics communication; |
| Medical and radiation physics; | High performance computing. |
| Renewable energies and energy efficiency; | |

(African School of Fundamental Physics and Application 2018)

To find out more about ASP and the ACP 2018, visit: <https://www.africanschoolofphysics.org/acp/>

Reasons to be Proud

Dean represents South Africa at the ICHEP in Seoul



Prof Azwinndini Muronga, Dean of Science, was invited to represent South Africa at the annual meeting of International Union of Pure and Applied Physics (IUPAP) Commission C11 as part of the International Conference on High-energy Physics in Seoul, South Korea from the 4th of July to the 11th of July 2018.

The primary aim of IUPAP is to stimulate and promote international cooperation in physics; to sponsor suitable international meetings and to assist organizing committees; to foster the preparation and the publication of abstracts of papers and tables of physical constants; to promote international agreements on other use of symbols, units, nomenclature and standards; to foster free circulation of scientists and to encourage research and education. (IUPAP 2018)

The international conference on high-energy physics (ICHEP) 2018 included the following tracks:

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| • Beyond the Standard Model | • Strong Interactions and Hadron Physics |
| • Neutrino Physics (Solar/Atm/SN) | • Higgs Physics |
| • Quark and Lepton Flavor Physics | • Computing and Data Handling |
| • Dark Matter Detection | • Accelerators: Physics, Performance, and R&D for Future Facilities |
| • Top Quark and Electroweak Physics | • Formal Theory Development |
| • Detector: R&D for Present and Future Facilities | • Education and Outreach |
| • Astro-particle Physics and Cosmology | • Technology Applications and Industrial Opportunities |
| • Heavy Ions | • Diversity and Inclusion |

Prof Muronga delivered lectures in the track classification Education and Outreach, on *The Role of Nuclear and Particle Physics, Astrophysics and Cosmology in building Capacity for physics in Africa* of which he was the primary author. The Dean also presented a lecture in the track classification Diversity and Inclusion, titled *Moving towards diversity and inclusion in science: Why it is essential for physics in Africa*.

The remaining conferences for 2018 include Tokyo, Japan 12 – 13 November 2018, Singapore 22 – 23 November and Vienna, Austria which takes place 27 – 28 December. The 2019 conference will be the 21st edition of the ICHEP and will include conferences in Indonesia, Brittan, Australia, Turkey, Switzerland, Singapore and the United States of America.

Explainer: what there is to know about South Africa's aquifers?

By Dr Gaathier Mahed



Many South African cities use ground water and aquifers as their main source of water. And with water scarcity an increasing threat, these sources are becoming more and more important. The Conversation Africa's Nontobeko Mtshali spoke to Gaathier Mahed to find out more about groundwater and aquifers.

What are aquifers?

Underground reservoirs are called aquifers. Groundwater gathers where the geology allows reservoirs to develop. Some aquifers are totally sealed, and some aren't. There are different types of aquifers. In some cases, they feed surface water supplies and even release water in the form of springs.

Groundwater is critical to the functioning of the entire water cycle. It plays a critical role in supplying ecosystems and helping them function.

Most of the available freshwater for human consumption actually lies in groundwater.

The idea that groundwater happens in the form of rivers under the earth's surface isn't entirely untrue. Rather, caves form due to the weathering of certain rock types and when they become interconnected the water flows through them.

Aquifers can be classified as primary, secondary or dual matrix. Primary aquifers are composed of loose material, like sand, that allows water to flow in between the pores. This water can be extracted by using a borehole.

Secondary aquifers form due to fracturing of hard rock material. The interconnected fractures allow water to flow through them. These types of reservoirs are generally more complex and require highly specialised equipment and knowledge to extract the water.

The dual matrix aquifer is a combination of primary and secondary porous media. Although harder to access, they supply bigger quantities of water.

Is groundwater an unending resource?

It's always been seen as the underground resource which never runs out. Many people believe that by sinking a well and just pumping as much as they want nothing will ever happen because the underground river can never dry up.

This out of sight out of mind attitude has meant that it's been abused by individuals and even by governments, particularly in times of drought.

Some scientists call it the Cinderella of water resources – it does all of the hard work and never gets any of the credit.

Is South Africa in danger of using up all its groundwater?

Extracting too much water can lead to the dewatering effect. This means that the amount of water being extracted exceeds the volumes of water entering the aquifer and thus the water table is lowered. This is a common practice in mining, for example, due to companies needing to extract resources. But it's not good for towns who rely solely on groundwater for their supply.

Overpumping in certain regions has led to a decline in water levels to the point where pumps are no longer able to access groundwater. An example of unsustainable extraction happened in Beaufort West, in the Western Cape Province, before 2010. Water levels in the aquifers dropped by 25 metres over a period of 20 years due to more water being pumped out of the aquifer than recharged.

Dewatering has also led to land subsiding, as the pressure provided by the water in between pores and fractures is no longer available. This means that houses and streets are structurally unstable and in certain instances even completely disappear into sinkholes. This has occurred in places like Gauteng, South Africa's economic hub.

Is groundwater quality better than surface water?

Sometimes we found that the interaction between rock and water does affect the chemistry of the water. Sometimes groundwater quality is inferior to surface water. But in many cases water from springs has a better quality and taste than most surface and tap water.

New Appointments



Ms Sandisiwe Baart is employed in the faculty office as an internal HR assistant. She was previously employed as a temporary secretary to the Dean of Science.



Ms Lesego Sepato was appointed as an nGap lecturer in the Statistics Department on South Campus.



Ms Pumeza Buza has recently been employed at the Govan Mbeki Mathematics Development Centre (GMMDC) as the Technical Manager.



Ms Mulalo Makhuvha was appointed as an nGap lecturer in the Department of Mathematics and Applied Mathematics on South Campus.

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