

# Faculty of Science

# News

## NSW 2019: Facing the Harsh Realities of Climate Change

Night sky viewing, rocket building, chemistry demonstrations and a celebration of the Periodic Table of Chemical Elements in indigenous languages are among the array of activities planned around National Science Week at Nelson Mandela University.

National Science Week (NSW) is an annual initiative of the Department of Science and Technology (DST), in partnership with the South African Agency for Science and Technology Advancement (SAASTA). It is a nationwide celebration of science, with the primary goal of contributing to the development of a society that is inspired by and knowledgeable about science, critically engaged and scientifically literate.

Institutionally, for NSW, Mandela University adopted the theme The Periodic Table of Chemical Elements in Science, Technology, and Sustainable Development of Humankind in celebration of 2019 being the International Year of the Periodic Table.

On 18th July the Faculty of Science kicked off National Science Week: From Cala to Thembalethu, with the symposium, Facing the harsh realities of climate change, which was subsequently launched nationally on the 27th July by Higher Education, Science and Technology Minister Dr Blade Nzimande in Kimberley, Northern Cape.

The symposium panel included science lectures, researchers, external guests and students who explored key local and global challenges, such as: facing the harsh realities of climate change in the era of Sustainable Development Goals (SDGs) and Industry 4.0; the efficacy of connectivity in response to Disaster Risk Reduction of the Eden wild fires, South Africa; climate change adaptation through the water- energy-food nexus in southern Africa; feeding the world and the role of farming, climate change and your health; and, local people's perception of environment and climate change in Madagascar and Solomon Islands.

The NSW programme included activities for primary and high school learners from Port Elizabeth and the surrounding areas. These activities included a tour of the Centre for High Resolution Transmission Electron Microscopy (CHRTEM), Physics Rocket Build, a virtual tour of SA CERN, InnoVenton campus tour, chemistry demonstration element naming, physiology journey through the human body and iThemba LABS International Masterclass: Hands on physics.

The various symposiums, public lectures and seminars included compelling presentation from special guests such as Prof Philani Moyo from Fort Hare Institute

**"The Masterclass offered insights into basic research, enabling the learners to perform measurements on real data from particle physics experiments."**



of Social and Economic Research, Prof Shankar Aswani from Rhodes University, Prof Sylvester Mpandeli from the Water Research Commission and Prof Godwell Nhamo from UNISA. The Dean of Science, Prof Muronga, also hosted a public lecture in Port Elizabeth titled: From Quarks to the Cosmos, Understanding the Universe in keeping with the NSW 2019 theme.

Nelson Mandela University staff, and students, together with learners and members of the public participated in several workshops and symposiums, including: Facing the harsh realities of climate change (symposium); the role of statistic and analytics in industry (public lecture), and Women in Science (motivational talk).

The highlight of NSW 2019 was the International Masterclass: Hands on physics, which took place over three days. This event was designed for high school learners doing grade 10-12 mathematics and physical science. The Masterclass offered insights into basic research, enabling the learners to perform measurements on real data from particle physics experiments.

The faculty's NSW programme reached a total of 4499 participants in Port Elizabeth and George. NSW 2019 was a great success and we look forward to achieving even greater heights in 2020.



NSW: From the Students

## The ease of human suffering through living science - By Sanele Thwala



*Students from Ndzondelelo High School visited the Nelson Mandela University Botany Laboratory with their Teacher Mr Qweqwe to learn about how plants are important in our daily lives and how they help to reduce human distress. Dr Paul Steyn, a lecturer in the Department of Botany, led the lesson.*

Culture describes people's past and present, and in South Africa, an important part of this is the passing of traditional knowledge of indigenous plants and their practical uses from one generation to the next. Ethnobotany is critical in understanding the cultural and intellectual traditions of different groups of people: it is the scientific study of the traditional knowledge and customs of a people concerning indigenous plants and their medical, spiritual, and other uses. South Africa has an incredibly high variety of indigenous plants, and features over 10% of the world's plant species.

Over 3000 of our plants have been used in medicine. Some of the examples Dr Steyn offered are *Aloe ferox* which is used in products as a laxative and to treat arthritis, *Hevea Brasiliense* is used to produce rubber, and several of our staple foods were developed from wild species such as *Triticum aestivum*, *Oryza sativa*, *Zea mays*, as well as *Solanum tuberosum*.

Restoring the natural habitat of all indigenous plants is also essential to biodiversity conservation. It's the basis for a healthy natural environment on which animals, plants and insects depend. It also helps to combat climate change and the carbon footprint. Indigenous forests, for example, are carbon sinks, storing carbon, thereby reducing the greenhouse gases emitted into the atmosphere.

Our indigenous plants have multiple uses, including for food, medicine, pesticides, clothing and other materials, and far more research needs to be carried out on this in our country.

Dr Steyn and the learners then walked around the university grounds and he pointed out all the indigenous plants. He also stressed the significance and the undeniable value of information from elderly people. "We need to value the knowledge of the elders; they know a lot," he said.

# Mandela University Faculty of Science engages with high school learners in Limpopo, Vhembe Region.

Nelson Mandela once said that the power of education extends beyond the development of the skills we need for economic success. It offers knowledge, meaning and general enrichment in our lives.

The Faculty of Science Team in partnership with Communication and Stakeholder Liaison (CSL) attended the Science Beyond Borders Festival (SBB Fest) in Thohoyandou, Limpopo from 13 to 18 May 2019. The aim of the SBB Fest is to take science to learners, educators and communities around the country.

The programme for this year's activities was focused on inspiring learner's and youth to become future engineers, scientists and innovators who will propel South Africa towards the envisioned knowledge-based economy.

About 57 schools visited the SBB Fest and 9105 learners participated. The Faculty of Science exhibited and marketed the Faculty and Nelson Mandela University here by sharing information on the programmes offered with the learners and community at large. Our exhibition stand and interactive exhibits, such as the Tanks computing sciences game, exposed people to the fascination of science and technology, as well as career opportunities in these fields. Our exhibition stand was the centre of attention and drew everyone who came to the festival. This new innovative way of communication reflects the Faculty of Science's mandate of advancing the public's awareness, appreciation and engagement with science.

The participants were given career brochures on science, as well as some Z-cards for educators to take to their schools. After the presentations

some of the educators and learners stayed behind to learn more about science and showed their keen interest in the many questions posed.

"During the visits, we had many opportunities for sharing university information and what the Faculty of Science has to offer" said Nomfuneko Mlumiso, the Faculty PR & Marketing Coordinator. "It was thoroughly worthwhile, and resulted in the participants being far more eager to go and learn more about the world of science.

Executive Dean of the Faculty of Science, Prof Azwinndini Muronga, is also pleased with the learner recruitment programme that the Faculty is involved in. The Nelson Mandela University delegation, led by Prof Muronga, visited three top performing schools, namely, Mbilwi Secondary School, Tshivase and Thengwe. The schools have been recognised amongst the best-performing schools in Limpopo for several years in a row, always delivering the most remarkable matric results. The Faculty shared our programmes and qualifications and discussed career opportunities with the learners. The team then visited ten additional schools in Limpopo and did the same.

The Faculty also spent time with the Mukula Royal Family Takalani Royal Family at their (Kraal Mukula Musanda), with whom our Faculty has a strong relationship. The family is passionate about education and empowering young minds.



## What the learners had to say:

The participating learners found the school visits exciting and motivating.

Nephawe Ntendeni, a learner at a High School in Sibasa Town in Limpopo, shared his thoughts "I feel so happy to have met with the Mandela University exhibitors. Today's presentation made me realise that there are many more opportunities in science and engineering than I was aware of. I was amazed to learn that environmental change can be monitored; the only aspect I knew that could be monitored was the weather."

Boitumelo from Azwifarwi, Mbilwi Secondary School said: "I never realised that research can be conducted on the coastal zone and oceans surrounding South Africa. I really enjoyed the presentation and would like to encourage Mandela University to visit rural schools around South Africa to inform learners about career opportunities in ocean science."

## Celebrating women scientists

# We're not "women in science" – we're scientists



The Faculty of Science celebrated the achievements and contributions of women in science. Women as citizens, mothers, daughters, workers, helpers, leaders, scientists – women, who just like men, are trying to make a difference in this world.

Dr Hlangothi and Dr Moleko-Boyce motivated high school learners from Masiphathisane High School by sharing their journey as "woman scientists" in the 21st century. They told tales of triumphs and adversity, and shared profound reflections on their personal experiences as women in STEM.

The resonating theme throughout the event was perseverance. Young girls were motivated to not only pursue science careers, but to become leaders and innovators in their own communities.

"It is our responsibility to pave a better road for the future of girls and women, ensuring that meritocracy, hard work and perseverance, rather than gender, race or religion, are the driving forces in achieving success in scientific and engineering careers", said Dr Moleko-Boyce. The event gathering served as an exercise in networking, helping young women connect with professionals who encouraged early engagement in STEM careers, and a more solid representation within this specific career path.

In her presentation, Dr Hlangothi, ambassador of BWA Investec Regional Business said, "The world cannot afford to miss out on what you have to offer, if I have done it, you can do it too". She added, "We owe it to ourselves and to our children to encourage STEM education, and the government has a role in this."

## Reasons to be proud

### Lizalise Mgcele received award for 2nd Place at the ISI & Esri Student Competition

The ISI & Esri Student Competition of 2018-2019 is an international student research competition sponsored by Esri and the International Statistical Institute (ISI).

There were 47 submissions in round 1. After review, 24 finalists were selected, with 15 completing a final submission. The finalists came from some of the high-ranking universities worldwide including Harvard, The University of Toronto, National University of Singapore, etc.

The competition aims to promote the integration of statistical and geospatial data, encourage location-based thinking, and inspire curiosity around geographic patterns and relationships.

Lizalise's research work has also been featured as part of AEON's "Tracking The Shale-Gas Debate" report, in the International Biometric Society 2018 Bulletin, and in the South African Statistical Association 2019 News Letter.



Lizalise Mgcele, a Masters student with AEON at the Nelson Mandela University's Faculty of Science, achieved 2nd Place at the "ISI & Esri Student Competition" held at the International Statistical Institute World Congress in Malaysia 18-23 August 2019.

# Physics

## PVTL maintains ISO accreditation

PV Research Group (PVRG) have recently had an SANAS surveillance assessment of the PV Testing Laboratory and passed with flying colours to be granted unconditional continuation of their ISO17025 accreditation, as well as the upgrade to the new (2017) standard. Well done to Dr Jacqui Crozier McClelland and Mariska Müller who have worked tirelessly over the past few months to convert all the laboratory technical and quality systems to ISO17025:2017 and at the same time maintaining their routine laboratory operations.

### PVRG assisting with Mini-Grid in Upper Blinkwater

The PV Research Group (PVRG) is collaborating with the Eastern Cape Provincial Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, and the DLR in Oldenburg on the implementation and evaluation of a PV mini-grid in the rural Eastern Cape village of Upper Blinkwater. Prof Ernest van Dyk and Dr Ross Schultz recently attended a Mini-Grid workshop at the DLR Institute of Networked Energy Systems in Oldenburg, Germany. The PVRG is actively involved in PV mini-grid research and has a fully functional research mini-grid setup at the Outdoor Research Facility (ORF) on South Campus.



*Prof Ernest van Dyk and Dr Ross Schultz attending the Mini-Grid Workshop in Oldenburg.*

### New mobile test lab installed and commissioned at the PVTL

The PV Research Group (PVRG) has successfully installed and commissioned new PV testing equipment at the PV Testing Laboratory (PVTL). The equipment is a containerized laboratory ("Mobile Lab") that includes a state-of-the-art A+A+A+ LED solar simulator, high resolution Electroluminescence (EL) imaging and analysis system, electrical insulation (Hi-Pot) tester and Thermal IR (TIR) camera. The Mobile Lab will soon be added to the ISO17025 accreditation scope of the PVTL, giving the PVRG extended PVT testing capabilities.



## Reasons to be proud

### Prestigious NRF rating for Mandela Uni researcher

Dr Alastair Potts, a Senior Lecturer and Researcher from Mandela University's Department of Botany was awarded a National Research Foundation (NRF) P research rating at its annual awards ceremony. This is the first time that a researcher from this University has been awarded a P rating.

At the event, South African academic and research excellence was feted and celebrated, with the added significance of the NRF celebrating 20 years of advancing knowledge, transforming lives and inspiring a nation.

In addition to the special achievements, the evening saw the awarding of A and P ratings. The NRF rating system is based on peer review and is a valuable tool for benchmarking the quality of our researchers against the best in the world. NRF ratings are allocated based on a researcher's recent research outputs and impact as perceived by international peer reviewers.

P ratings are awarded to researchers (normally under 35 years of age) who are considered likely to become future international leaders in their respective fields, on the basis of exceptional potential demonstrated in research performance and output during doctoral and/or early postdoctoral careers. They would normally have held a doctorate or equivalent qualification for less than five years at the time of application.

Dr Potts is interested in many aspects of South African ecology, including palaeovegetation distributions, plant phylogeography, drivers of biome boundaries and Albany Subtropical Thicket ecology (e.g. physiology, seed dispersal and restoration). He also spends time exploring the interface between phylogenetic trees and networks, as evolution is often poorly described using a bifurcating tree.





*Congratulations to Mr William Goosen who was the recipient of the best poster presentation at the EMAS 2019 conference in Norway. Well done William!*

### Faculty of Science Award Winners:

- Researcher of the Year: Prof Pierre Pistorius
- Emerging Excellent Researcher of the Year: Dr Adeniyi Ogunlaja
- Research Excellence Awards: Prof Benita Barton
- Faculty Excellent Researchers of the Year: Prof Pierre Pistorius
- Faculty Emerging Researchers of the Year: Dr Adeniyi Ogunlaja
- Faculty Excellent Teachers of the Year: Dr Suresh Juglal
- Faculty Emerging Teachers of the Year: Ms Anita Noah
- Engagement Excellence Award (STEM): Agricultural Technology Transfer Programme - Dr Tim Pittaway
- Innovation Excellence Award: Prof Jean Greyling
- Emerging Innovation Excellence Award: Dr Nicole Vorster

## Inside the Large Hadron Collider, a stroll through CERN's underground spaces

Port Elizabeth school learners experienced a once-in-a-lifetime opportunity on July 26 as they took a virtual tour of the CERN Laboratory near Geneva, Switzerland. The Faculty of Science became the gateway for learners to visit the birthplace of the World Wide Web and where the movie and the book "Angels and Demons" was conceived.

CERN, the European Council for Nuclear Research, is the largest physics lab in the world. It was established in 1954 as a world-class fundamental physics research organization.

Dr Thomas Dietel, from the University of Cape Town in collaboration with the Faculty of Science, presented a seminar on "CERN and South Africa". The talk was informed by the research done at CERN and the contributions from South Africa, highlighting the possibilities for learners and staff to visit CERN and get involved with the research work done there.

The seminar was followed by a one-hour CERN virtual Tour hosted by Dr Claire Lee from Brookhaven National Laboratory. She was interacting with the audience in Port Elizabeth live from the Large Hadron Collider at CERN, Geneva Switzerland. Dr Lee took learners on a virtual tour through the underground lab, where they were able to see the Compact Muon Solenoid, a large instrument in which protons collide at virtually the speed of light to provide insights into the fundamental laws of nature. These collisions are caught on camera through highly sensitive equipment to help scientists answer fundamental questions such as: What is the Universe really made of and what forces act within it? And what gives everything substance? At the end of the hour-long tour, learners asked several questions.

The recording of the tour can be viewed at: <https://videos.cern.ch/record/2684432>



### Interesting facts about CERN

- The World Wide Web, invented at CERN in 1989 by British scientist Tim Berners-Lee, has grown to revolutionize communications worldwide.
- Large Hadron Collider (LHC) - The 27-kilometre LHC is the world's largest particle accelerator. It collides protons or lead ions at energies approaching the speed of light. To learn more, visit the CERN website at <http://home.web.cern.ch/>
- To collect data of up to 600 million proton collisions per second, physicists and scientists have built devices to measure the passage time of a particle to a few billionths of a second. The trigger system also registers the location of particles to millionths of a meter.

# Discovering the world of Quarks and Leptons with real data

## The Faculty of Science hosted a two-day intensive Alice International Masterclass: Hands on Particle Physics



The Faculty of Science hosted a two-day intensive Alice International Masterclass: Hands on Particle Physics.

During National Science Week, learners from five high schools and their teachers were invited to participate in a day-long programme to experience what researchers do in one of the most important emerging fields in science. The learners took a day off from school to dive into actual data as scientists introduced them to the tiniest building blocks of the universe and to the accelerators and detectors, which probe these mysterious particles. By analysing real data from experiments at CERN's Large Hadron Collider (LHC), the learners got a taste of how modern physics research works.

The International Masterclasses gave learners the opportunity to be particle physicists for a day by analysing real data from CERN's Large

Hadron Collider (LHC). This year's NSW masterclasses attracted 80 learners from five schools. The learners got insight into topics and methods of basic research relating to matter and forces. As part of the programme, they performed measurements on real data from the ATLAS experiments at CERN.

The main idea of this programme was to give learners an opportunity to work (as much as possible) like real scientists. "The International Masterclasses are a unique opportunity for learners to work elbow-to-elbow with scientists and get a taste of how modern research in physics works," says Prof Zinhle Buthelezi from iThemba LABS, Cape Town.

Just as in many real collaborations in particle physics, the learners presented their collaborative findings at the end of their research day.



### Staff Graduates:

- Dr Christiaan Pretorius PhD in Applied Mathematics from Nelson Mandela University. His thesis was entitled 'A Comparative Study of Artificial Neural Networks and Physics Models as Simulators in Evolutionary Robotics'.
- Ms Christa Esterhuizen MBA from Nelson Mandela University. Her thesis was entitled 'Job embeddedness and employee retention in Higher Education'.
- Ms Mulalo Makhuvha MSc in Applied Mathematics from the University of Venda. Her thesis was entitled 'Multi-Scale Modelling of Soil-transmitted Helminths in Humans'.

# Reasons to be proud

## 8th SOUTH AFRICAN CONFERENCE ON PHOTONIC MATERIALS 2019

By Prof Andre Venter

The 8th biennial South African Conference on Photonic Materials (SACPM 2019) took place from 6 - 10 May 2019 at Kariega Game Reserve in the Eastern Cape. The conference was organised by the Physics departments of Nelson Mandela University, University of the Free State and University of Pretoria. It was hosted by the Division for Physics of Condensed Matter and the Applied Physics Forum of the South African Institute of Physics.

The purpose of the conference is to bring together scientists from Africa and abroad, researching various aspects of photonic materials (materials able to detect and emit photons).

The continued search for better and more efficient methods of generating and harnessing light and other forms of radiation, will unquestionably continue to stimulate the development of novel optoelectronic technologies needed to facilitate industrial evolution. A primary goal of this special meeting has always been to provide our postgraduate students and emerging researchers with an opportunity to present their work and meet with scientists whom they otherwise would only know through literature studies. This year was no exception, with postgraduates comprising nearly half of the 84 participants.

This year's outstanding academic programme allowed for active debate around significant research questions in photonics.

We were particularly privileged to have hosted nine esteemed invited speakers who travelled across the globe (USA, Italy, Sweden, Germany, Poland, Brazil, and Norway), to share their research highlights at SACPM 2019. Additionally, a number of meaningful international and local scientific collaborations originated from interactions at this conference. The value of this to local research activities and student training is immeasurable. Moreover, over the years Nelson Mandela University has benefited significantly from the conference proceedings, published as refereed research papers in *Physical B: Condensed Matter*.

CONGRATULATIONS to Mr Isaac Kwembur, PhD student in the PV group of Prof van Dyk and Dr Vorster, Department of Physics at Nelson Mandela University, for being awarded the best PhD oral presentation. Well done Isaac. Finally, the meeting would not be possible without my organising committee and Ms Neveling for her administrative support.

A special word of appreciation to all our sponsors for making this significant academic meeting possible.

Prof André Venter

Chairperson

SACPM 2019

This is what two of our esteemed invited speakers had to say about their SACPM2019 experience:

Prof Marco Bettinelli: Professor of Inorganic Chemistry, Department of Biotechnology, University of Verona

"I want to thank you from my heart for the invitation to SACPM 2019. The conference has really been great and I have learnt many things. The atmosphere that you have created has been wonderful, and I have thoroughly appreciated the interaction with the students.

Of course, Kariega has enchanted Astrid and me. The game drives have been incredible, and the whole visit will be unforgettable."

Prof Olga Shenderova

President, Adamas Nanotechnologies Inc, Raleigh, USA

"It was a great honour to attend the SACPM and present our work. It was an excellent conference and venue. It was worthwhile to have taken time from a busy schedule to attend such a nice meeting.



Mr Isaac Kwembur won the Best PhD Oral

## Physiology

# First runner-up for the Best Exhibition Stall at Open Day, Port Elizabeth



Best Stall Exhibition Open Day 2019

## New Appointments



Dr Gaathier Mahed has been appointed as the Deputy Dean of the Faculty of Science



Mr Sinethemba Zono, MSc in physiology



Dr Duyilemi Chris Ajonijebu senior lecturer in physiology in the School of Biomolecular and Chemical Sciences



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