GRADUATION CEREMONY

Faculty of Engineering and the Built Environment and Faculty of Science

14 December 2021

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT AND FACULTY OF SCIENCE

Graduation ceremony held virtually on 14 December 2021 due to the COVID-19 pandemic.

ORDER OF PROCEEDINGS

The National Anthem.

The Registrar will make introductory comments.

The Chancellor will constitute the congregation.

The University Dedication will be read by the President of the SRC.

A message by the Dean of the Faculty of Engineering & the Built Environment.

The Dean of the Faculty of Engineering & the Built Environment will present the Fellowship Award to Professor M Claeys.

A message by the Dean of the Faculty of Science.

The Dean of the Faculty of Science will present the Social Responsiveness Award to Associate Professor G Ziervogel and the Fellowship Award to Professor N Illing.

The Chancellor will confer the qualifications.

Graduation poem by the imbongi.

Presentation of graduands' names.

The Vice-Chancellor will congratulate the new graduates and diplomates.

The Chancellor will congratulate the new graduates and diplomates and dissolve the congregation.

Closing performance.

NATIONAL ANTHEM

Nkosi sikelel' iAfrika
Maluphakanyisw' uphondolwayo,
Yizwa imithandazo yethu,
Nkosi sikelela, thina lusapho lwayo.

Morena boloka etjhaba sa heso,
O fedise dintwa la matshwenyeho,
O se boloke,
O se boloke setjhaba sa heso,
Setjhaba sa South Afrika – South Afrika.

Uit die blou van onse hemel,
Uit die diepte van ons see,
Oor ons ewige gebergtes,
Waar die kranse antwoord gee,

Sounds the call to come together,
And united we shall stand,
Let us live and strive for freedom,
In South Africa our land.

DISTINCTIONS IN THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

A qualification may be awarded with distinction, honours, and first class honours where a student has shown outstanding academic achievement.

The Bachelor of Architectural Studies (BAS) may be awarded with distinction where a candidate has obtained

> a minimum of 75% in the Design and Theory Studio III examination and minimum of 60% in one of the other Design and Theory Studio examinations
>
> and an additional three marks of at least 75% in his or her BAS course work.

The degrees of Bachelor of Science in Engineering and Bachelor of Science in Geomatics may be conferred with

> first class honours, where the candidate has obtained at least 75% for the research project and a weighted average of 75% for the degree or,
>
> honours, where the candidate has obtained a minimum of a second class pass in the research project and a weighted average of 65% for the degree.

The degrees of Bachelor of Science in Construction Studies and Bachelor of Science in Property Studies may be awarded with distinction where a candidate obtains a minimum weighted average of 75% for the degree.

Postgraduate diplomas may be awarded with distinction if the candidate has achieved 70% and above for all courses with a weighted average of at least 75%

Honours degrees are awarded by class (first, second class division one, second class division two, or third).

Master's degrees (by coursework and dissertation) may be awarded with distinction

> for the dissertation, where the mark for the dissertation is at least 75%
>
> for the degree, where the weighted average is 75% or better and no component is below 70%

Master's degrees (by dissertation) may be awarded to a candidate who achieves a mark of 75% and above for the dissertation.

DISTINCTIONS IN THE FACULTY OF SCIENCE

Bachelors degrees may be awarded with distinction

in a subject (or major), where the student achieves first class passes in specified courses

in the degree, where the student has both distinction in at least one subject (or major) and first class passes in at least the equivalent of six full courses.

Honours degrees are awarded by class (first, second class division one, second class division two, or third).

Master's degrees may be awarded with distinction

in the degree, (by dissertation) for especially meritorious work

in the degree, (by coursework and minor dissertation) for especially meritorious work for the dissertation as well as achieving 75% or better for the coursework.

SOCIAL RESPONSIVENESS AWARD

The Social Responsiveness Award provides an institutional signal to members of the University that social responsiveness is an important priority.

Associate Professor Gina Ziervogel

Gina Ziervogel, an Associate Professor in the Department of Environmental and Geographical Science, has worked to shed light on the importance of urban governance for reducing climate risk and addressing broader social development challenges. She believes that building environmental sustainability requires understanding social and governance issues as much as environmental and technical issues. This is particularly important in contexts of inequality where the voice of the marginalised is often insufficiently heard yet critical for ensuring sustainability.

In 2017 she was appointed to the City of Cape Town's Water Resilience Advisory Committee to provide expert input on the City's drought plans. She was also asked to lead a climate change project for National Treasury's City Support Programme. Drawing on interviews with City officials and observation from engagement in many drought-related processes, she produced a report on lessons learned from the drought that was shared with other municipalities in South Africa. It was presented at the National Budget Forum that supports decision making of the country's metros. This work, which is often seen as the responsibility of environment departments, was now being recognised as a city-wide priority. Drawing on the interview material, she worked with a journalist to produce a book, *Day Zero: One city's response to a record-breaking drought*. Her aim was to ensure that the citizens of Cape Town and interested parties globally could understand more about what happened within the City during the drought. She feels that citizens need to better understand urban governance in order to understand their role in building water resilience and holding government accountable.

One of the gaps in managing water at the City level is the limited public engagement on water issues and exclusion of different social perspectives. To address this, Gina Ziervogel has been working with a local NGO, the Environmental Monitoring Group, and a social movement, the Western Cape Water Caucus on an action learning project. As part of this project, the activists wanted to develop their research skills and document evidence about challenges with water access in the low-income communities where they lived. Along with some other academics, the team developed a transdisciplinary research process using the SenseMaker methodology to collect over 311 stories and associated data about water access across Cape Town. Through this work, relationships between City of Cape Town officials and the Caucus have been strengthened, leading to plans for water dialogues that were unfortunately postponed due to COVID-19.

The new City Water Strategy has identified the need for community-generated data and working in a more collaborative way with different stakeholders. The SenseMaker work talks directly to this as it captures the lived realities of poorer households' struggle with water access and seeks to provide a voice for those often not heard. Ongoing work at both the neighbourhood level and City level is continuing on how to take these issues forward.

Gina Ziervogel has integrated this work in her undergraduate and postgraduate teaching and has had a number of students undertake theses on related topics. There have also been a number of academic and popular publications from this work.

The election by Senate of a member of the faculty to be a fellow recognises sustained and original contributions through research or creative endeavour.

FELLOWSHIP

The fellows in the Faculty of Engineering and the Built Environment and their years of election are:

1998: GA Ekama
2005: MG Alexander
2012: V Watson
2013: AE Lewis
2015: S Harrison
E van Steen
2017: A Zingoni
2019: A Mainza
E Pieterse
2020: G Langdon

The fellows in the Faculty of Science and their years of election are:

1995: BD Reddy
2005: A Chinsamy-Turan
AP le Roex
2009: I Barashenkov
JC Sealy
2010: SA Bourne
K Chibale
JM Farrant
2011: TJ Egan
2012: G Janelidze
HP Kunzi
E Rybicki
2015: S Richardson
2016: R Kraan-Korteweg
2018: P Dunsby
B Hewitson
C Reason
P Ryan
2019: M Meadows

FELLOWSHIP (CONTINUED)

The following member of the Faculty of Engineering and the Built Environment has been elected to a fellowship:

Professor Michael Claeys

Department of Chemical Engineering

Professor Michael Claeys holds undergraduate and doctoral degrees in Chemical Engineering from the Karlsruhe Institute of Technology in Germany. In 1998 he joined the Catalysis group at the Department of Chemical Engineering at UCT as a post-doctoral fellow and he has remained with this group ever since, as a Senior Research Officer, Associate Professor and Professor (since 2010). His research is strongly focused on the development of new catalysts in energy applications with emphasis on synthesis gas conversion (Fischer-Tropsch synthesis) and CO_2 valorization for the production of synthetic fuels and chemicals.

Professor Claeys is highly recognised internationally for his work using in-situ methods that he invented. These include an XRD reaction cell which can be attached to commercial X-Ray diffractometers and a worldwide unique magnetometer for the study of ferromagnetic materials such as cobalt, nickel or iron bearing catalyst which are often used in catalytic applications. Importantly, these methods allow to study materials at fully relevant industrial conditions in terms of high temperatures, pressures and reaction environment allowing to identify correlations between the catalyst structures and catalytic performance. “Catching catalytic reactions in the act” greatly facilitates the identification of catalyst deactivation mechanisms and preferable catalyst phases and has led, in many cases, to improvement of catalysts and strategies to avoid loss of catalyst performance. Both instruments have been patented and are extensively being used by Professor Claeys’ students and by his collaborators. The XRD reaction cell has been fully commercialized by the UCT spin-off Cape Catalytix and is being distributed worldwide.

As a soft-funded researcher Professor Claeys has a strong focus on applied industrial research and postgraduate-training. Amongst the industry work conducted the close collaboration with Sasol stands out and the use of the magnetometer, which was developed under this partnership, has helped the company in various instances to improve their catalysts and optimise their processes. Professor Claeys has supervised over 60 postgraduate students and 15 post-doctoral fellows, and he is currently involved in the training of 19 postgrads. He has published over 120 journal articles, 3 book chapters and 22 patents, and presented over 40 invited, keynote and plenary lectures at international meetings. He has recently received an A2 NRF rating.

Apart from conducting his research Professor Claeys also plays an important leadership role in various national and international catalysis societies, committees and advisory boards. Importantly, since 2008 he is also the director of the South African DSI-NRF Centre of Excellence in Catalysis, known as c*change, where he also serves as the manager of the synthesis programme since the Centre’s inception in 2004. Under his leadership the Centre has established a strong national catalysis network with a current membership 25 researchers from 11 higher education institutions in South Africa, 50 to 60 postgraduate students and 15 postdoctoral fellows. The Centre of Excellence works in large multidisciplinary teams on issues which are of key importance to the South African chemical industry with programmes on synthesis gas conversion, paraffin and olefin upgrading. As of recently the Centre concentrates on catalytic approaches for CO_2 activation using various catalytic approaches. This includes the production of fuels from CO_2 and green hydrogen derived from renewable energy, a multistep process often called power-to-liquids, in which the Fischer-Tropsch reaction as researched by Professor Claeys and his team plays a key role. To date c*change has graduated over 180 MSc and PhD students and published over 350 journal papers. It also has a strong transformation record with more than 50% of the recent graduates being female and more than 70% black. The Centre enjoys international recognition in particular through reputation of Prof Claeys’ Synthesis Gas Programme, which runs its own international conference series, the Syngas Convention (2012, 2015, 2018).

FELLOWSHIP (CONTINUED)

The following member of the Faculty of Science has been elected to a fellowship:

Professor Nicola Illing

Department of Molecular & Cell Biology

Professor Illing is a BSc (Eng) and master's graduate of UCT who went on to complete a DPhil at Oxford. She came back to UCT first as a Postdoctoral Fellow in the Department of Chemical Pathology from 1990-1993, and was then appointed as a Lecturer in the then Biochemistry Department in the Faculty of Science. She was appointed *ad hominem* to Associate Professor in 1996, became Head of Department of Biochemistry in 1998, and then Head of the new Molecular & Cell Biology Department from 2001-2003. She was promoted *ad hominem* to full Professor in 2011. She has been awarded a number of prestigious scholarships and bursaries, but most notably the NRF/FRD's President's Award, for excellence in a young researcher, in 1995. She also received the SA Biochemistry Society's Silver Medal in 1995. She is presently rated B3 by the NRF.

Professor Illing has established herself as a leading international expert in the field of "evo-devo" – evolution and development – research, with a holistic rather than narrowly-defined single-disciplinary approach. She has focused in on the fundamental theme of evolution of development, with studies on how morphological adaptation and variation has arisen in vertebrates and plants, from a common genetic toolkit. Thus, in recent years she has worked on bat wing development as well as on desiccation tolerance in plants, with a wide range of South African and international collaborators.

She and her team have published 62 peer-reviewed articles or book chapters since 1989, which have garnered 2321 citations (Scopus, 2021) for a Scopus H-index of 29 and Google Scholar H-index of 33. Her publication record shows ample evidence of high-impact and novel research, in high-ranked international journals – and an uncompromising approach to publishing quality rather than quantity. She has also graduated 17 MSc students by dissertation and 13 PhD students, which is an excellent record. She presently has 5 PhD students registered.

Her contributions go beyond just academic research, as she has been a reviewer for a wide variety of top international journals in her field, and was an Associate Editor for the SA Journal of Science for 2010-2012. Most recently, she has been a Deputy Dean in the Faculty of Science for 5 years, and has spearheaded initiatives to give funding to young researchers, as well as being involved in a University initiative for funding postgraduates.

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

Dean: Professor A Lewis

DOCTOR OF PHILOSOPHY

Abikoye, Semilore Ben Olaoluwa
Thesis Title: *Synthesis of integrated solar thermal networks for domestic and industrial utilization*

Ben Abikoye holds a BSc degree in Chemical Engineering from Ladoke Akintola University of Technology and an MSc degree in Production & Industrial Engineering from the University of Benin, both in Nigeria. He joined UCT in 2016 for full-time PhD studies in Chemical Engineering.

Ben Abikoye's thesis involves developing design methods for integrating solar thermal with domestic and industrial energy demands. His study investigates the techniques for circumventing the intermittent nature of solar thermal, through periodic heat storage, and methods for improving thermal performance of the system (especially during cloudy periods) by incorporating solar thermal and heat pump technologies. Ben Abikoye developed flowsheet models, where the aforementioned components are combined to form a single integrated system, which are linked with the hourly solar irradiation and ambient temperature data, and hourly heat demand profile. He then proposed a generic method for simultaneous design and optimization of the integrated systems. Overall, the results show that substantial renewable heat for both residential and industrial utilization could be derived from solar thermal when solar collector and other accompanying technologies are suitably sized relative to the demand load and solar thermal potential.

Supervisor: Associate Professor AJ Isafiade (Department of Chemical Engineering)
Co-supervisor: Assistant Professor L Čuček (Faculty of Chemistry and Chemical Engineering, University of Maribor)

Alibrahim, Fuad
Thesis title: *Direction of arrival estimation for spinning antenna based electronic intelligence systems*

Fuad Alibrahim holds a Bachelor degree in Electrical Engineering from King Saud University, Saudi Arabia. He joined King Abdulaziz City for Science and Technology in 2006, and the department of Electrical Engineering, University of Cape Town, in 2011 for his postgraduate studies.

In this thesis, Fuad Alibrahim proposes high accuracy estimators that find the direction of hostile radio frequency emissions relative to a spinning antenna-based intelligence collecting equipment. He used biased estimation techniques that outperform conventional estimation techniques to construct the high accuracy estimators. Also, he proposed a user parameter-free estimator that increases the spatial resolution to allow more details to be observed, so that closely spaced radio frequency emissions are resolved in direction. Using Monte Carlo simulation and real data, he demonstrated that the proposed estimators outperform conventional estimators.

Supervisor: Emeritus Professor MR Inggs (Department of Electrical Engineering)

America, Ezra Luke
Thesis title: *Absolute electrical impedance tomography and spectroscopy: an orthogonal chirp division multiplexed (OCDM) approach*

Ezra America completed his BSc (Eng) and MSc (Eng) qualifications in Electrical Engineering at UCT and began full-time study towards his PhD in August 2018.

Ezra America's research introduces a novel alternative multiplexing technique – orthogonal chirp division multiplexing, to acquire wideband frequency information about numerous biological specimens. He investigated how this information can be utilized to constrain and stabilize a solution to an ill-posed inverse problem. This allowed him to reconstruct high-quality images of the absolute impedance distribution of a specimen under test, from a single wideband measurement frame. The final prototype acquires a 1 MHz wideband measurement frame within 1 micro-second. These findings will help shift Electrical Impedance Tomography and Spectroscopy toward becoming independent of in vivo measurements from previous empirical studies, observing the wide frequency behaviour from a single measurement frame and faster high-quality imaging of biological specimens.

Supervisor: Dr MS Tsoeu (Department of Electrical Engineering)

Heyns, Michael John
Thesis Title: *Operational modelling of geomagnetic fields and geomagnetically induced currents*

Michael Heyns holds an MPhil degree in Electrical Engineering from UCT, having been part of the National Astrophysics and Space Science Programme. While completing his PhD research, he was based at the Space Science directorate of the South African National Space Agency in Hermanus.

Michael Heyns's thesis focuses on the modelling of geomagnetically induced currents (GICs) and the fluctuating geomagnetic field that drives them. When induced in a power network, these currents may cause damage and pose a risk to system stability. Making use of measured geomagnetic field and GIC data from four countries, he developed novel data-driven adaptations of conventional modelling. These new approaches improve on previous implementations by being more accurate and being able to quantify model uncertainty, needed in an operational context. For utilities that face the challenge of sparse geomagnetic data coverage, he developed new interpretations of an existing interpolation scheme that leverages low-cost variometer data and is able to describe the relevant near-Earth current system. As the cost of monitoring decreases and the availability of data increases, this research has direct applications for power system operators by augmenting existing modelling efforts and aiding in decision-making.

Supervisor: Emeritus Professor CT Gaunt (Department of Electrical Engineering)
Co-supervisor: Dr SI Lotz (South African National Space Agency)

Ilangakoon, Niran Anthony
Thesis Title: *A higher-order VOF interface reconstruction scheme for non-orthogonal structured grids with application to surface tension modelling*

Niran Ilangakoon completed his BSc(Eng) in 2013 at UCT and commenced his MSc(Eng) in 2014, which he later upgraded to a PhD.

Niran Ilangakoon's thesis proposes a novel higher-order scheme for reconstructing liquid-gas interfaces tracked by the volume-of-fluid (VOF) method and achieves unprecedented accuracy for non-orthogonal structured grids. His scheme is applied in the context of curvature computations for surface tension modelling. He first extends the interface reconstruction component of the height-function (HF) method to non-orthogonal structured grids. This results in a piecewise-linear interface (PLIC) representation, and the PLIC normals are iteratively refined to improve accuracy. He achieves rapid acceleration of the latter by a spring-based normal refinement acceleration procedure. He then fits higher-order polynomial curves/surfaces to local stencils of PLIC facets for interface reconstruction purposes. He demonstrates up to fourth-order accuracy in the computed interface curvature as well as the Laplace pressure jump across the interface of a 2D stationary bubble. He also achieves second-order accuracy for the oscillation frequency of a 2D oscillating droplet in zero-gravity.

Supervisor: Professor AG Malan (Department of Mechanical Engineering)

Kabanga, Lucky
Thesis Title: *Compensation assessment practices in expropriation of customary land rights in Malawi*

Lucky Kabanga holds a BSc degree in Geology from the University of Malawi, Malawi, and two MSc degrees in Real Estate from the University of Twente, Netherlands, and the University of Pretoria. He commenced his PhD studies at UCT in 2016.

Lucky Kabanga's thesis focuses on compensation assessment practices for expropriated customary land in Malawi. He investigates the goal of compensation (theoretical orientation) by looking at existing compensation laws in Malawi and establishes that they desire to fully compensate (indemnity compensation) affected people for their losses and wholly restore them. He then analyses the applicability of this indemnity compensation to customary land and finds that it is difficult to achieve, because of inadequate laws, non-existence of required conditions to achieve intended market-based compensation, customary land dominance and omission of various losses from compensation, thereby bearing inadequate compensation. He continues to show that indemnity compensation for expropriated customary land is possible if the core compensation variables are revised and new compensation assessment methodologies that embrace customary land are adopted. He makes a contribution to knowledge regarding the compensation of customary land acquired compulsorily, in the areas of theory, empirical data and policy development.

Supervisor: Associate Professor MM Mooya (Department of Construction Economics and Management)

Lewis, Simon Alexander Cole
Thesis Title: *Time and frequency transfer in a coherent multistatic radar using a white rabbit network*

Simon Lewis completed his BSc(Eng) Mechatronics Engineering degree at UCT before entering the UCT Radar master's programme in 2015. He upgraded to a PhD in 2017, and also worked as a Teaching Assistant for the Radar Masters.

Simon Lewis's thesis focuses on time and frequency transfer for networks of coherent multistatic radars, and specifically uses the White Rabbit protocol for synchronisation and timing. His work involved quantifying the performance of precision oscillators using high resolution phase measurements for use in multistatic radar. He made practical radar measurements using the NeXtRAD multistatic radar, where the radar was synchronised using a White Rabbit and a network of multi-channel GPS disciplined oscillators. Simon's results showed that the White Rabbit protocol is an effective means to synchronise multistatic radars, and future networked radar projects should consider the technology as a means of simplifying the non-trivial problem of coherent synchronisation of precision networked sensors.

Supervisor: Emeritus Professor M Inggs (Department of Electrical Engineering)
Co-supervisor: Associate Professor A Wilkinson (Department of Electrical Engineering)

Little, Warren Macmillan
Thesis Title: *Performance of the vertical roller mill in a mineral processing application when coupled with internal and external classifiers*

Warren Little holds a BSc in Chemical Engineering from UCT. He began full-time study towards an MSc(Eng) in 2013, and upgraded to a PhD in 2016.

Warren Little's thesis focuses on the use of the vertical roller mill (VRM) with different classification systems in a minerals processing application. He investigated the effect that different design and operating variables have on grinding performance and downstream recovery processes, for the platinum group element bearing Platreef ore. He found that the VRM, operating with the standard internal air classifier, is able to efficiently produce a comminution product suitable for valuable mineral recovery through flotation. His investigation showed that operating the vertical roller mill with

alternative classification systems can reduce overall energy consumption of the comminution process. Being a dry process, makes this technology viable for small and large scale operations, particularly in water scarce regions.

Supervisor: Professor A Mainza (Department of Chemical Engineering)
Co-supervisors: Associate Professor M Becker (Department of Chemical Engineering), Mr S Geldenhuys (Centre for Minerals Research)

Louw, Michael Paul
Thesis Title: *The search for hybrid tectonics in contemporary African architecture: encounters between the global and the local*

Michael Louw holds a BArch degree in architecture and an MPhil in Sustainable Development. He is a Senior Lecturer at UCT's School of Architecture, Planning and Geomatics, where his teaching, research and practice focus on transformative design, design-build practice, and technology.

Michael Louw's research inquiry arises from his practice and teaching which focus on contemporary African architecture. This work recognises the emergence of an identity constructed through local sensibility leading to a proposition positing a process of local hybridisation. Examining recent 'tectonic encounters' in Africa, he deploys a case study method through the survey and examination of literature, interviews with architects and academics, and a close comparative analytic reading of related architectural projects. This work identifies what he recognises as 'tectonic constellations' by virtue of their local situatedness and a globalised 'Southern' identity and contributes a significant expansion and extension of existing discourse on critical regionalism, thereby contributing a new measure for recognising, studying and evaluating the critical tectonic production of what might be termed a 'Southern' global architecture.

Supervisor: Professor Emeritus I Low (School of Architecture, Planning & Geomatics)

Molifie, Andrea
Thesis Title: *Investigating the use of sodium metasilicate to improve the flotation performance of altered PGE ores*

Andrea Molifie holds BSc and BSc (Hons) in Earth Science degrees from the University of Stellenbosch. She began full-time study towards her PhD in the Centre for Minerals Research at UCT in 2018.

Andrea Molifie's thesis investigates the use of dispersants for the improved flotation performance of altered platinum group element ores. She successfully decoupled the three main mechanisms of action of sodium metasilicate as a dispersant, namely, electrostatic dispersion of ultrafine alteration minerals, reduced viscosity of rheologically complex ores and selective adsorption onto floatable gangue minerals. The reasons for improvements in flotation performance due to these mechanisms were explored in detail. The potential benefits to the South African platinum industry, which provides the raw materials necessary for environmentally friendly energy sources, is immense, with plant trials already under way at certain concentrators.

Supervisor: Associate Professor B McFadzean (Department of Chemical Engineering)
Co-supervisors: Associate Professor M Becker (Department of Chemical Engineering), Mr S Geldenhuys (Centre for Minerals Research)

Mosameem, Abdul Rahman
Thesis Title: *Management and modelling of contaminant intrusion events in South African water distribution systems*

Abdul Rahman Mosameem holds BE and ME degrees in Civil Engineering and Water Engineering and Management from Kandahar University and Asian Institute of Technology (AIT), Afghanistan and Thailand, respectively. He joined the Faculty of Engineering and the Built Environment (EBE) at UCT in 2017 for his PhD studies.

Abdul Rahman Mosameem's thesis focuses on the analyses and modelling of risks and mechanisms of contaminant intrusion in water distribution systems. He describes the characteristics and classification of these events, their prevalence and control measures in South African water distribution systems, combined with modelling contaminant intrusion through leak openings under negative pressure conditions. He used two experimental arrangements to investigate the behaviour of leak openings under both positive and negative pressures. From the results, he concluded that the head-area slopes of leaks under positive and negative pressures are nearly identical. He applies this finding to estimate the potential and maximum contaminant intrusion flows in common pipe materials used in water distribution networks. The results show that large intrusion flows are more likely in rigid than in flexible pipe materials. While intrusion flows are affected by a range of factors, this study provides upper limits for this phenomenon.

Supervisor: Professor H Beushausen (Department of Civil Engineering)
Co-supervisor: Professor JE van Zyl (Department of Civil Engineering)

Mphuthi, Matthews Siphiwe
Thesis Title: *Towards a geoid consistent vertical datum in South Africa*

Siphiwe Mphuthi holds BSc and MSc degrees in Geomatics from UCT, and joined the School of Architecture, Planning and Geomatics in 2018 for his PhD studies. He is a professional land surveyor at the Department of Rural Development and Land Reform.

Siphiwe Mphuthi's thesis focuses on the establishment of a geoid consistent vertical datum over South Africa, based on the international height reference system. He used terrestrial and satellite gravity, global positioning system, precise levelling, and global digital elevation model data over South Africa. He carried out critical studies on the existing national height system(s) and related distortions, appropriate height system and related reference surface, and offsets between a local height datum and the international height reference system. He found normal height and quasigeoid appropriate for the South African height

system, requiring an overhaul of the current land levelling datum. He then provided a framework for establishing a geoid-based vertical datum in South Africa. Implementation of the proposed height system will ensure direct use of space-based positioning techniques for height determination. This will in turn support applications and research in geodesy, geophysics, geodynamics and construction engineering in South Africa.

Supervisor: Associate Professor P Odera (Architecture, Planning and Geomatics)

October, Lisa Louise
Thesis Title: *Water quality effects on the bubble-particle attachment of sulfide minerals*

Lisa October completed her BSc(Eng) in Chemical Engineering at UCT in 2016, began her MSc in Chemical Engineering in 2017 and upgraded to a PhD in 2018 at UCT.

Lisa October's thesis reports on the effect of recycled water of high ionic strength on the bubble-particle attachment of sulfide minerals using the Automated Contact Time Apparatus. Her works aims to validate the use of the Automated Contact Time Apparatus as a measurement for floatability, determine the effect of deteriorating water quality on bubble-particle attachment and determine the effect of specific ions on the bubble-particle attachment of sulfide minerals. The effect of the water quality on the adsorption of the collector molecules on the mineral surface and the charge on the mineral surface was further studied to elucidate the findings of the bubble-particle attachment measurements. The findings of this work provide flotation operations with an understanding of how specific ions within plant water affect bubble-particle attachment; which will allow for the water quality to be tailored towards achieving high bubble-particle attachment of value and subsequently high mineral recoveries.

Supervisor: Associate Professor K Corin (Centre for Minerals Research)
Co-supervisor: Dr M Manono (Department of Chemical Engineering)

Oladejo, Sunday Oladayo
Thesis Title: *Efficient radio resource management for the fifth generation slice networks*

Sunday Oladayo Oladejo holds a BEng (Hons) in Electrical and Electronic Engineering from the Federal University of Technology, Akure, Nigeria (2004) and an MEng in Communication Engineering from the Federal University of Technology, Minna, Nigeria (2016). He joined the Centre of Excellence for Broadband Networks within the Department of Electrical Engineering at UCT for his doctoral studies in 2017.

Sunday Oladejo's thesis concerns developing radio resource management schemes for multi-tenant 5G slice networks. He developed a revenue-aware resource allocation scheme for a multi-tenant 5G slice network to ensure mobile network operators efficiently allocate radio resources to subscribers in a manner that quality of service is not compromised. He also developed a latency-aware dynamic resource allocation scheme for a multi-tenant multi-tier heterogeneous 5G slice network. Using the concept of the developed latency-aware dynamic resource allocation scheme, he further developed an auction-based radio resource management scheme for a multi-tenant multi-domain multi-tier 5G slice network with multiple network player. Finally, he developed an energy-efficient resource allocation scheme for a three-tier heterogeneous 5G slice network for optimal radio resource and energy management. These have been compared with state-of-the-art radio resource management schemes.

Supervisor: Associate Professor OE Falowo (Department of Electrical Engineering)

Olonde, Victor Otieno
Thesis title: *Affordable rental housing delivery in Kenya*

Victor Olonde completed his BA Land Economics (Hons) at the University of Nairobi, Kenya in 2001 and MSc in Real Estate at the University of Glasgow, United Kingdom in 2011. He joined the Department of Construction Economics and Management as a PhD student in 2016.

Victor Olonde's thesis focuses on investigating the influence of the institutional environment on the housing market, and how it leads to market failure in the affordable rental housing sector. He formulates a conceptual framework based on combining the New Institutional Economics concepts and the Institutional Analysis and Development (IAD) structure that is used to analyse housing market operations to identify the observable outcomes, while probing the causal mechanisms that lead to the outcomes. He analyses how the rental housing market relates to policy, institutional regulatory framework and housing finance systems. The findings indicate that, as currently constituted, the institutional framework is not practically well-matched to support delivery of affordable rental housing units, and therefore systematically but inadvertently leads to market failure in the rental housing sector. The findings will be useful in policy interventions aimed at invigorating a vibrant rental housing sector in the overall housing system.

Supervisor: Associate Professor MM Mooya (Department of Construction Economics and Management)
Co-supervisor: Professor K Rajaratnam (School of Data Science and Computational Thinking, Stellenbosch University)

Omopariola, Emmanuel Dele
Thesis Title: *Modelling the relationship between project payment systems, financial management strategies and construction organisation performance in South Africa*

Emmanuel Omopariola completed his MSc in Quantity Surveying at Glasgow Caledonian University. He joined the Construction Economics and Management Department at UCT in August 2017 for PhD studies. Prior to this, he worked as a lecturer with Kogi State Polytechnic, Lokoja, Nigeria.

Emmanuel Omopariola's thesis models the impact of different financial management strategies and

payment systems on the performance of construction companies, using Structural Equation Modelling. Based on these findings, the study concludes that the failure of construction projects and organisations can be reduced through the adoption of effective financial management strategies by construction organisations and appropriate payment systems by the clients. The research extends the theory on financial management strategies and its impact on financial organisation performance in the context of construction companies and the construction industry. These findings will be useful in future for construction stakeholders.

Supervisor: Professor A O Windapo (Department of Construction Economics and Management)

Patel, Zubeida
Thesis Title: *Kalman filtering and its application to on-line state estimation of a once-through boiler*

Zubeida Patel qualified with a BSc in Physics and Astrophysics and a BScEng in Electrical Engineering at UCT before pursuing her PhD. Zubeida Patel's thesis contributes to the development of non-linear Kalman filtering methods for state estimation of large-scale stiff systems. The Jacobian of the dynamic model of the system, required for linearly implicit integration, is estimated from a collection of function evaluations already used by the unscented Kalman filter to propagate the mean and covariance of the system's state variable estimates. A stochastic model of the simulation errors is embedded into the scheme to mitigate the decline in accuracy as the simulation step-size increases, thereby allowing greater filter efficiency. The new filtering approach is applied in simulation to the problem of state estimation of the main components of a once-through boiler with more than one hundred state variables and shows its utility in detecting common problems such as fouling in the plant's convection pass. The filter is applied to measured data from a utility power plant boiler to demonstrate its real-world capability.

Supervisor: Professor E Boje (Department of Electrical Engineering)

Sharma, Rajesh
Thesis Title: *Development of a novel bioreactor and systems for suspension cell culture in biopharmaceutical production*

Rajesh Sharma holds an MSc degree in Microbial and Food Technology from Punjabi University, Patiala, India. He joined the Department of Chemical Engineering in 2014 for his PhD studies in biotherapeutic production from mammalian cells. He has ten years' experience in the biopharmaceutical industry for the development of various biologicals. Rajesh Sharma's thesis focuses primarily on two approaches to achieve the same goal of biologicals production. The first approach is the development of a novel horizontal tubular bioreactor (HTB) with spiral impeller for the propagation of shear-sensitive mammalian cells. He characterised the engineering parameters of the bioreactor and grew mammalian cells (Chinese Hamster Ovary), which expressed a protein that controls hypertension. He further recommended that to enhance the performance of the HTB, further physical and process parameters must be evaluated. In the second approach, he used an anti-cancer drug to bring the cells into suspension, which is otherwise difficult in economic scale-up. This was done by suppressing the expression of surface receptors, such as Integrin. He was successful in keeping the cells viable in suspension for a week, which opens a new window of research into more intensive cell biology interventions and techniques for the production of biologicals.

Supervisor: Dr. SL Tai (Department of Chemical Engineering)
Co-supervisor: Professor STL Harrison (Department of Chemical Engineering)

Van Huyssteen, Daniel
Thesis Title: *A virtual element method for hyperelasticity*

Daniel van Huyssteen holds BScEng and MScEng degrees in Mechanical Engineering from UCT. He began full-time study towards his PhD in 2019. Daniel van Huyssteen's thesis focuses on the formulation of a virtual element method with a novel approach to the construction of the stabilisation term and its application to problems concerning hyperelasticity. Through an extensive range of numerical examples he shows the method to be robust with respect to element geometry and severe deformations, versatile in its suitability for a variety of isotropic and transversely isotropic material models and a wide range of material properties, and pathology-free in the numerically challenging simulation conditions of limiting material incompressibility and inextensibility, both separately and combined. His work represents a significant extension of the body of knowledge regarding virtual element methods and their suitability for hyperelastic problems. It also provides an approach to the stabilisation of virtual element methods for other anisotropic material models.

Supervisor: Emeritus Professor BD Reddy (CERECAM)

MASTER OF ARCHITECTURE

Kleynhans, Derek James

MASTER OF ENGINEERING IN CIVIL INFRASTRUCTURE MANAGEMENT & MAINTENANCE

Likhade, Rendani

MASTER OF CITY AND REGIONAL PLANNING

Dreyer, Luka (with distinction)

MASTER OF ENGINEERING

Allison, Alonzo Benjamin

Chikosha, Franklin Tafadzwa
Jacobs, Mugammad Gasan
Jelliman, Shanen Kyle (with distinction in the coursework component)
Kakaza, Mnikeli (with distinction in the dissertation)
Katsiru, Noah Kudakwashe
Masongwa, Sello Adam
Mthembu, Siphesihle Henry
Mzengereza, Isaac Tchinga
Ngwira, Vera Duduzile
Olifant, Tshepo Moses
Potts, Wesley James (with distinction in the coursework component)
Sizamo, Yandisa

MASTER OF GEOTECHNICAL ENGINEERING

Bosman, Isak (with distinction)
Ehujuo, Nkem Nora (with distinction in the coursework component)

MASTER OF PHILOSOPHY

Andreou, Alexandros Adonis
Attwood, Arthur Craig
Humby, Lara
Johnson, Wendy-Loo Maureen
Louw, Cornelia Dorathea Cordia
Moshapo, Mologadi Thabo Kholofelo
Munting, Karen
Nolan, Gareth Cyril
Rebeiro, Jyotsna
Samie, Quahnita
Simpson, Marquard Franklin (with distinction)
Steenkamp, Aletta Catharina
Stewart, Maurietta Diane (with distinction)
Ugo, Prince Destiny
Van Biljon, Petrus Jacobus Lodewiekus

MASTER OF SCIENCE IN ENGINEERING

Arnold, Kathryn Anne (with distinction)
Baloyi, Tebogo (with distinction)
Boniface, Chigozie Jacob (with distinction)
Buys, Johannes Lolo (with distinction)
Chagwedera, Taona Malvin
Chenge, Simcelile
Dikoko, Boitumelo
Du Toit, Johan Kritzinger
Dube, Bright Nyasha (with distinction in the coursework component)
Dyasi, Nontsikelelo Grace
Fernandes, Sarah Johanna (with distinction)
Funk, Oliver
Govender, Mivashya (with distinction)
Heerlall, Heeran (with distinction)
Hislop, Amy Louise
Jacobson, Jamie Nicholas
Jankee, Pitambar (with distinction)
Jimoh-Taiwo, Qudus Boluwatife (with distinction)
Kinabo, Arnold (with distinction in the coursework component)
Konan, Othniel Jean Ebenezer Yao (with distinction in the dissertation)
Lewis, Emily (with distinction)
Lin, Chiao-Shing (with distinction)
Mabaleha, Sebete Solomon
Mabuka, Thabo
Marepula, Hlumelo (with distinction in the coursework component)
Mathe, Silethukuthula
McKune, Danica
Mhinga, Masana (with distinction in the dissertation)
Motibane, Londiwe (with distinction)
Mufunde, Tariromunashe Tracey (with distinction)
Muluti, Shade Sitwala (with distinction)
Munywoki, Margaret Ngeli
Mzolo, Ntokozo Gladness (with distinction in the coursework component)
Naidoo, Joash Nicholas
Ndamase, Nolihle (with distinction)
Nxumalo, Emmanuel
Oluwatosin, Olasumbo Oluwatoyin
Onwudinjo, Kenechukwu Chukwudubem
Quevauvilliers, Matthieu (with distinction in the dissertation)
Sebothoma, Dimakatso (with distinction)
Sewlall, Preetha (with distinction in the coursework component)
Simo, Eugene Fotso (with distinction in the coursework component)
Smith, Joanet
Smuts, Francois (with distinction in the dissertation)
Tareka, Pithetu Edwin (with distinction)
Van Zyl, Joshua Peter
Venter, Jason Christopher Thomas

MASTER OF SCIENCE IN PROJECT MANAGEMENT

Chiloane, Poelo Leo (with distinction in the dissertation)
Chiswanda, Farai (with distinction in the dissertation)
Galetta, Wilhelmina Magdalene
Hamana, Olsen Ndeiweda
Moshidi, Mpelegeng Mologadi Promise
Osman, Faizal Bique
Rodgers, Lance Saun
Salie, Maahir
Silo, Tawanda Chingani

MASTER OF SCIENCE IN PROPERTY STUDIES

Douglas, Kathlyn Sarah
Meelun, Gaushal
Nobaza, Lwazi Bruce
Smith, Sian Jessica

MASTER OF TRANSPORT STUDIES

Badenhorst, Hendri Jan
Mashiane, Ayanda Esme
Matota, Chuma Wande Zulu
Motsumi, Charmaine Molebogeng
Shiimi, Mary Ndeshihafela

BACHELOR OF SCIENCE HONOURS IN GEOGRAPHICAL INFORMATION SYSTEMS

Hesewu, Zothando

BACHELOR OF SCIENCE HONOURS IN CONSTRUCTION MANAGEMENT

Maboreke, Tinotenda Lawrence
Nhlapo, Thokozani

BACHELOR OF SCIENCE HONOURS IN QUANTITY SURVEYING

Lunga, Prudence

POSTGRADUATE DIPLOMA IN PROJECT MANAGEMENT

Vukeya, Muhluri Victor

POSTGRADUATE DIPLOMA IN PROPERTY STUDIES

Khathi, Zipho Albert

BACHELOR OF SCIENCE IN ENGINEERING IN MECHANICAL & MECHATRONIC ENGINEERING

Machipisa, Bill
Mpofu, Amber Keamogetswe

BACHELOR OF SCIENCE IN ENGINEERING IN ELECTRICAL & COMPUTER ENGINEERING

Mthethwa, Mpumelelo Mondli
Pohl, Alan Christopher
Samuels, Edwin

BACHELOR OF SCIENCE IN ENGINEERING IN CHEMICAL ENGINEERING

Casse, Taylor Duncan
Chamoto, Tapiwa Resego
Cheney, Sean Matthew
Gwebu, Paballo Makgale
Hlambelo, Salusiwe
Kholumo, Reitumetse
Mudau, Franklin Dakalo
Rikhotso, Mbhoni Joy

BACHELOR OF SCIENCE IN ENGINEERING IN CIVIL ENGINEERING

Ahmed, Ziyaad
Maunick, Krishnen
Munsamy, Kameron Rowen
Ramesega, Dineo Karabo (with honours)

BACHELOR OF SCIENCE IN ENGINEERING IN ELECTRICAL ENGINEERING

Bray, Muneeb Mohamed Aslam
Cuthbert, Julia Morgan
Iyer, Sean Camden
Masunungure, Tonderai Walter
Pudaruth, Atyrek Yashil
Zimuto, Tanaka Raymond

BACHELOR OF SCIENCE IN ENGINEERING IN MECHANICAL ENGINEERING

Armadien, Mogammad Nur
Bailey, Nicholas Michael
Baroyi, Sabelo
Chinnasamy, Ethan Charles
Lubisi, Jones
Manga, Shivani
Mohapi, Katiso Albert

BACHELOR OF SCIENCE IN ENGINEERING IN MECHATRONICS

Brown, Kai Bartholomew
Jokomo, Tinomudaishe Ephraim
Malalamabi, Aluwani Patson
Mungadzi, Tinotenda
Muzorori, Ngonidzashe
Rawthee, Riselle
Robinson, Keenan
Rügheimer, Austin Ryan
Waleed, Hamza
Winter, Adrienne Elizabeth

BACHELOR OF SCIENCE IN GEOMATICS

Bineshtarigh, Seyed Mahyar
Malatji, Kgwarishi Cleopas

BACHELOR OF SCIENCE IN PROPERTY STUDIES

Goff, Liam Hadjidakis
Mildenhall, Matthew James
Molisana, Tshepang Lerato
Nkosi, Bongumusa Clement
September, Daniel Matthew

FACULTY OF SCIENCE

Dean: Professor M Ramutsindela

The symbol † indicates that the qualification is awarded posthumously.

DOCTOR OF PHILOSOPHY

Acquah, Kojo Sekyi
Thesis Title: *Exploring the molecular diversity and biomedicinal potential of marine invertebrates and South African actinomycetes for tuberculosis drug discovery*

Kojo Acquah obtained his MPhil degree in Organic Chemistry from the University of Ghana, Legon. He joined the Department of Chemistry at UCT in 2017 for studies towards his PhD degree.

Kojo Acquah's thesis reports on an efficient approach to screening extracts from biological organisms for activity against the TB causing organism *Mycobacterium tuberculosis*, and the isolation of novel chemical entities with potential as anti-TB drugs. LC- HRMS and NMR data for active extracts and their fractions, in combination with mining of natural product databases allowed for dereplication of extracts and efficient identification of novel chemical entities. A total of 54 of 984 marine invertebrate extracts exhibited promising activity, with those of the Mauritian sponges *Hyrtios reticulatus* and *Jaspis splendens* subsequently yielding bioactive chemical components. Studies of a collection of South African novel and rare actinomycetes led to the isolation of new bioactive compounds from *Streptomyces* strain Muiz4Y and *Kribbella speibonae* strain SK5. His findings reaffirm the marine invertebrates as a source of anti-TB compounds and establish South African actinomycetes as a source of novel bioactive compounds.

Supervisor: Professor DW Gammon (Chemistry)
Co-supervisors: A/Professor DR Beukes (University of the Western Cape, Pharmaceutical Chemistry); Dr PR Meyers (Molecular and Cell Biology); Professor DF Warner (Pathology)

Arena, Gina
Thesis Title: *Expanding grasslands? Structural biome shifts in the dryland rangelands of the eastern Karoo revealed through long-term observation of climate, vegetation and land use change*

Gina Arena began her tertiary education at the University of the Witwatersrand, where she obtained her BSc, BSc(Hons) and MSc degrees in Ecology and Conservation by 2013. After a brief hiatus to work and travel abroad, she resumed her education in 2017, when she started her PhD at UCT.

Twentieth century rangeland degradation in South Africa was caused primarily by high livestock densities, overgrazing and frequent droughts. Due to growing concerns, an eastward spread of Karoo shrublands was predicted for the 21st century. Long-term studies, however, have refuted these predictions suggesting instead that an increase in grasses has occurred across the Nama-Karoo-Grassland biome boundary. Gina Arena's thesis is a continuation of the long-term monitoring of vegetation change across this biome transition. She reports an overall increase in vegetation cover since the 1960s, which is represented by a persistent westward expansion of grasses, driven by a directional increase and seasonal shift in rainfall trends over the region. An improvement in rangeland condition, represented by grazing capacity, is also reported. This research emphasises the value of long-term observation of vegetation change across biome boundaries to track the influence of climate and land use change.

Supervisor: Professor MT Hoffman (Biological Sciences)
Co-supervisors: Dr H van der Merwe (South African Environmental Observation Network); Professor TG O'Connor (South African Environmental Observation Network)

Attipoe, David Sena
Thesis Title: *Novel fitted schemes based on mimetic finite difference method for options pricing*

David Attipoe obtained a BSc in Mathematics in 2012 from the University of Ghana. He also holds an MSc (with Distinction - 2014) from the African Institute for Mathematical Sciences (AIMS) in Senegal. He joined UCT in 2015 for an MSc in Mathematics, which was upgraded to a PhD in 2016.

David Attipoe's thesis developed novel numerical methods to approximate the solutions of partial differential equations arising in the pricing of options. The focus was on the degenerate Black-Scholes equation, which governs European options and American options with known constraints. The proposed mimetic finite difference and fitted mimetic finite difference schemes gave accurate approximated discrete solutions in space by mimicking certain important properties of the continuous problem and handling the degeneracy of the Black-Scholes differential operator. Important existence, uniqueness and consistency results were presented in one and two spatial dimensions. Some computations were performed for the full discrete solutions to validate all the theoretical results presented in the work.

Supervisor: Professor A Tambue (Western Norway University of Applied Sciences, Computer Science, Electrical Engineering and Mathematical Sciences)
Co-supervisor: Dr F Ebobisse Bille (Mathematics and Applied Mathematics)

Attram, Henrietta Dede
Thesis Title: *Antimalarial benzimidazoles and related structures incorporating an intramolecular hydrogen bonding motif: medicinal chemistry and mechanistic studies*

Henrietta Attram completed her BSc and BSc(Hons) qualifications at University of Ghana and began full-time study towards a PhD in 2018, having upgraded from her initial MSc programme.

Henrietta Attram's thesis reports the medicinal chemistry of antimalarial benzimidazoles and related structures incorporating an intramolecular hydrogen bonding motif, based on knowledge gained from clinically used antimalarial drugs, such as amodiaquine, which incorporate the aforementioned motif. *In vitro* biological evaluation allowed her to propose the relationship between the chemical structure and biological activity in the classes of compounds pursued. Finally, fluorescence drug localisation, computational docking and cellular heme fractionation studies were employed as approaches towards elucidating the mechanism of action of the frontrunner compounds.

Supervisor: Professor K Chibale (Chemistry)

Awine, Timothy Adingiyuure
Thesis Title: *The malaria elimination agenda: prospects for Ghana using mathematical modelling tools*

Timothy Awine received his BSc and MSc degrees in Physics and Medical Statistics from the Kwame Nkrumah University of Science and Technology in Ghana and University of London respectively. Before starting his PhD in UCT in 2016, he worked as a statistician in the health research industry in Ghana.

Timothy Awine's thesis focuses on development of mathematical models to study the dynamics of malaria incidence in various settings in Ghana. His models are used to investigate the impact of malaria interventions and the prospects of achieving set goals for possible attainment of disease elimination. He uses routine health facility data from all 216 districts in Ghana from 2008 to 2017 to demonstrate that the dynamics of malaria incidence vary greatly along different ecological zones and goes on to calibrate his models with these data. He shows using all models, that insecticide treated bed-nets and indoor residual spraying were very effective in reducing the incidence of disease, if the uptake of these interventions were improved. He further demonstrates that elimination of malaria is possible by 2030, in most regions of Ghana, if the deployment of these interventions are combined and sustained.

Supervisor: A/Professor SP Silal (Statistical Sciences)

Azaki, Bukola Aderewa Debola
Thesis title: *The breeding ecology and behavioural adaptions of African Black Oystercatchers in light of climate change*

Bukola Azaki holds a BSc in Zoology and MSc in Conservation Biology from the University of Jos, Nigeria. Before joining UCT, she worked as the Conservation Officer at Eden Creation Care, Jos, Nigeria, where she developed a management plan for the reclamation of wetland habitats to benefit birds.

Bukola Azaki's thesis examined breeding ecology of African Black Oystercatchers, including how climate change could affect breeding success and whether they could adjust their behaviour to cope. She analysed weather, habitat, and behavioural data from breeding oystercatchers on Robben Island. She found that climate change could potentially increase the heat load of adults, decrease egg viability, increase nest loss to storm surges, and increase nest predation, thus reducing breeding success. However, oystercatchers used behavioural adjustments, like panting, shading their eggs, and cooling-off at the water-edge frequently under warm conditions, to mitigate high temperatures. Oystercatchers also varied the location of their nests in ways that made them safer from storm surge and predation, but their ability to do so was limited in narrow areas of shore. Oystercatchers show behaviours which could help them cope with future climate change, but nesting habitat availability may become increasingly important.

Supervisor: Emeritus Professor L Underhill (Biological Sciences)
Co-supervisor: Dr S Cunningham (Biological Sciences)

Bavuma, Yanga
Thesis Title: *The relevance of the Pauli group in dynamical systems with pseudo-fermions*

Yanga Bavuma holds a BSc and BSc(Hons) from Rhodes University. He joined UCT in 2017 for an MSc in Algebraic Topology, and continued to doctoral research in Mathematics, having won the prestigious Shuttleworth Fellowship. His PhD is the first to be completed in South Africa with the support of the Shuttleworth Fellowship.

In his thesis, Yanga Bavuma investigates the group matrices of Wolfgang Pauli, well known in mathematical physics, because it describes some relevant symmetries in quantum dynamical systems. It is less known its structure of finite 2-group of order 16, which may be decomposed in the central product of two of its subgroups. From this new perspective, the Pauli group has an interesting structure both at a topological and algebraic level. Applications are illustrated for the theory of the pseudo-fermionic operators, introducing a framework of quantum mechanics and suggesting a physical interpretation for the topological decomposition, which has been found at an abstract level in his thesis.

Supervisor: Dr F Russo (Mathematics and Applied Mathematics)

Blanckenberg, Michelle Claire
Thesis title: *The effects of a land use change, from small livestock farming to protected area, on vegetation and mammal communities in the SKA region of the Karoo, South Africa*

Michelle Blanckenberg completed her BSc and BSc(Hons) at Rhodes University, and her MSc in Conservation Biology at UCT. She began full-time study towards her PhD in 2017.

Michelle Blanckenberg's thesis focuses on the impacts of land use change, from commercial small livestock farming to protected area status, on both the flora and fauna of the Northern Cape region of the Karoo. Her study was based in the Square Kilometre Array (SKA) and included the use of extensive surveys of vegetation and mammals within the SKA core area. The combined results have produced the single largest baseline data set for biodiversity estimates of wildlife in the northern Karoo and will form part of a long-term monitoring project by the South African Earth Observation Network. Additionally, she monitored the abundance of livestock predators and their prey and the effectiveness of predator-proof fencing at mitigating conflict between the SKA managers and neighbouring livestock farmers. The thesis seeks to find the balance between reduced livestock losses for farmers and improved conservation of wildlife to meet national biodiversity objectives.

Supervisor: Professor MJ O'Riain (Biological Sciences)
Co-supervisor: Dr G Bronner (Biological Sciences)

Bok, Jamie
Thesis Title: *Probing the role of environment and HI content in galaxy evolution: a multiwavelength study of isolated and paired galaxies*

Jamie Bok completed her BSc and BSc(Hons) qualifications at UCT, and began full-time study towards her PhD in 2016.

Jamie Bok's thesis examines and contrasts the neutral hydrogen (HI) content of isolated and paired galaxies in the local Universe as a means of assessing the impact of galaxy environment (external influences) on HI content. Elemental hydrogen provides the raw fuel for star formation and is thus critical to galaxy formation and evolution. Jamie Bok presents HI profile asymmetries for statistically-significant samples of isolated and paired galaxies, and finds enhanced profile asymmetries in her pair sample, relative to isolated. She attributes the enhancement to merger activity and proposes that high profile asymmetries may be used to infer potential merger activity at high redshifts with upcoming SKA surveys. She then extends her study to include galaxies in more densely-populated environments and investigates their HI content on the WISE mid-infrared (MIR) star-forming main sequence (SFMS). In so doing she probes the role of both galaxy environment and HI content in galaxy quenching, as indicated by a galaxy's location on the SFMS diagram. She invokes the use of optical galaxy morphologies, the gravitational tidal influence parameter (Q), the local density parameter (eta), star-formation efficiencies (SFE), and HI profile asymmetries, to propose plausible quenching scenarios for low and high

mass galaxies.

Supervisor: Professor TH Jarrett (Astronomy)
Co-supervisors: A/Professor ME Cluver (Swinburne University of Technology, Astronomy); Dr RE Skelton (South African Astronomical Observatory); A/Professor S-L Blyth (Astronomy)

Du Preez, Brandon Kyle
Thesis Title: *Distance in planar graphs*

Brandon du Preez holds a BSc in Astrophysics and Mathematics in 2016 and a BScHons in Mathematics from UCT. After spending 2018 as an MSc student, his registration was upgraded to PhD on the strength of his original work.

Brandon du Preez's thesis focuses on distances in planar graphs. A graph is a mathematical model of a network in which we have vertices (representing people, places, computers etc.) and lines representing connections between them. A graph is planar if it can be drawn on paper such that no two lines cross. The distance between two vertices in a graph is the smallest number of lines you need to go through to get from one vertex to the other. In this thesis, Brandon determines how large certain kinds of planar graphs can be. In particular, he finds an exact upper limit on how many vertices a graph can have given that it is planar, every pair of vertices are within some fixed distance of each other, and one other geometrical constraint on what a drawing of the graph looks like. He also describes the most centrally located parts of such graphs.

Supervisor: Dr D Erwin (Mathematics and Applied Mathematics)

Enfield, Kim
Thesis Title: *Modulation of the progesterone receptor by progestogens, antiretroviral drugs and the glucocorticoid receptor*

Kim Enfield completed her BSc and BSc(Hons) qualifications at UCT. She started her master's degree and after obtaining several novel results, upgraded to a PhD in 2018.

Kim Enfield's thesis reports on progestogens used in hormonal contraceptives and replacement therapies used globally by millions of women. Many different progestogens are used in these treatments. Her thesis used an in vitro mechanistic approach to characterise the relative activity of different progestogens via their target progesterone receptor (PR). She also investigated other factors that may affect PR activity. These included the role of PR isoforms, antiretroviral drugs (ARVs), progestogen metabolism and crosstalk of the PR with the glucocorticoid receptor (GR). Her findings show that progestogens have the potential to elicit differential PR actions depending on the type of progestogen and the target gene, as well as being affected by multiple factors, including the expression of PR isoforms and the GR, the use of ARVs and differential degrees of metabolism. Her results suggest that choice of progestogen and the other factors investigated are crucial in determining treatment efficacy and side-effects in women.

Supervisor: Professor JP Hapgood (Molecular and Cell Biology)
Co-supervisor: Dr C Avenant (Molecular and Cell Biology)

Fearon, Giles Geoffery
Thesis Title: *The influence of the land-sea breeze on coastal upwelling systems*

Giles Fearon holds a BSc and BSc(Eng) from UCT and an MSc(Eng) from Stellenbosch University. He joined the Oceanography Department at UCT in 2017 for his PhD studies. Prior to commencing his PhD, he acquired over nine years' work experience as a port and coastal engineer.

Giles Fearon's thesis investigates how sub-daily wind variability associated with the land-sea breeze impacts the functioning of coastal upwelling systems at the critical latitude of 30˚ N/S. Numerical experiments on the Benguela upwelling system revealed the physical processes through which resonance between the land-sea breeze and the local inertial frequency drive energetic diurnal-inertial currents and internal waves, resulting in enhanced vertical mixing. The experiments further displayed how the land-sea breeze drives significant daily variability in sea surface temperatures in coastal upwelling systems, while enhanced vertical mixing at the sub-daily scale reduces upwelling and affects coastal circulation at longer time scales. The response was shown to be particularly amplified in St Helena Bay, which is characterised by large episodic phytoplankton blooms. The study suggests that the land□sea breeze may influence the bloom development in this region, as well as other coastal upwelling systems near the critical latitude.

Supervisor: A/Professor M Vichi (Oceanography)
Co-supervisors: Dr S Herbette (Université de Bretagne Occidentale); Dr J Veitch (South African Environmental Observation Network)

Gouveia, Dominique Mateus Fragoso
Thesis Title: *The effects of an arbitrary waveform generator on single-electron pumps in GaAs/AlGaAs heterostructures*

Dominique Gouveia completed his BSc and MSc in Electrical Engineering at UCT and joined the NanoElectronics Group in the Department of Physics in 2017 to work towards his PhD.

Dominique Gouveia's thesis focuses on investigating the behaviour of the new split-gate quantum dot single-electron pumps in response to different driving megahertz waveforms synthesised with an arbitrary waveform generator. His work reveals a new pumping regime when the single-electron pump is driven with a specific non-sinusoidal waveform. Not only does this new pumping regime contain a high degree of accuracy in transporting a single-electron per cycle, but it also allows one to pump multiple integer number of electrons (up to nine per cycle) at an unprecedented level of robustness. His work will have direct applications towards the development of a new quantum standard for the electrical current, as well as for further studies in quantum optics and entanglement.

Supervisor: A/Professor MD Blumenthal (Physics)

Groenewald, Grea
Thesis Title: *Developing dynamic energy budget (DEB) models for small pelagic fishes in the Southern Benguela*

Grea Groenewald (nee Wessels) obtained her undergraduate and MSc degrees from UCT. Her MSc degree, awarded with distinction, provided evidence that sardines off South Africa comprised several stocks, a factor that is now used to inform fisheries management.

Grea Groenewald's thesis uses computer simulations to understand why three similar, commercially-important fish species co-occur in large numbers off South Africa. She uses existing information to construct mathematical descriptions of how anchovy, redeye round herring and sardine feed, grow and reproduce through their lifetimes. Her study mimics energy use by these fishes under varying temperatures and food environments. She shows that the three species differ in the ways they partition energy received from their food. Redeye round herring invest energy mainly in body growth, whereas sardine and anchovy invest mostly in reproduction, but differ in their responses to food and temperature. Young fish grow slowly in cool waters, mitigated by improved food availability under cool conditions. Fast growth by juveniles results in improved egg production as adults. These results help understanding of differential responses of the three species to ocean variability and help in predicting the impacts of climate change.

Supervisor: A/Professor CL Moloney (Biological Sciences)
Co-supervisor: Dr CD van der Lingen (Biological Sciences)

Healy, Julia Lynn
Thesis Title: *Insights from spectral stacking on the Hi content of cluster galaxies in various environments: a tale of two clusters*

Julia Healy completed her BSc (Physics and Astrophysics), BSc(Hons) in Physics, and MSc in Astronomy at UCT. She started study towards a joint PhD degree between the University of Groningen and UCT in 2017.

Julia Healy's thesis focuses on the neutral gas (HI) content of galaxies in different sub-environments within and around galaxy clusters as a means to investigate the physical processes leading to the observed morphology-density relation. She uses a range of multi-wavelength data from optical to radio wavelengths, imaging and spectroscopy, and including data from the Westerbork Synthesis Radio Telescope and the MeerKAT radio telescope, to study two large galaxy clusters, Coma and Abell 2626. With her spectroscopic datasets she identifies sub-structures within the clusters, as well as large-scale structure in front of and behind Abell 2626 and discovers that Abell 2626 is a richer cluster than previously realised. She uses a novel technique called HI stacking to measure the average gas content of cluster galaxies, even where galaxies are not individually detectable. This work paves the way for future studies using similar techniques with the upcoming Square Kilometre Array.

Supervisors: A/Professor S-L Blyth (Astronomy); Professor M Verheijen (University of Groningen, Kapteyn Astronomical Institute)
Co-supervisors: Professor T van der Hulst (University of Groningen, Kapteyn Astronomical Institute); Emeritus Professor R Kraan-Korteweg (Astronomy)

Joseph, Rageema
Thesis Title: *The MYC transcription factors are involved in regulating the time-of-day variations in susceptibility to Botrytis cinerea in Arabidopsis thaliana*

Rageema Joseph completed a BSc in Microbiology and a BSc(Hons) in Molecular and Cell Biology at UCT and is a recipient of a Harry Crossley Research Fellowship.

Rageema Joseph's thesis investigates the molecular links between the endogenous timekeeping mechanism, or circadian clock, and the immune system in the model plant Arabidopsis thaliana. Using a reverse genetic approach, she shows that the closely related transcription factors MYC2, MYC3 and MYC4 are involved in regulating time-of-day differences in susceptibility of the plant to a fungal pathogen. She went on to show that while MYC2, MYC3 and MYC4 function redundantly in regulating temporal differences in defence responses, they also have some distinct functions. Using gene expression analyses, she showed that the circadian clock regulates the expression of the *MYC* genes with peak levels at discrete times of the day-night cycle. Furthermore, misexpression of *MYC2* and *MYC3*, but not *MYC4*, altered circadian leaf movement rhythms, indicating the potential for reciprocal regulation of the circadian clock by the immune system via these transcription factors.

Supervisor: A/Professor RA Ingle (Molecular and Cell Biology)
Co-supervisor: A/Professor LC Roden (Coventry University, School of Life Sciences)

Kusena, Kudzai
Thesis Title: *Understanding the resilience of local seed systems: a case study of Uzumba-Maramba-Pfungwe and Chimanimani districts, Zimbabwe*

Kudzai Kusena holds an MSc in Biodiversity Management from the Swedish University of Agricultural Sciences. He joined the Department of Environmental and Geographical Science at UCT for his PhD studies in 2015. Before joining UCT, he worked for the National Genebank of Zimbabwe, researching and conserving plant genetic resources.

Kudzai Kusena's thesis focuses on understanding how local seed systems persist in the face of social and ecological adversities. He uses two case studies from eastern Zimbabwe to characterize local seed systems and the strategies used by smallholder farmers to manage them. Through exploring social and ecological factors he reveals their influence on the resilience of local seed systems and the importance of innovations used by smallholder farmers to sustain these systems. Ten key principles are proposed that underpin the resilience of local seed systems. Findings of the thesis challenge the appropriateness of mechanistic

interventions for seed security such as seed aid and emphasise the importance of integrating resilience principles into policy and practice to advance the seed and food security of smallholder farmers.

Supervisor: Professor R Wynberg (Environmental and Geographical Science)
Co-supervisor: Dr C Mujaju (Department of Research and Specialist Services, Zimbabwe)

Kusza, Daniel Andreas
Thesis title: *An activity-based proteomics approach for identifying Ajoene's S-thiolation protein targets in blood and cancer cells*

Daniel Kusza completed his BSc and BSc(Hons) in Chemistry at UCT, followed by an MSc with distinction.

In 2016, he commenced his PhD in synthetic chemical biology, working on the cancer-fighting properties of a small organic compound found in cooked garlic called ajoene. A principal question posed in the thesis was how ajoene kills cancer cells. By chemically synthesising structural variants of ajoene, he was first able to identify the different roles that ajoene's functional groups play in its anti-cancer activity. He then designed and synthesised an ajoene probe that acted as a "chemical bait" to pull out cancer-cell protein targets reacting with ajoene as part of the cell-killing process. A few of these proteins were known before his work, but the probe successfully identified a collection of new ones, some as critical proteins involved in cancer. Overall, his findings provide new, fundamental insights into the cancer-fighting properties of cooked garlic.

Supervisor: Emeritus Professor R Hunter (Chemistry)
Co-supervisor: Dr CH Kaschula (Stellenbosch University, Chemistry and Polymer Science)

Leighton, Gabriella Ruth Michaela
Thesis Title: *Life on the edge: exploring the effects of urbanisation on the foraging ecology and ecotoxicology of caracals*

Gabriella Leighton completed her BSc and BSc(Hons) degrees in Biological Sciences at UCT. She began full-time study towards an MSc in 2016, which she upgraded to a PhD in 2018.

Gabriella Leighton's thesis explores risk-reward trade-offs for caracals living at the urban edge of Cape Town. Using a range of analytical approaches, her research reveals that caracals have flexible diets that focus on wild prey and presents a novel, integrated method to describe diet of medium-sized carnivores. She investigates foraging-habitat selection by individual caracal and their strategies to avoid risk in developed areas. When exposed to increasing urbanisation, caracals select to forage nearer the urban edge, mitigating risk by remaining cryptic where cover is available. However, she also finds that favoured foraging-habitats often overlap with areas that increase risk of exposure to several toxic environmental pollutants that can disrupt immune responses, suggesting caracal pay significant health costs for high returns of foraging in human-dominated areas. These findings contribute to our understanding of how wildlife cope with urban stresses and informs conservation strategies that promote coexistence of wildlife and people in and around cities.

Supervisor: Dr J Bishop (Biological Sciences)
Co-supervisors: Dr L Serieys (Biological Sciences); Professor J O'Riain (Biological Sciences)

Lester, Nina Catherine
Thesis Title: *The interaction of acidification and warming on the South African abalone, Haliotis midae, and the potential for mitigation in aquaculture*

Nina Lester holds a BSc and a BSc(Hons) in Marine Biology from UCT. She upgraded her master's to a PhD in 2015, and during her studies worked as a Hatchery Manager on an abalone farm.

Nina Lester's PhD thesis examines the impact of ocean acidification and warming on the South African abalone and assesses the potential use of the green seaweed *Ulva* to mitigate the effects of ocean acidification in a flow-through aquaculture system on a South African abalone farm. This is the first study to assess the effects of long-term elevated CO2 and warming on *Haliotis midae*, and the first to incorporate long-term, natural variability into climate change research for molluscs outside of a laboratory. The results are of particular relevance to the South African abalone industry, as ocean acidification conditions are likely to result in slower abalone growth, increased cultivation time to reach market-size, reduction in quality of abalone (as the shells are more easily damaged), and a likely increased susceptibility to parasites and disease as a result of long-term metabolic stress. This study highlights the importance of incorporating local-scale, natural variability into ocean acidification and warming studies to guide management practices for cultivation and protection of this valuable species.

Supervisors: Emeritus Professor JJ Bolton (Biological Sciences)
Co-supervisors: A/Professor M Lucas (Biological Sciences); Professor L Auerswald (Department of Environment, Forestry and Fisheries of South Africa and Stellenbosch University, Animal Science)

Makhubele, Marvel Hope
Thesis Title: *Reinterpreting vintage geophysical data from the Algoa and Gamtoos Basins, South Africa: an integrated sequence stratigraphic framework since the middle Mesozoic*

Marvel Makhubele holds a BSc and BSc(Hons) from UCT, and an MSc in Petroleum Geoscience from the University of the Western Cape. He returned to UCT for doctoral studies in 2018.

Marvel Makhubele's thesis gives a contemporary understanding of the geological development of the Algoa and Gamtoos Basins in South Africa. It is based on borehole and seismic data acquired between 1968 and 2001, and

uses an integrated sequence stratigraphic approach to show how sediments were deposited along the southern coast since the supercontinent Gondwana broke up in the middle Mesozoic. His study tracks the transition from rift basin to passive margin sedimentation, illustrates the relative sea level changes since the Middle Jurassic and highlights the implications of basin development for hydrocarbon prospectivity in this understudied region. More specifically, the study shows how key geological surfaces in this sediment record formed while the shoreline was at different positions relative to its modern-day location. It also reaffirms that in sequence stratigraphy the key geological surfaces are not limited to subaerial unconformities, but rather to surfaces that bound genetically related sedimentary successions.

Supervisor: A/Professor EM Bordy (Geological Sciences)

Mambwe, Dickson
Thesis Title: *Repositioning of astemizole for Malaria*

Dickson Mambwe completed his BSc in Chemistry at the University of Zambia in 2013, after which he spent three years working in industry. He joined Professor Kelly Chibale's group for his MSc in 2017, which he upgraded to a PhD in 2018.

Dickson Mambwe's thesis reports the use of medicinal chemistry approaches to reposition antihistamine drug astemizole (Hismanal) for malaria, by addressing its cardiotoxicity risk associated with the blockade of the human ether-á-go-go-related gene (hERG) potassium channels. He investigated molecular features responsible for hERG blockade and antimalarial activity via chemical synthesis and biological testing in vitro. This enabled him to iteratively derive structure-activity and structure-property relationships, which have led to the identification of novel derivatives of astemizole with lower hERG affinities. Additionally, the new derivatives show potential for blocking malaria transmission via their action on sexual stages of the human malaria parasite, Plasmodium falciparum. These findings provide a basis for future development of novel antimalarial compounds derived from astemizole.

Supervisor: Professor K Chibale (Chemistry)

Mdutyana, Mhlangabezi
Thesis Title: *Mixed layer nitrogen cycling in the Southern Ocean: seasonality, kinetics, and biogeochemical implications*

Mhlangabezi Mdutyana completed his BSc and BSc(Hons) qualifications at Walter Sisulu University. In late 2015, he began working towards an MSc in Oceanography at UCT, upgrading to full-time PhD study in 2017.

Mhlangabezi Mdutyana's thesis reports seasonally-resolved rates of phytoplankton nitrogen uptake and nitrification across the Southern Ocean south of Africa – these are the first such measurements of nitrification for the entire Southern Ocean. He finds that nitrogen recycling in the wind-mixed upper layer in winter impedes the Southern Ocean's capacity for carbon dioxide drawdown on an annual basis. He further investigates the physiological limitations imposed on phytoplankton and nitrifying bacteria by the harsh conditions of the Southern Ocean. Through the application of Michaelis-Menten kinetic models to experimental data, he demonstrates the very high affinity of phytoplankton and nitrifiers for recycled nitrogen, and shows that their activity is restricted by environmental factors that change seasonally. Surprisingly, his data suggest that nitrification is limited by the availability of the trace element iron, rather than by nitrogen. His research shows that better predictions of the Southern Ocean's future role in atmospheric carbon dioxide drawdown require an improved understanding of the controls on mixed-layer nitrogen cycling.

Supervisor: Dr SE Fawcett (Oceanography)
Co-supervisor: Dr SJ Thomalla (Council for Scientific and Industrial Research)

† Mostert, Andre George
Thesis Title: *Fault diagnosis in multi-variate statistical process monitoring*

André Mostert completed BSc, BSc(Hons) and MSc degrees at Stellenbosch University, after which he joined Sasol as a statistician. His part-time PhD studies focused on theoretical solutions for practical challenges in industry.

In a large, complex process, it is important for engineers to monitor and correct any deviations from the optimal production conditions. André Mostert's thesis illustrates that current methodology to identify the causes of deviations is inadequate for multivariate fault diagnosis. He developes novel measures to rank variable contributions, providing engineers with a clear statistical interpretation of multivariate faults to correct sub-optimal operation. By simulating data typical from such a complex process, it is shown that the new methods are superior in interpreting multivariate statistical deviations, specifically in the presence of correlations between different factors. He also provides a case study where the usefulness and value of the newly-developed methodology are illustrated.

Supervisor: Professor S Lubbe (Stellenbosch University, Statistics and Actuarial Science)
Co-supervisor: Professor RLJ Coetzer (Statistics, North-West University and Mathematical Statistics and Actuarial Science, University of the Free State)

Naylor, Kyle Andrew
Thesis Title: *Development of a dusky kob scFv gene phage display library for the discovery of antibodies to Brome mosaic virus - a proxy for a novel, emerging fish pathogen*

Kyle Naylor obtained a BSc with majors in Marine Biology and Genetics, and a BSc(Hons) in Genetics *(cum laude)* from the University of KwaZulu-Natal.

Fish farming is expected to become the main source of fish due to decreasing wild fish populations. As with any farmed product, disease outbreaks are a constant threat to production. Phage display allows antibodies, screened

for their ability to bind to a specific pathogen, to be presented on the phage surface. Kyle Naylor constructed a phage display library of dusky kob IgM heavy and light chain fragments that was screened for antibodies against Brome mosaic virus (BMV), a grass virus to which dusky kob would have had no prior exposure and therefore, would act as a proxy of an emerging fish pathogen. *Saccharomyces cerevisiae* (yeast) displaying the dusky kob-derived anti-BMV dAb demonstrated the therapeutic potential of yeast displayed anti-BMV by preventing BMV infection of barley plants. Similarly, the anti-BMV yeast displayed dAb detected BMV injected into the blood stream of dusky kob, indicating the diagnostic potential of yeast displayed antibodies. This study confirmed the feasibility of this novel approach for rapid antibody deployment for diagnosis and treatment of infectious diseases in farmed fish.

Supervisor: A/Professor V Coyne
(Molecular and Cell Biology)

Nebel, Carina
Thesis Title: *A mechanistic approach to understanding the colour polymorphism in black sparrowhawks (Accipiter melanoleucus)*

Carina Nebel completed her BSc and MSc qualifications at the University of Vienna, Austria, and began full-time study towards her PhD in 2017.

How is variability maintained in animal populations? Carina Nebel's thesis focuses on a novel idea related to this question, the 'complementarity hypothesis'. Selective mechanisms associated with the complementarity hypothesis might be present in the colour polymorphic black sparrowhawk *(Accipiter melanoleucus)*: pairs that express two different morphs raise more young that have higher fitness than pairs that express the same morph. Her research aim was to understand if these differences could lead to stable morph equilibria over time in the black sparrowhawk. She investigated different mechanistic aspects and found that pair complementarity is pronounced in prey delivery behaviour, whereas her simulations show that mechanisms associated with the complementarity hypothesis are capable to maintain colour polymorphism in this animal population. These findings add to our understanding of how variability can be maintained in nature.

Supervisor: A/Professor A Amar
(Biological Sciences)
Co-supervisor: Dr P Sumasgutner
(University of Vienna, Konrad Lorenz Research Centre)

Ngcamphalala, Sandile
Thesis Title: *Exploring adaptive policy management and evaluation for improved water resources management in the face of uncertainty and complexity in South Africa*

Sandile Ngcamphalala holds an MA in Public Policy from University of the Witwatersrand and an MSc in International Development from the Royal Agricultural University in the United Kingdom. He began his PhD studies in 2016, while working full-time for the Agricultural Research Council in South Africa.

Sandile Ngcamphalala's thesis focuses on improving evidence-based water policy management in contexts bedevilled by challenges of uncertainty and complexity. Such challenges risk increased policy failure, including unintended negative outcomes. The study hypothesises that adaptiveness in policy making, supported by comprehensive monitoring and evaluation, can improve and benefit the management of water resources in a South Africa targeting *'water equity'*. Challenges related to water policy design, institutional governance and operational implementation are identified for adjustments in order to ensure contextually successful adaptive policy. Fifteen environmental, economic, socio-cultural and political systems' variables that interactively affect, or are affected by, *'Water Equity'* are identified as the drivers and leverage points that should be comprehensively evaluated to improve the credibility of the policy management evidence-base. In a context of high poverty, inequality and unemployment, policy efforts cannot afford to fail. Thus improving evidence-based water policy efficiency could help accelerate much-needed *'Water Equity'* outcomes.

Supervisor: Dr O Crespo
(Environmental and Geographical Science)
Co-supervisor: Emeritus Professor J Louw (Psychology)

Nyamai, Mumbua
Thesis Title: *Radio observations as a tool to study shock interactions and mass ejections in novae*

Mumbua Nyamai obtained her BEd (Science) at Kenyatta University in Kenya, her BSc(Hons) NASSP at UCT, and her MSc with distinction at the University of the Free State. She began full-time study towards her PhD in 2017.

Mumbua Nyamai's thesis presents a radio wavelength study into ejection processes in thermonuclear eruptions (novae). Novae occur in binary systems of stars known as Cataclysmic Variables and closely related objects. In these systems a thermonuclear eruption occurs on the surface of a white dwarf following extensive periods of accretion of material from a companion star. The thermonuclear eruption leads to an explosive ejection of the outer layers of the accumulated material. The radio data are used to study shock interactions and mass ejections following such explosions. This thesis presents the detailed study of three novae, namely V445 Puppis, V339 Delphini and V3890 Sagitarii, using new observations from the MeerKAT radio telescope array in South Africa, as well as archival data from radio telescopes around the world. Exceptionally well-sampled radio light curves and high-resolution images have allowed new insights in the understanding of the complex concept of mass ejections in novae.

Supervisor: Professor PA Woudt
(Astronomy)
Co-supervisors: Dr VARM Ribeiro (Instituto de Telecomunicações and Universidade de Aveiro); A/Professor L Chomiuk (Michigan State University, Physics and Astronomy)

Omosun, Nikechukwu Nike
Thesis Title: *Design, synthesis and catalytic evaluation of mono- and polynuclear organometallic materials as hydroformylation catalysts*

Nikechukwu Omosun holds BSc and MSc degrees in Analytical Chemistry from the Federal University of Agriculture, Nigeria. She joined the Department of Chemistry at UCT for her PhD studies in 2017, before which she worked as an academic staff member at the Michael Okpara University of Agriculture, Nigeria.

Nikechukwu Omosun's thesis focuses on the design, synthesis and characterisation of new water-soluble alpha-diimine Rh(I) complexes, alpha-diimine Rh(I) metallodendrimers and a water-soluble tetraimine binuclear Rh(I) complex. She further evaluated these complexes as catalyst precursors for the hydroformylation reaction, an important industrial process for the production of aldehydes, valuable precursors for the surfactant industry. The complexes are highly active for the hydroformylation of 1-octene with good chemo- and regioselectivity under mild conditions. More importantly, she went on to investigate the recovery and recyclability of the designed water-soluble complexes, using an aqueous biphasic strategy. The water-soluble alpha-diimine Rh(I) complexes could easily be recovered and reused up to three times without a loss in catalytic activity. This she attributes to the good solubility and stability of the complexes in water. These findings will be useful in future for the development of eco-friendly industrial hydroformylation catalysts.

Supervisor: A/Professor GS Smith (Chemistry)

Oreta, Timothy
Thesis Title: *A study of relativistic fluids with applications to cosmology: A variational approach*

Timothy Oreta holds a BSc degree in Physics and Mathematics (double major) from the University of Zambia. He joined the Mathematics and Applied Mathematics Department at UCT in 2013 for honours, master's and PhD studies.

Timothy Oreta's thesis focuses on relativistic fluids. Such studies are thought to hold the key to resolve some of the problems in cosmology, such as the generation and growth of magnetic fields and the coincidence problem. He starts by examining single-fluid and multi-fluid formalisms in the context of a variational approach. He then incorporates aspects of electrodynamics and thermodynamics, intending to capture physical properties of realistic fluids, as opposed to the idealised fluids. This allows him to extend the Mueller-Israel-Stewart theory for relativistic fluids. When he uses the extended formalism to study the growth of dark-matter and dark-energy, he finds that an entrainment effect between these two species induces a relative modulation in their growth pattern. This may help explain the cosmological coincidence problem. He also examines the growth of inflation-generated magnetic fields and finds modes of these fields that evolve super-adiabatically during the radiation-dominated epoch. Coupled with a dynamo effect, such modes may account for the recent observations that suggest possible existence of large-scale magnetic fields.

Supervisor: A/Professor B Osano (Mathematics)

Phokeer, Amreesh Dev
Thesis Title: *Improving content delivery in low-resource networks: a case study of the African internet ecosystem*

Amreesh Phokeer graduated with an MS in Computer Science and Engineering at the University of Lorraine, France, in 2008 and with an MSc in Information Security at the Royal Holloway, University of London, in 2013. He joined the Computer Science Department at UCT to begin his PhD in 2016.

Amreesh Phokeer's thesis performs a series of empirical evaluation of the state of the Internet in Africa and explores the challenges of content delivery in low-resource networks. Using a mixed-method approach, he uncovered important user behaviours and mobile Internet usage patterns in South African townships. He then investigated the bottlenecks in the hosting and distribution of local web content and the impact on the Quality of Experience in several African countries. He further explored the African interconnection ecosystem by running a large-scale longitudinal study looking into delays and sub-optimal cross-continental paths. This study revealed important findings on the lack of proper traffic engineering and peering at a regional level. Finally, he uses an econometric model to estimate the effects of peering on local content hosting and distribution in African countries. His findings can be used by African network operators and policymakers to improve access to local content in the African region.

Supervisor: Dr DL Johnson (Computer Science)
Co-supervisor: A/Professor MR Densmore (Computer Science)

Poulsen, Zoe Chapman
Thesis title: *Conserving living landscapes: investigating the impacts of livestock grazing and assessing rangeland restoration potential in Overberg Renosterveld, South Africa*

Zoë Poulsen holds a BSc in Geography from Royal Holloway College, University of London and an MSc in Botany from UCT. She started her PhD in the Department of Biological Sciences at UCT in 2014.

Zoë Poulsen's thesis focuses on livestock grazing and restoration ecology of Overberg Renosterveld in South Africa. She examines the role of cattle and sheep grazing on plant species richness and diversity using Modified Whittaker plots. Her findings reveal that grazing by sheep reduces richness and diversity across all plant growth forms, but particularly bulbs. She then investigates the role of the soil seed bank in the restoration potential of overgrazed renosterveld. Her work demonstrates that Overberg Renosterveld has a species rich indigenous seed bank with high restoration potential. Furthermore, she examines the effect of exclusion of grazing on renosterveld vegetation recovery over four years. Her findings indicate that passive restoration through

fencing patches of renosterveld is an effective tool in driving vegetation recovery. The results of her research play a significant role in informing grazing management in this Critically Endangered vegetation.

Supervisor: Dr SBM Chimphango (Biological Sciences)
Co-supervisors: Professor MT Hoffman (Biological Sciences); Professor AM Muasya (Biological Sciences); A/Professor PML Anderson (Environmental and Geographical Science)

Roberts, Ethan Alexander
Thesis Title: *Aspects of Bayesian inference, classification and anomaly detection*

Ethan Roberts completed a BScEng in Mechanical Engineering at UCT, followed by a BScHons in Astrophysics and Space Science. His master's in this field was upgraded to a PhD in 2018.

Ethan Roberts' thesis focuses on the challenge of performing rigorous statistical learning about the world when there are significant errors, noise or contamination. He presents and tests Bayesian techniques that use information about the measurement errors to optimally perform classification and anomaly detection, and shows that the resulting algorithm is robust to model misspecification. He then presents an algorithm called zBEAMS, tested with an application to the next generation of cosmology surveys, to learn parameters of interest in the presence of both significant contamination and noise, showing that zBEAMS both delivers unbiased results and constraints that are not significantly different from the ideal case of no errors and no contamination. This work will inform the data analysis of future large-scale photometric supernova cosmology surveys.

Supervisor: Professor BA Bassett (Mathematics and Applied Mathematics)

Rogan, Matthew Schaffer
Thesis Title: *The application of spatial capture-recapture models to investigate leopard ecology and conservation in South Africa*

Matthew Rogan completed his BA at Pomona College and his MEM at the Nicholas School of the Environment, Duke University, USA. He began his PhD at UCT in 2015.

Matthew Rogan's thesis applies quantitative models to understand patterns in leopard density within more than two dozen protected areas in South Africa. He used data from 88 camera-trap surveys conducted over six years as part of Panthera's leopard monitoring program for Southern Africa. He first estimates population densities and assesses the relationship between population density, local abundance, and the proportion of area used. He then estimates temporal trends in leopard density and assesses the conservation status of seven populations. Lastly, he investigates patterns in density among the study sites to understand what factors most influence leopard density. This thesis significantly advances our understanding of the threats and conservation needs of an iconic wildlife species and offers lessons on how better to monitor leopards in the future.

Supervisor: Professor MJ O'Riain (Biological Sciences)
Co-supervisors: Dr G Balme (Panthera); Dr G Distiller (Statistical Sciences)

Schoombie, Stefan
Thesis Title: *Remotely sensing motion: the use of multiple biologging technologies to detect fine-scale, at-sea behaviour of breeding seabirds in a variable Southern Ocean environment*

Stefan Schoombie completed his BSc, BSc(Hons) and MSc at the Universities of Pretoria, KwaZulu-Natal and Cape Town, respectively, and began full-time study towards his PhD in 2017.

Stefan Schoombie's thesis describes the flight behaviour of soaring seabirds using an array of technologies to measure the fine-scale movement of free-ranging birds. He describes the limitations of such technologies and presents two novel methods to extract body angles from bird-borne sensors. He applied these methods to data collected from Wandering Albatrosses on sub-Antarctic Marion Island to describe how these birds respond to changing wind conditions by varying roll angles and flapping flight. He then used these methods to compare flight behaviour of several seabird species and to show how differences in their flight behaviour may ultimately shape their distribution and foraging grounds.

Supervisor: Professor PG Ryan (Biological Sciences)
Co-supervisor: Professor RP Wilson (Swansea University, Biosciences)

Singels, Elzanne
Thesis Title: *The role of geophytes in Stone Age hunter-gatherer subsistence and human evolution in the Greater Cape Floristic Region*

Elzanne Singels completed her BSc and MSc qualifications at Stellenbosch University, and began full-time study towards her PhD in 2014.

Elzanne Singels' doctoral thesis reports on the relationship between ancient humans and geophytes in the Greater Cape Floristic Region. Geophytes are plants with underground storage organs that were an important food resource to hunter-gatherers. The abundance of this resource in the contemporary landscapes is presented, illustrating that geophytes could have supported large populations of hunter-gatherers, rivalling contemporary crops such as potatoes in the nutrition offered. The archaeological evidence presented shows how widespread and complex geophyte foraging was in the region. Novel methods of archaeobotancial analysis presented here will aid future research into hunter-gatherer subsistence. From the various lines of evidence documented it is clear that geophytes were an important food resources for early humans and would have had a profound effect on our cognitive development and evolution.

Supervisor: Emeritus Professor J Parkington (Archaeology)

Co-supervisor: Professor K Esler (Stellenbosch University, Conservation Ecology and Entomology)

Singini, Isaac Luwinga
Thesis Title: *Diagnostics for joint models for longitudinal and survival data*

Isaac Luwinga Singini holds a BSc in Statistics and Computer Science from University of Malawi (1999), a Postgraduate Diploma and an MSc, both in Medical Statistics, from University of London (UK) (2008). He joined the Department of Statistical Sciences at UCT in 2016 for his PhD studies. He has written two manuscripts from his thesis, one published, and the other reviewed for resubmission.

Isaac Singini's thesis focuses on joint model diagnostics which investigate and develop optimal ways for performing valid inferences for treatment effects in the joint analysis of longitudinal and survival data. Joint models for longitudinal and survival data are a class of models that jointly analyse an outcome repeatedly observed, such as a marker of disease and a time-to-event outcome, such as death. He starts with a thorough literature review on longitudinal data analysis, a review on time-to-event models and, finally, models for a joint analysis of the two processes. A multicentre clinical trial dataset and suitably constructed simulations are put through estimation and analysis processes. He develops tools which make inferences about treatment effects in clinical trials, that have longitudinal and survival data robust to outliers.

Supervisor: A/Professor FN Gumedze (Statistical Sciences)
Co-supervisor: Professor HG Mwambi (University of KwaZulu-Natal, School of Mathematics, Statistics and Computer Science)

Stander, Jennifer
Thesis Title: *Development of West Nile virus candidate vaccines in Nicotiana benthamiana*

Jennifer Stander completed her BSc, BSc(Hons) and MSc (cum laude) qualifications at the University of Pretoria (2009-2016) and began her PhD full-time at UCT in 2017.

Jennifer Stander's thesis reports on the successful production of two West Nile virus (WNV) candidate vaccines using *Nicotiana benthamiana* as the expression platform. The first candidate vaccine was produced from the co-expression of the WNV membrane and envelope genes together with the human chaperone calnexin, yielding native WNV virus-like particles. The second approach was based on the SpyTag-SpyCatcher technology for the display of the immunogenic envelope domain III epitope on the surface of the bacteriophage AP205 particle. Both approaches resulted in the production of particulate WNV candidate vaccines from tobacco plants. These findings illustrate the potential of plants for use as biofactories for the production of pharmaceuticals, with a focus on affordability for low-and-middle-income countries.

Supervisor: Dr AE Meyers (Molecular and Cell Biology)
Co-supervisors: Dr A Chabeda (University of Massachusetts, Medical School); Professor EP Rybicki (Molecular and Cell Biology)

Swanepoel, Juan
Thesis Title: *The influence of Microhodotermes viator nest density and dispersion on ecological processes*

Juan Swanepoel completed his BSc in Botany and Zoology at UNISA, followed by an honours degree in Ecology, and MSc in Ecophysiology, both at University of the Free State. He then completed a research internship with the South African Environmental Observation Network, where he was introduced to his PhD topic.

Using satellite imagery and remote sensing technology, Juan Swanepoel's thesis compares the spatial pattern of southern harvester termite mounds, also known as *heuweltjies*, within their distribution with other termite species and explores the influence of such patterns on ecological processes of productivity and biodiversity. This study represents the first quantification of the nutrient enrichment from *heuweltjies* through termite activity and how this, along with other soil modifications by termites, results in the formation of distinct plant communities on *heuweltjies*. Invertebrate communities on *heuweltjies* were not as distinct, but showed correlation with increasing plant cover, which in turn correlated with productivity. His findings support the theory of termite origin of *heuweltjies* and contribute to research on spatial patterning in ecosystem stability, which is relevant given the growing impacts of climate change. The influence of southern harvester termites and their spatial pattern on ecological processes have earned them the title of keystone species.

Supervisor: Emeritus Professor C Griffiths (Biological Sciences)
Co-supervisors: Emeritus A/Professor M Picker (Biological Sciences); Dr JR Henschel (South African Environmental Observation Network, Arid Lands Node); Professor S Milton (Wolwekraal Conservation and Research Organisation)

Vicatos, Giselle Marianthi
Thesis Title: *Development of dermally absorbed copper(II) complexes as potential anti-inflammatory drugs*

Giselle Vicatos completed her BSc, BSc(Hons) and MSc qualifications at UCT, and began full-time study towards her PhD in 2016.

Giselle Vicatos' thesis focuses on the development of a drug that can be applied onto the skin, in the form of a cream, to treat the inflammation caused by rheumatoid arthritis (RA). Copper has anti-inflammatory properties and, once in blood plasma, has been shown to reduce the inflammatory response of the disease. Therefore, the challenge was to transport copper across the skin barrier and increase the concentration of copper

in the blood plasma without disrupting the homeostasis of other endogenous metal ions. Four tripeptides, which formed complexes with copper, were designed. The thermodynamic properties of the complexes were measured, and their structures characterised spectroscopically. Permeation studies showed that the ligands promoted the dermal absorption of copper. Computer modelling showed that the drugs are able to increase the pool of copper from endogenous sources. These results indicate that these drugs may treat the inflammation associated with RA and warrant further testing.

Supervisor: Professor S Bourne (Chemistry)
Co-supervisor: Emeritus Professor GE Jackson (Chemistry)

Weston, Laura Frances
Thesis title: *The biology, ecology and population trends of jacopever Helicolenus dactylopterus in South Africa*

Laura Weston has a BSc(Hons) from Rhodes University and an MSc from UCT. After taking a four-year hiatus from academia to work in industry, she returned in 2017 to begin full-time study towards a PhD. Laura Weston's thesis describes the life history, habitat preference and population trends of a fish species called the jacopever, an important catch in the South African demersal trawl fishery. Using samples obtained from the commercial fishery, she investigates the age, growth, reproductive and diet characteristics of the species. She then investigates the habitat requirements of the species using research trawl data and underwater video footage. She concludes that jacopever in South Africa are vulnerable to fishing pressure. Finally, she uses 30 years of commercial and research trawl data to describe the abundance trends of the species. Irrespective of their vulnerability to exploitation, her population assessment provides an optimistic outlook for jacopever in South Africa, with a 0.83% increase in abundance per year over the study period. These findings will be useful for conservation assessment and in improving the ecosystem-level management of South Africa's most valuable fishery.

Supervisor: A/Professor C Attwood (Biological Sciences)
Co-supervisor: Professor K Sink (South African National Biodiversity Institute)

MASTER OF PHILOSOPHY

Beerthuis, Sharda Lucca
Faria, Hendrina Cicilia
Hassan Basheir Hassan, Razaz (with distinction in the coursework component)
Jana, Wilfred Alfred (with distinction in the dissertation)
Joshi, Namita Viren
Kirr, Julia Sophia (with distinction)
Koehler, Lara-Marie
Lopez Gomez, Camila
Mahumane, Cezar Sebastiao
Mtombeni, Khanyisa
Ndenge, Kinsley Ngwa (with distinction in the dissertation)
Oliver, Dominic (with distinction in the coursework component)
Schroder, Claudia Enid
Stein, Malte (with distinction in the coursework component)

MASTER OF SCIENCE

Abdulmajid, Aminu
Adams, Luther Aldrin (with distinction)
Atkins, Kayla Tracey (with distinction)
Bachoo, Teejaswani (with distinction)
Bloy, Shonese Thora (with distinction)
Burnette, Jessica Rose (with distinction)
Cherry, Matthew Pinchuck
Chilambwe, Alice
Chirwa, Temweka Scolastica (with distinction in the coursework component)
Conrady, Christopher Richard (with distinction)
Duncan, Aurora Frances Margaret
Edwards, Hannah Jean (with distinction in the coursework component)
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UCT is committed to engaging with the key issues of our natural and social worlds through outstanding teaching, research and scholarship. We seek to advance the status and distinctiveness of scholarship in Africa through building strategic partnerships across the continent, the global south and the rest of the world.

UCT provides a vibrant and supportive intellectual environment that attracts and connects people from all over the world.

We aim to produce graduates and future leaders who are influential locally and globally. Our qualifications are locally applicable and internationally acclaimed, underpinned by values of engaged citizenship and social justice. Our scholarship and research have a positive impact on our society and our environment.

We will actively advance the pace of transformation within our University and beyond, nurturing an inclusive institutional culture which embraces diversity.

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- Friends of UCT: formerly <R60,000, now <R100,000.

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Science:	Maano Freddy Ramutsindela, MA *UNIN* PhD *London* FSSAG

Dean of Higher Education Development
Alan Frank Cliff (Interim), HDE BA MEd *Cape Town* PhD *Auckland*

Director of the Graduate School of Business
Catherine Duggan, BA *Brown* PhD *Stanford*

Welcome, Wamkelekile, Welkom – today is not the end of your relationship with the university but the beginning of a new phase in your continuing relationship with UCT, one that you share with the UCT community of over 100 000 alumni.
Diverse as this community is, the shared experiences of a critical academic ethos and a spectacular campus make for a strong network that has a wide footprint, not only in South Africa, but across the continent and the globe.

We set a great store by our links with our alumni, and indeed the links alumni have with each other. We promise that we will be in touch, and ask you in turn to let us know not only your current contact details but also, from time to time, something of your lives and where you are in your careers.

Updates can be done on the web – http://www.uct.ac.za/dad/alumni/update/
- or by writing to the Alumni Office, UCT, PB X3 Rondebosch 7701
or by contacting us on (27) (21) 650 3746.

Your alma mater looks forward to welcoming you back, whether to a public lecture, a leadership forum, your class reunion, or just an informal call!