



AIMS

African Institute for
Mathematical Sciences
SOUTH AFRICA

ANNUAL REPORT 2018



ABOUT US

The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for postgraduate education, research and public engagement in mathematical sciences. Its mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of driving Africa's future scientific, educational and economic self-sufficiency.

AIMS was founded in Cape Town, South Africa, in 2003. Since then AIMS centres have opened in Senegal (2011), Ghana (2012), Cameroon (2013), Tanzania (2014) and Rwanda (2016). The pan-African network of AIMS centres is coordinated by the AIMS Next Einstein Initiative (AIMS-NEI).*

This is the annual report of AIMS South Africa for the period 1 August 2017 to 31 July 2018. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2017 calendar year.

Since AIMS South Africa opened in 2003, 757 students, of which 34% are women, from 37 different African countries have graduated from its core academic programme.

AIMS South Africa has local association with the Universities of Cape Town (UCT), Stellenbosch (SU) and the Western Cape (UWC) and international association with the Universities of Cambridge, Oxford and Paris-Sud.

AIMS South Africa offers:

- An intensive one-year structured Master's in Mathematical Sciences with intakes in August and January.
- Specialised courses as part of regular postgraduate programmes at South African universities.
- A well-established research centre which hosts regular workshops and conferences.
- Professional development programmes for teachers.
- Public engagement activities.

* **AIMS Next Einstein Initiative, Kigali, Rwanda**
Email: info@nexteinstein.org
For further information, see www.nexteinstein.org

CONTENTS

1. Foreword by the Director
2. Academic programmes
14. Research
26. Workshops and conferences
29. AIMS Schools Enrichment Centre (AIMSSEC)
32. Public engagement
37. The AIMS Network
39. Governance and Administration
41. Financial Reports

FOREWORD

BARRY GREEN, DIRECTOR

The AIMS Mission statement is presented at the beginning of each annual report: "...to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of propelling Africa's future science, educational and economic self-sufficiency."

Over 1600 Master's students have graduated from the network of AIMS centres and a strong effort is being made to establish linkages with organisations and institutions that can provide opportunities for our students to enter formal employment.

The AIMS Network Industry Initiative has built significant partnerships, and at centres cooperative educational programmes with experiential learning in industry, industrial immersion programmes adapted from those offered at business schools, and special short courses, particularly in the area of data science and its applications, have been introduced.

The AIMS-ESMT (European School of Management and Technology) Industry Immersion Programme attended by 25 alumni in 2017 continued in 2018 with another group of 25. Of the students who attended the programme in 2017, eleven were offered employment afterwards. At AIMS the programme was coordinated by Mr Mark Heerden and assisted by Mr David Attipoe, an AIMS Senegal graduate from Ghana. In 2018 Dr Simukai Utete, a Senior Researcher at AIMS, took over the coordinating role of the programme.

Two new research initiatives were launched both focusing on activities aimed at acquiring data science skills. The first is the Theoretical Foundations in Data Science course, which is a year-long PhD preparatory programme for students who are either contemplating registering for, or are in, their first year of doctoral study in Data Science. Made up of on-site workshops and distance learning the initiative is organised by Dr Bubacarr Bah, our German Research Chair.

The second initiative is a collaboration between the UK Science and Technology Facilities Council-funded 'Data Intensive Science Centre in SEPnet' (DISCnet) and AIMS South Africa. Together we are piloting an innovative course of training and internships for the next generation of data analysts. Coordinated by Prof. Bruce Basset, Head of the Cosmology Group, the collaboration has funded a short Data Science School for Master's and PhD students, hosted interns from the UK and is running a two month Data Science Intensive Programme (DSI) attended by 16 participants, including three from industry, tackling real world data science projects in teams.

In 2017 we registered 40 students on the August 2017/2018 intake of the AIMS Master's degree, lower than normal due to the financial challenges throughout the AIMS network, and 15 students on the January 2018 intake. This affected the number of full bursary places we could offer, as well as the start date by a couple of weeks. Our Academic Director, Prof. Jeff Sanders, managed the additional challenges admirably. In July we held our 15th Graduation Ceremony, and we were honoured that Prof. Thuli Madonsela, who recently joined the AIMS-NEI Governing Board, was the guest speaker at this special occasion. AIMS South Africa has now graduated 757 students, among them 73 from South Africa.

The AIMS Desktop is a Linux distribution with customised artwork and scientific software, used by centres and alumni. This platform is a key feature of the academic and skills development programme at AIMS. It is expertly maintained by Mr Jan Groenewald and Mr Jonathan Carter from our IT department. In 2017 it was upgraded to a derivative of Debian GNU/Linux which allows it to be freely modified and redistributed.



This year the AIMS School Enrichment Centre (AIMSSEC) offered the 28th and 29th Mathematical Thinking course, attended by 61 and 60 teachers respectively. AIMSSEC began its activities at the same time as AIMS, 15 years ago, and we are proud of the excellent contribution it has made towards training teachers, particularly from rural parts of South Africa; more than 1800 have attended its courses. The dedication of Ms Toni Beardon, its Founder, and Dr Barrie Barnard the AIMSSEC Manager, leading the AIMSSEC team, has been remarkable and has provided a very helpful AIMS precedent for large scale network teacher training activities now being run in Cameroon and Rwanda.

The tighter financial situation provided many challenges and we have had to be very careful and critical in the use of our resources. For this we appreciate the enormous effort made by all staff and especially by our Finance Department led by Ms Deborah Wilsnagh. Fortunately for our centre we continue to receive essential support from the South African Departments of Higher Education and Training (DHET) and Science and Technology (DST), which supports the operational costs of the AIMS Master's Programme as well as the activities of our Research Centre and Teacher Training Programme.

The very severe water situation in Cape Town and the Western Cape made headlines all over the world. In Muizenberg this affected us too and our Facilities Team, led by Mr Igsaan Kamalie, introduced a number of water saving measures including the installation of large emergency rainwater tanks to help us cope in a desperate situation. Fortunately this did not occur, but the awareness and follow up care in using this precious resource was an important wake up call to us all.

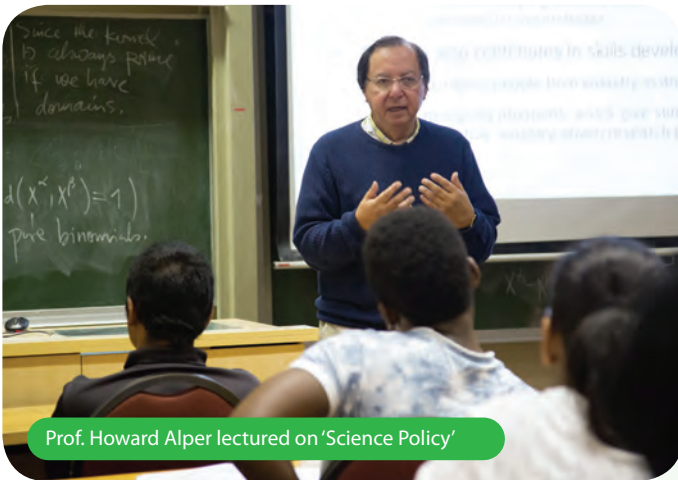
I would like to conclude by celebrating the success of our talented young Africans, illustrated by the following three special achievements. Our Robert Bosch Foundation ARETÉ Chairholder and NEF Fellow, Dr Yabebal Fantaye, was nominated to the World Economic Forum Young Scientists Class of 2018 for his contribution to advancing the frontiers of science and passion for integrating scientific knowledge into society. Dr Cynthia Ramiharimanana, a Postdoctoral Fellow at our centre, was appointed as an Assistant Professor at Clemson University in the US. A 2010 alumnus, Dr Ludovic Tangpi Ndounkeu, who completed a PhD at the Humboldt University in Berlin, was appointed Assistant Professor of Operations Research and Financial Engineering at Princeton University. We are proud of their remarkable achievements!

A handwritten signature in black ink that reads "Barry Green". The signature is written in a cursive style and is positioned above a horizontal line.



ACADEMIC PROGRAMMES

The academic programme at AIMS South Africa once more conformed to the AIMS ideal of providing opportunities rather than merely enforcing requirements. That has been possible due to enthusiastic international and South African interest combined with the support of a strong team of tutors.



Prof. Howard Alper lectured on 'Science Policy'

The outcome has been another year run according to the AIMS model, graduating students with a broad mathematical and IT foundation and entrepreneurial edge, who think independently and are passionate about solving the problems confronting Africa.

Whilst many opportunities arose from the academic programme there were, as usual, many from outside it: Language and Communications; IT and LaTeX; The Scientific Environment (containing anti-plagiarism, gender issues, managing research, reading and writing mathematics, ethics, professional talks and job opportunities); lectures on science policy by Prof. Howard Alper; the AIMS-ESMT Industry Immersion Programme run in partnership with ESMT Berlin for the second year; the Maths in Industry Study Group; Data Science workshops run by Dr Bubacarr Bah; a kaggle submission; opportunities to 'give back' by teaching local students; and various workshops.

GIVEBACK PROGRAMME

During this April and May, AIMS participated in a Giveback Programme by voluntarily tutoring students from False Bay College during their spare time. Students travelled to the Fish Hoek, Khayelitsha and Westlake campuses of the College to provide this assistance.

OUTINGS

On 8 February, students joined Prof. Turok on a special outing to view the opera *Tsotsi* at the Artscape Theatre.



Prof. Amanda Gouws lectured on 'Understanding Gender'.



Students with Prof. Neil Turok before their outing to the opera.

COMBINED COURSES TABLE

Period	Lecturer	Course	MSc Jan 2017	MSc Aug 2017	MSc Jan 2018	Hons Biomaths 2018
2017						
28 Aug – 24 Nov	Jan Groenewald, AIMS South Africa	Computing and LaTeX		x		
28 Aug – 24 Nov	Noluvuyo Hobana, AIMS South Africa	English and Communication Skills		x		
30 Aug – 15 Sept	Florian Breuer & Dimbinaina Ralaivaosaona, Stellenbosch	Mathematical Problem Solving		x		
30 Aug – 15 Sept	Jeff Sanders, Martha Kamkuemah & Jordan Masakuna, AIMS South Africa	Python		x		
18 Sept – 6 Oct	Evans Ocansey, Johannes Kepler University	Experimental Mathematics with Sage		x		
18 Sept – 6 Oct	Gabriel Lord, Heriot-Watt University	The Numerical Solution of Differential Equations		x		
9 – 20 Oct	David Aschman, Cape Town	Concepts and Problem Solving in Physics		x		
23 – 27 Oct	Jonathan Marks, GIBS	Entrepreneurship Skills	x	x		
6 – 24 Nov	Karin-Therese Howell, Stellenbosch	Algebra		x		
6 – 24 Nov	Olalekan Kazeem Obisesan, Ibadan	Statistics		x		
27 Nov – 15 Dec	Gareth Boxall, Stellenbosch	Model Theory		x		
27 Nov – 15 Dec	Rafael Nepomechie, Miami	Quantum Mechanics		x		
27 Nov – 15 Dec	Pete Grindrod, Oxford & Jeff Sanders, AIMS South Africa	Data Analytics		x		
2018						
8 Jan –	Jan Groenewald, AIMS South Africa	Computing & LaTeX			x	
8 – 26 Jan	Nancy Neudauer, Pacific	Discrete mathematics		x	x	
8 – 26 Jan	Grae Worster, Cambridge & Richard Katz, Oxford	Fluid Dynamics		x	x	
8 – 26 Jan	Jeff Sanders & AIMS South Africa tutor	Python			x	
11 – 26 Jan	Workshop	Mathematics in Industry Study Group		x		
8 – 26 Jan	Ronnie Becker, AIMS South Africa & Kerstin Jordaan, South Africa	Financial Mathematics		x	x	
29 Jan – 16 Feb	Stéphane Ouvry, Paris Sud XI	Introduction to Random Systems, Information Theory, and related topics		x	x	
29 Jan – 16 Feb	Rob Beezer, Puget Sound	Sage		x	x	
29 Jan – 16 Feb	Neville Fowkes, Western Australia	Industrial Modelling		x	x	
29 Jan – 16 Feb	Steve Bradlow, Illinois at Urbana-Champaign	Surfaces		x	x	
26 Feb – 16 Mar	Wilson Lamb, Strathclyde	Analytical Techniques in Mathematical Biology		x	x	x
26 Feb – 16 Mar	Stefan Jaehnichen, Berlin	Entrepreneurship case studies		x	x	
26 Feb – 16 Mar	Wolfram Decker & Gerhard Pfister, Kaiserslautern	Computational Algebra		x	x	
26 Feb – 16 Mar	Costas Zoubos, Pretoria	General Relativity		x	x	
19 Mar – 6 Apr	Patrick Dorey, Durham	Solitons		x	x	
19 Mar – 6 Apr	Matt Macauley, Clemson	Algebraic Biology		x	x	x
19 Mar – 6 Apr	Joan Simon Soler, Edinburgh	Quantum Field Theory		x	x	
19 Mar – 6 Apr	David Spiegelhalter, Cambridge (video lecture)	Statistics			x	
16 Apr – 4 May	Juerg Weber, Western Australia	Insurance Economics			x	
16 Apr – 4 May	Emma Spurlock, Strathclyde	Energy			x	x
7 – 18 May	Montaz Ali, Witwatersrand	Discrete Optimization			x	
7 – 18 May	Bubacar Bah & Jeff Sanders, AIMS South Africa	Data Science			x	
17 Apr – 5 May	Michael Grinfeld, Strathclyde	Asymptotics			x	
21 – 25 May	Rebecca Borchering, Florida	Mathematical Modelling in Medicine				x
28 May – 8 June	Rebecca Borchering, Florida	MMED Workshop				x
28 May – 15 June	Simukai Utete, AIMS South Africa	Distributed Coordination			x	
28 May – 15 June	Justin Munyakazi, Western Cape	Numerical Maths			x	
11 – 29 June	Jeff Sanders, AIMS South Africa	Designing Algorithms			x	

ACADEMIC PROGRAMMES

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2017 INTAKE)

The January 2017 intake consisted of ten South Africans and one Nigerian. This was an average year with one student passing with 'Distinction', four with 'Good' and five with 'Pass'. Ms Shané van Graan was awarded a prize, and one student had to revise the research report for resubmission (recently accomplished successfully). The research projects were in Financial Maths (4); Data Science (3); Applied Maths (3); and Pure Maths (1).

MASTER'S IN MATHEMATICAL SCIENCES (AUGUST 2017 INTAKE)

The 2017-2018 academic programme balanced the themes of Physics, Pure and Applied Maths, Statistics and Computer Science. Selected students represented 17 African countries. The year ended up being an exceptionally strong one with all 40 students graduating, 35% with 'Distinction', 52.5% with 'Good' and 12.5% with 'Pass'. Just over a quarter completed 3-month research projects in Pure Mathematics, just under a quarter in Data Science and a quarter in Financial Mathematics. Oral defences were particularly eloquent and assured and the top four students (at least) had all begun to do research.

This year, the highlight was once again the course in Data Science given by Prof. Pete Grindrod, Oxford, whose lectures included industry-related applications, new theory, and a lecture on the experience of a mathematician working in industry.

RESEARCH PROJECTS OF THE JANUARY 2017 INTAKE

	Students	Gender	Origin	Research Project Title	Supervisors
1	Tasiu Yusuf Abdullahi	M	Nigeria	Renormalization Group Methods in Asymptotics	M Grinfeld, Strathclyde
2	Mncedisi Comfort Ketwa	M	South Africa	Rate-Induced Tipping	M Grinfeld, Strathclyde
3	Thabang Doreen Lebeso	M	South Africa	State Space Time Series Analysis with Classical and Bayesian Inference	R Becker, AIMS
4	Daniel Mashishi	M	South Africa	Approximation for Total Value Adjustment of American Put Options using Finite Difference Method	P Mashele, North-West
5	Oratilwe Penwell Mokoena	M	South Africa	On the Inverse Topology, with Applications to Function Rings	O Ighedo, UNISA
6	Ndamulelo Mudau	M	South Africa	Computational Analysis of Shear flow of Non-isothermal Rolie-poly Fluids	T Chinyoka, Cape Town
7	Boipelo Sihle Ncube	F	South Africa	Communicability in Complex Networks and Applications	FK Mutombo, AIMS/ Cape Town/Lubumbashi
8	Mulalo Netshithuthuni	M	South Africa	Prediction of credit card default using Machine learning	B Bah, AIMS
9	Rendani Emmanuel Tshisikule	M	South Africa	Optimal Stopping of a Partially Observed Long-Memory Process with Applications in Finance	D Ikpe, UNISA
10	Shané Van Graan	F	South Africa	Finding Suitable Locations of Wind Farms in South Africa	B Bah, AIMS & V Marivate, CSIR
11	Noluvuyo Yumata	F	South Africa	Approximation for Total-Value Adjustment of European Put Option using Central Finite Difference Method	P Mashele, North-West

The year ended up being an exceptionally strong one with all 40 students graduating, 35% with 'Distinction', 52.5% with 'Good' and 12.5% with 'Pass'.

GRADUATE PROFILES

MS BOIPELO SIHLE NCUBE

AIMS South Africa 2017

Ms Boipelo Sihle Ncube was born and raised in Pretoria, South Africa. She discovered her strength in mathematics when her mother took her to a high school that focused on Science and Mathematics. She completed her BSc at Sefako Makgatho Health Sciences University, where she triple-majored in Mathematics, Statistics and Applied Mathematics.

Her academic mentor Dr MT Masetshaba encouraged her to apply to AIMS. "The AIMS community is a very diverse and multi-cultural community that allows you to focus on your studies while learning and embracing the essence of being African. The environment is very conducive to studying as all the needs of a student are taken care of. The intense coursework is not for the faint-hearted but it takes your thinking and reasoning capacity to a whole new level."

According to Boipelo, AIMS has left her with a hunger to continue studying and bridging the gap of scarce skills in the STEM area. "Being a woman in this field makes me very proud and I am determined to inspire other aspiring mathematicians and scientists." She is currently employed in a graduate trainee programme at Samsung Electronics as a Product Manager, which applies mathematics in competition analysis and sales forecasting, and plans to enrol for a PhD in Mathematics Education.

"I would like to take this opportunity to thank AIMS, together with all the sponsors, for the opportunity afforded to me and for instilling discipline and a hunger to flourish in the academic space. I am now a proud black female Mathematician."



MS BATHATA MASEGO BOSWELETSE

AIMS South Africa 2017

Ms Bathata Masego Bosweletse, a Botswanan national, received her BSc in Applied Mathematics at Botswana International University of Science and Technology in 2016. Prior to joining AIMS South Africa for her Structured Master's in Mathematical Sciences she lectured Mathematics at Marapong Brigade College in Botswana.

Bathata is passionate about sharing her mathematics knowledge with others. As well as being a Mastercard Foundation Scholarship holder, she was also chosen to be a student assistant at AIMS. Her research project in Financial Mathematics was titled 'Penalty Method for Continuous -Time Portfolio Selection with Transaction Costs' and supervised by Prof. Philip Mashele from North-West University.

"What kept us going as the class of 2018 is that even though we left our family members to come and study here in South Africa we cared, supported, motivated, and helped each other. The AIMS staff and visiting lecturers were friendly and helpful. They put a smile on our faces."

"Dr Rejoyce Gavhi-Molefe especially played a significant role in the life of young ladies at AIMS as she coordinated the AIMS Women in STEM mentorship program which provided us with mentors and motivational talks. Ms Noluvuyo Hobana the Language and Communications teacher helped us all in many ways she also encouraged us all to get out of our comfort zones by boosting our self-confidence. At AIMS not only did I improve my mathematical skills but I also had the opportunity to improve by leadership skills." She is currently taking part in the 2018 AIMS-ESMT Industry Immersion Program and is completing her internship at Letshego in Botswana as a Credit Risk and Data Analyst.



MR FARID SEDAIRIA

AIMS South Africa 2018

Mr Farid Sedairia from Algeria, grew up in a little village called Morsott. His interest in physics and maths started when he was in high school, "I was motivated by small but remarkable experiments with light, magnets and electricity which changed my way of seeing the world and since then I have always been amazed by science."

He holds a BA in theoretical physics from the University of Tebessa and completed his Master's in particle physics at Constantine University in 2016.

"I did not hear about AIMS until one month before the application deadline but I told myself this is an important opportunity to further my mathematical science skills and give me more opportunities to find a PhD position. I truly believe that AIMS is one of the best maths institutes in Africa."

Farid found that moving from the north of Africa to the south was an exciting experience and the international environment at AIMS allowed him to interact with leading people in science. Living and studying in South Africa also helped him to improve his English skills and he had the opportunity to meet many people from different countries and cultures. "AIMS is a unique place of science and research and being in there is a dream for many students and I was fortunate to be able to live the dream."

Farid will be pursuing a Research Master's at UCT and he would like to participate in solving current problems in theoretical physics and contributing to the scientific community in Africa by encouraging research in his home country.



RESEARCH PROJECTS PHASE

Students	Gender	Origin	Research Project Title	Supervisors
Sohila Mahmoud Saad Abdelhafiz	F	Egypt	Lattice Topological Field Theory in 2d	B Bartlett, Stellenbosch
Abdalla Gali Ahmed Bakheet	M	Sudan	The ϕ^8 model Solitons and their quantum fluctuations	H Weigel, Stellenbosch
Faiz Alhadi Ali Abdelgadir*	M	Sudan	Upper and lower bounds for Merrifield-Simmons index and Hosoya index	S Wagner, Stellenbosch
Kiady Mahefa Andry Manantena	M	Madagascar	Discriminating Quark and Gluon Initiated Jets	D Kar, Witwatersrand
Emmanuel Appiah-Kubi*	M	Ghana	Exponential Integrators for Ordinary and Partial Differential Equations	N Hale, Stellenbosch
Lorain Asongo*	F	Ghana	Calibrating the Ornstein Uhlenbeck Equation Using Three Methods	R Becker, AIMS
Taofikat Abidemi Azeez*	F	Nigeria	Spectral Deferred Correction for Ordinary Differential Equations	N Hale, Stellenbosch
Kelebogile Phatsimo Baliki*	F	Botswana	Backtesting of Value at Risk	R Becker, AIMS
Elie Bimenyimana*	M	Burundi	Modelling the Mechanics of Malaria Parasite Entry into Red Blood Cells	K Muller-Nedebock, Stellenbosch & R Hawkins, Sheffield
Bathata Masego Bosweletse*	F	Botswana	Penalty Method for Continuous -Time Portfolio Selection with Transaction Costs	P Mashele, North-West
Yasser Salah Eddine Bouchareb	M	Algeria	Machine learning applied to aerial images for vegetation detection	J Shock & A West, Cape Town
Carlos Dibaya Mbala	M	Democratic Republic of the Congo	Maximum principle for weak solution of reaction-diffusion equations	R Anguelov, Pretoria
Mrwa Hajo Ibrahim Alsharif*	F	Sudan	The Equivalence Principle in Static Anisotropic Spacetime	D Solomons, Western Cape
Nkosinathi Hlophe	M	Swaziland	Power Output Prediction For Wind Farms With Machine Learning	V Marivate, CSIR, B Bah, AIMS
Thobani Hlophe*	M	Swaziland	Comparative Study of the Thermal Loading Properties of Newtonian and Non-Newtonian Fluids in Shear Flow	T Chinyoka, Cape Town
Mohamed Ibrahim Hussein	M	Somalia	The Linear Quadratic Estimation for Linear Quadratic Gaussian(LQG) Regulator Problem with non Gaussian Noises	M Ali, Witwatersrand
Mohamoud Ahmed Hussein*	M	Somalia	Permutation Statistics	S Wagner, Stellenbosch
Jeromy Kalunga	M	Zambia	The Decomposition Theorem For Near Vector Spaces	KT Howell, Stellenbosch
Lambert Kubwimana*	M	Burundi	Classifying the behaviour of African penguins from animal-borne cameras	I Durbach, Cape Town
Vincent Kipkemoi Langat*	M	Kenya	A Review Survey of Optimisation Models for the Unit Commitment Problem	FD Fomeni, Quebec & M Ali, Witwatersrand
Juliana Thomasia Chakirath Marcos*	F	Benin	Tuning Convolutional Neural Networks	S Utete & J Sanders, AIMS
Gizachew Gobebo Mekebo	M	Ethiopia	Statistical Analysis of Factors Associated With Anaemia Among Women of Child Bearing Age in Ethiopia	OK Obisesan, Ibadan
Jean Michel Menjanahary	M	Madagascar	Deformations and resolutions of Type A surface singularities	B Szendrői, Oxford & A Cazzaniga, AIMS
David Kibe Muchiri*	M	Kenya	Modelling of Shear Banding in Viscoelastic Fluids via the Giesekus Model	T Chinyoka, Cape Town
Frenick Kudakwashe Mudzingwa*	M	Zimbabwe	Differential susceptibility in drug use epidemics	F Nyabadza, Stellenbosch
Louisah Namarare*	F	Zimbabwe	On a Bivariate Successive Substitution Spectral Method for Unsteady Mixed Convection Boundary Layer Flow, Heat, and Mass Transfer due to a Stretching Surface in a Rotating Fluid	VM Magagula, Swaziland
Grace Nnennaya Ogwo*	F	Nigeria	Some Characteristic Inequalities in Hilbert Spaces and Application to Approximations of Nonlinear Equations	OT Mewomo, KwaZulu-Natal & GC Ugwunnadi, Michael Okpara
Felgona Tana Omondi*	F	Kenya	HIV Prevalence Estimation in Kenya	JL Hutton, Warwick
Amanda Pandi	F	Democratic Republic of the Congo	Stochastic Optimal Control Theory Applied in Finance	P Mashele, North-West
Fanomezana Rakotomalala*	M	Madagascar	Statistical Test for Alignment of Radio Galaxy	R Taylor, Cape Town
Rojo Fanamperana Randrianomentsoa*	F	Madagascar	Approximation by Deep Neural Networks	JW Sanders, AIMS
Mahefa Ratsisetraina Ravelonanosy	M	Madagascar	Action of Finite Groups on Compact Riemann Surfaces	A Cazzaniga, AIMS & D Martinelli, Edinburgh
Mai Samir Adly Rizk	F	Egypt	Gravitational-wave phenomenology in scalar-tensor gravity theories	A de la Cruz-Dombriz, Cape Town
Farid Sedairia*	M	Algeria	BPS and non-BPS Giant Gravitons	K Zoubos, Pretoria
Zekhaya Benard Shoji	M	South Africa	The Metric Dimension of Cayley Graphs	T Vetrík, Free State
Timothy Sinyangwe*	M	Zambia	Representation Theory of Finite Groups and Some Applications	T Lê, Pretoria
Zenabu Suboi*	F	Ghana	Comparing post-sampling correction methods for Approximate Bayesian Computation	W Delva & MC Hazelbag, SACEMA, Stellenbosch
Fatima Alkhalifa Suliman Abd Arahman Suliman	F	Sudan	Relative Motion of Space Junk and the International Space Station	P Dunsby, Cape Town
Kelone Tefoetsile	M	Botswana	Near-Vector Spaces Constructed Over Z_p for p a prime	KT Howell, Stellenbosch
Sandra Annie Tsiorintsoa*	F	Madagascar	Pseudo-monomials in algebraic biology	M Macauley, Clemson

*MasterCard Foundation Scholar

ACADEMIC PROGRAMMES

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2018 INTAKE)

The January 2018 intake consists of 13 South Africans and two Nigerians. Students have recently completed electives which this year included: Distributed Coordination by Dr Simukai Utete; and Numerical Mathematics by Dr Justin Munyakazi (an AIMS alumnus from the first intake!). The compulsory Statistics course successfully used a video of the course presented several years ago by Prof. David Spiegelhalter, Cambridge; naturally the course was overseen and videos interrupted regularly for discussion to ensure "active listening". Students are currently undertaking research projects, about half in Data Science and a quarter in Financial Mathematics.

This year the timetable is a little different, making it possible for students to attend the last couple of compulsory courses with the new August intake after submitting their research projects.



Full name	Gender	Country	Previous institution
Daniel Ajedamola Ajeleye	M	Nigeria	Obefemi Awolowo
Mhlanguleli Boqwana	M	South Africa	Rhodes
Vongani Cyril Chabalala	M	South Africa	Limpopo/Cape Town
Zakiena Hoossen	F	South Africa	Stellenbosch
Munira Zainab Jowaheer	F	South Africa	Mauritius
Nadine Charmel May	F	South Africa	Western Cape/ Cape Town
Vukani Mhlongo	M	South Africa	Zululand
Sinenhlanhla Mtshali	F	South Africa	KwaZulu-Natal
Lubabalo Ndohe	M	South Africa	Zululand
Ylaney Ramlall	F	South Africa	KwaZulu-Natal
Phumudzo Lloyd Seabe	M	South Africa	Venda
Phillemon Ntona Senoamadi	M	South Africa	Limpopo
Tijani Ahmad Sulaimon	M	Nigeria	Ahmadu Bello
Wanda Tsewu	M	South Africa	Walter Sisulu/ Cape Town
Tumisang Irvin Tshikare	M	South Africa	North-West/Cape Town

January 2018 Intake

COURSES TOWARDS A BSC HONOURS IN MATHEMATICS WITH A FOCUS IN BIOMATHEMATICS

For the past ten years AIMS South Africa has joined with SU to offer an Honours in Mathematics with a focus in Biomathematics. Students spend the first half of the year at AIMS (with a full and varied programme of courses including computing, statistics, modelling in biosciences, bioinformatics, and mathematical methods) and the second half of the year at SU concentrating on a research project.

Five students graduated at the end of 2017, with final defences of particularly high standard.

The four students enrolled in the 2018 programme are: Mr David Louw, Ms Thandiwe Princess Njephe, Mr Makabongwe Nombula and Mr Handre Janse van Vuuren.



BSc Honours Students

GRADUATIONS

JANUARY 2017 INTAKE



Recognition of Achievement Ceremony 2017

AIMS South Africa acknowledged the success of its sixth group of January intake students at a special Recognition of Achievement Ceremony held on 8 November 2017 at its centre in Muizenberg. Ten students (including 9 South Africans) received their certificates.

The invited speaker at the event was Ms Mmabatho Mokiti, Founder and CEO, Mathemaniacs, who encouraged the students by stating, "Every day is a new day to conquer the world. Live a life that is purpose-driven, there is so much you can do with a maths degree so don't be afraid to go out and change the world. But never forget

to give back, impart your knowledge to others so that you can live a life to leave a legacy."

For the student address, Ms Shané van Graan and Ms Boipelo Sihle Ncube shared their experiences of their year at AIMS and noted, "At AIMS you find a dedication that you don't find at other places."

Students subsequently graduated at their respective university graduation ceremonies.



Ms Ncube and Ms van Graan



Ms Mokiti

AUGUST 2018 INTAKE

The 15th AIMS South Africa Graduation took place on 19 June 2018, 41 students (including 16 women) from 17 African countries were awarded a Master's in Mathematical Sciences.

The invited speaker at the event was Prof. Thuli Madonsela, Chair in Social Justice in the Law Faculty: Stellenbosch University and member of the AIMS International Board of Directors who stated, "The future belongs to those who not only believe but are prepared to walk into an unknown future choosing hope over fear."

She went on to ask the mathematical science graduates to help combat social injustice: "We have many programmes in our country and on our continent to tackle poverty and inequality but they are not working – the day-to-day human experience is becoming more unequal. You can help government policy makers calculate the impact of their policies before they implement them by designing mathematical applications that can predict the future outcome of these policies helping to ensure that the correct policies are put in place."

The ceremony was officiated by Prof. Susan Bourne, Interim Dean of Science, University of Cape Town; Ms Nita Lawton-Misra, Registrar at the University of the Western Cape; and Prof. Nico Koopman, Vice-Rector: Social Impact, Transformation and Personnel, Stellenbosch University.



Prof. Madonsela

AIMS ENDOWED SCHOLARSHIPS

In the ceremony AIMS Endowed Scholarships were awarded to a number of top achievers by Dr Thandi Mgwebi, Deputy Vice-Chancellor: Postgraduate Studies, Research, Innovation and Engagement, Tshwane University of Technology and AIMS South Africa Council Member.

- The Stephen Hawking Scholarship, named in honour of the world-renowned physicist, was awarded to Mr Kiady Mahefa Andry Manantena, from Madagascar.
- The Martin Rees Scholarship, named in honour of Lord Martin Rees, who is widely acknowledged as one of the world's leading astronomers and cosmologists, was awarded to Ms Juliana Thomasia Chakirath Marcos, from Benin.
- The Paul G. Allen Family Foundation Scholarship, endowed by the Microsoft co-founder and philanthropist, was awarded to Ms Sandra Annie Tsiointsoa, from Madagascar.
- And two Dr Victor Rothschild Scholarships went to Ms Rojo Fanamperana Randrianomentsoa, from Madagascar and Mr Yasser Salah Eddine Bouchareb, from Algeria.



Prof. Green, Ms Tsiointsoa, Ms Randrianomentsoa, Dr Mgwebi, Ms Marcos, Mr Bouchareb, Mr Manantena and Prof. Sanders.



AIMS South Africa Graduation 2018

POST AIMS: SUPPORT, OPPORTUNITIES & ALUMNI

AIMS BURSARIES FOR STUDY AT SOUTH AFRICAN UNIVERSITIES

Through the generous support of the South African Department of Science and Technology (DST), and the ForExcellence partners, AIMS South Africa is able to offer matching half bursaries to its students who are accepted for Master's or PhD study at South African

universities. This year AIMS South Africa awarded five such bursaries for Master's study and two for doctoral studies. Recipients of these bursaries are asterisked in the table below. A further xx students who will be supported in the AIMS Research Centre, are also noted.

Students	Gender	Origin	Institution	Programme
Graduates from January 2017 intake				
Tasiu Yusuf Abdullahi	M	Nigeria	Umaru Musa Yar'adua University, Katsina	Research Master's
Thabang Doreen Lebese	M	South Africa	Still exploring opportunities	
Daniel Mashishi	M	South Africa	Still exploring opportunities	
Oratilwe Penwell Mokoena	M	South Africa	Sefako Makgatho Health Sciences University	PhD
Ndamulelo Mudau	M	South Africa	Still exploring opportunities	
Boipelo Sihle Ncube	F	South Africa	Samsung Electronic Graduate Trainee Programme	Product Manager
Mulalo Netshithuthuni	M	South Africa	Still exploring opportunities	
Rendani Emmanuel Tshisikule	M	South Africa		Data Scientist
Shané Van Graan	F	South Africa	Still exploring opportunities	
Noluvuyo Yumata	F	South Africa	Still exploring opportunities	
Graduates from August 2018 intake				
Sohila Mahmoud Saad Abdelhafiz	F	Egypt		PhD
Abdalla Gali Ahmed Bakheet	M	Sudan	Still exploring opportunities	
Faiz Alhadi Ali Abdelgadir	M	Sudan	Still exploring opportunities	
Kiady Mahefa Andry Manantena	M	Madagascar	Still exploring opportunities	
Emmanuel Appiah-Kubi	M	Ghana	University of Manitoba	Research Master's
Lorain Asongo	F	Ghana	AIMS Research Centre/Stellenbosch	Research Master's
Taofikat Abidemi Azeez	F	Nigeria	AIMS-ESMT IIP	Intern
Kelebogile Phatsimo Baliki	F	Botswana	AIMS-ESMT IIP & Letshego (Botswana)	Credit Risk and Data Analyst Intern
Elie Bimenyimana	M	Burundi	Cyprus Institute	Research Master's
Bathata Masego Bosweletse	F	Botswana	AIMS-ESMT IIP & Letshego (Botswana)	Credit Risk and Data Analyst Intern
Yasser Salah Eddine Bouchareb*	M	Algeria	Cape Town	PhD
Carlos Dibaya Mbala	M	Democratic Republic of the Congo (DRC)	University of Leeds	PhD
Mwa Hajo Ibrahim Alsharif	F	Sudan	Still exploring opportunities	
Nkosinathi Hlophe	M	Swaziland	Still exploring opportunities	
Thobani Hlophe*	M	Swaziland		
Mohamed Ibrahim Hussein*	M	Somalia	AIMS-ESMT IIP & Ecobank (Rwanda)	Intern
Mohamoud Ahmed Hussein	M	Somalia	AIMS-ESMT IIP	Intern
Jeromy Kalunga	M	Zambia	Still exploring opportunities	
Mncedisi Comfort Ketwa	M	South Africa	Witwatersrand	Research Master's
Lambert Kubwimana	M	Burundi	AIMS-ESMT IIP	Intern
Vincent Kipkemoi Langat	M	Kenya	Still exploring opportunities	
Juliana Thomasia Chakirath Marcos	F	Benin	AIMS Research Centre/Stellenbosch	Research Master's
Gizachew Gobebo Mekebo	M	Ethiopia	Still exploring opportunities	
Jean Michel Menjanahary	M	Madagascar	Central European University	Research Master's
David Kibe Muchiri*	M	Kenya	Stellenbosch	Research Master's
Frenick Kudakwashe Mudzingwa	M	Zimbabwe	Still exploring opportunities	
Louisah Namarare	F	Zimbabwe	Still exploring opportunities	
Grace Nnennaya Ogwo*	F	Nigeria	KwaZulu-Natal	Research Master's
Felgona Tana Omondi	F	Kenya	Still exploring opportunities	
Amanda Pandi*	F	DRC	North West	Research Master's
Fanomezana Rakotomalala	M	Madagascar	Still exploring opportunities	
Rojo Fanamperana Randrianomentsoa	F	Madagascar	AIMS Research Centre/Stellenbosch	Research Master's
Mahefa Ratsisetraina Ravelonanosy	M	Madagascar	CEU Budapest	Research Master's
Mai Samir Adly Rizk*	F	Egypt	Cape Town	PhD
Farid Sedairia	M	Algeria	Cape Town	Research Master's
Zekhaya Benard Shoji	M	South Africa	Still exploring opportunities	
Timothy Sinyangwe	M	Zambia	Still exploring opportunities	
Zenabu Suboi	F	Ghana	Still exploring opportunities	
Fatima Alkhalifa Suliman Abd Alrahman Suliman	F	Sudan	Still exploring opportunities	
Kelone Tefoetsile	M	Botswana	Botswana International University of Science and Technology	Research Master's
Sandra Annie Tsiortintsoa	F	Madagascar	Still exploring opportunities	

THE AIMS-ESMT INDUSTRY IMMERSION PROGRAMME

Enhancing employability and opportunities in business for mathematically-trained graduates



AIMS-ESMT Recognition of Achievement Ceremony 2017

The AIMS-ESMT Industry Immersion Program (IIP) is a partnership between AIMS and the European School of Management and Technology (ESMT) in Berlin, with funding support from the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD). The programme aims to provide mathematically-trained AIMS graduates with business skills to enhance their ability to take up careers in business and industry. The program launched in 2017 and is currently in its second year. The joint founders of the programme were Prof. Wulff Plinke and Mr Nick Barniville, from ESMT Berlin, and Mr Mark Heerden at AIMS.

On 1 December, 25 AIMS students from eight African countries received their certificates for completing the programme. Several of which have now gone on to careers in business across the continent.

In 2017, the Programme Leader for the AIMS side of the partnership was Mr Heerden. Since 2018, the Programme Leader has been Dr Simukai Utete, a Senior Researcher in the Research Centre. Mr Heerden has continued as a consultant and Mr David Attipoe, an AIMS PhD student, continued as Programme Assistant. Mr Barniville is the Programme Leader from ESMT Berlin.

The 2018 programme which started on 2 July, builds on the highly successful programme run in 2017 over three phases. The first phase consists of business skills courses and took place at AIMS South Africa in July 2018. Courses were given by ESMT Berlin staff and SU staff (from the university's Careers Service and the Frederik Van Zyl Slabbert Institute at Stellenbosch). AIMS staff have also been involved in course delivery. During five weeks, from July to early August 2018, students completed courses on data analytics for business for mathematicians, organisational behaviour, business strategy, marketing, economics, finance and accounting, as well as on leadership, careers, communication, negotiations, and other areas relevant to careers in business. The students were also introduced to a business simulation, which they will work on, in teams, for the period of the programme. From August to October, the candidates will embark on the second phase of the programme during which they will take up internships of approximately three

months with industrial partners across Africa. The third and final phase comprises two weeks of curriculum and wrap up back at AIMS South Africa, and will take place in November 2018.

The 2018 cohort of candidates consists of 25 AIMS students and graduates from across Africa, who will complete their internships in their home countries. Industry partners providing internships for the candidates include members of the German Chambers of Commerce in Southern Africa, East Africa and West Africa, as well as new company partners participating in the programme this year.

The programme is one of several industry initiatives across the AIMS Network and benefits from links and synergies with the work of the AIMS Industry Initiative, led by Dr Charles Mberi-Kimpolo, the Student Development Officers, and other key stakeholders across the AIMS Network.



AIMS-ESMT 2018 Group

ESMT
BERLIN

DAAD BURSARIES FOR DOCTORAL STUDY

This year DAAD generously awarded five scholarships within its DAAD/AIMS agreement which was signed in 2008. According to the agreement in-region scholarships are awarded based on

recommendations by AIMS to students from sub-Saharan Africa (excluding South Africa) for PhD studies in the Mathematical Sciences.

New awards for 2018 were made to:

Students	Gender	Country	University
Prudence Djangba	M	Benin	Stellenbosch
Mahouclo Anicet Hounkanrin	M	Benin	Cape Town
Timothy Oreta	M	Uganda	Cape Town
Jean Bernoulli Ravelomanana	M	Madagascar	Stellenbosch
Holinirina Dina Miora Ratsimandresy	F	Madagascar	Stellenbosch

In addition to the new awards, scholarships of 19 DAAD scholars in their second and third year of study were renewed.

A number of DAAD scholarships holders in previous years graduated.

AIMS ALUMNI UPDATES

On 27 September, AIMS alumnus and inspiring nuclear physicist Dr Thifhelimbilu Daphney Bucher gave an interview on Cape Talk radio station. She revealed how she had to endure a six-kilometer walk come rain or sunshine to complete her secondary schooling and how the AIMS scholarship helped her to achieve her career goals. Podcast Link: <https://omny.fm/shows/afternoons-with-pippa-hudson/inspiration-wednesdays-dr-thifhelimbilu-daphney-bu>. Thifhelimbilu was one of the 25 South African Emerging Women scientists profiled in a book titled *Because Science is Fun – Stories of Emerging Female Scientists in South Africa*.

The Rwandan Association for Women in Sciences and Engineering (RAWISE) was launched on 23 March at the Lemigo Hotel in

Kigali. AIMS South Africa Alumni, Ms Alice Ikuzwe (2012) is Chairperson and Ms Eva Ujeneza (2011) is Vice President. RAWISE is an association of Rwandan women who aim to promote female participation in science, technology, engineering and decision-making processes.

Dr Dephney Mathebula, who completed an Honours in Biomaths at AIMS South Africa/SU in 2009 recently received her PhD from the University of Venda, making her the first female South African registered at the university to obtain a PhD in Mathematics and the first person from Muyexe Village where she was born to obtain one.

GRADUATE PROFILES

DR LUDOVIC TANGPI NDOUNKEU

AIMS South Africa 2010

Dr Ludovic Tangpi Ndounkeu is currently assistant professor for Operations Research and Financial Engineering at Princeton University. His research focuses on the application of stochastic analysis and probability theory to finance.

Ludovic was born in Cameroon where he did his undergraduate studies in Mathematics. He graduated with his Postgraduate Diploma in Mathematical Sciences at AIMS South Africa in 2010. "During this time I studied a variety of topics and developed an interest in mathematical finance."

He then went on to obtain his Research Master's Degree in Financial Mathematics under the supervision of Dr Raouf Ghomrasni and graduated with distinction in December 2011 from Stellenbosch University. Thereafter, he started his doctoral studies in Mathematics at Humboldt University in Berlin, through a scholarship from the Berlin Mathematical School. His thesis was completed jointly with the University of Konstanz in Germany and was followed by a three-year postdoctoral research fellowship at the University of Vienna.



DR OMOWUNMI E ISAFIADÉ

AIMS South Africa 2010

Dr Omowunmi Isafiade is currently a postdoctoral researcher in the Department of Computer Science, UWC, under the DST-NRF Innovation Fellowship. She holds a BSc (Hons) in Computer Science from the Federal University of Agriculture, Abeokuta, Nigeria, and a Postgraduate Diploma in Mathematical Sciences from AIMS South Africa. She successfully completed her Research Master's and PhD at UCT in December 2012, and July 2017 respectively. She has had the privilege to lecture computer science courses both at UCT and UWC. She is also involved in students' research supervision at post-graduate level.

Her research interests include machine learning, ubiquitous intelligence, pattern recognition and data-driven decision support. Omowunmi has a number of good quality publications in internationally accredited journals/conference in the aforementioned research areas. She has authored an edited book titled: *Data Mining Trends and Applications in Criminal Sciences and Investigation* published by IGI Global, USA (2016). In addition to her extensive research and teaching experience, she is one of the two hundred most qualified young researchers selected from all countries to participate in the Heidelberg Laureate Forum, Germany, 2015.

Omowunmi's continued academic and research excellence has earned her various honours and awards, amongst which are the NRF-DST Innovation Postdoctoral Fellowship (2017) and the prestigious L'Oreal-UNESCO for Women in Science award (2014). She was an invited speaker at the strategic workshop for State Information Technology Agency (SITA) and the South African Police Service (SAPS) Coastal (2018). Her research on fostering smart city development in developing nations received a best paper award at ITU Kaleidoscope: Challenges for Data-Driven Society conference, Nanjing, China (2017).

"I am passionate about using my skills to help dismantle barriers that keep women and the less privileged from entering the STEM domain." To this end she chaired the team that resuscitated the Women in Computer Science Society at UCT and also created and led the effort to establish the Women in Computer Science at UWC and successfully secured a Google grant to launch this society in 2017. She is the founding president of Digit_Inspire foundation, a worthy cause to facilitate and promote the participation of more women and the disadvantaged in STEM. She has been a mentor, facilitator and speaker for AIMSWIS and has served as a Global Planning Committee Member for the Google Anita Borg Scholars Community.



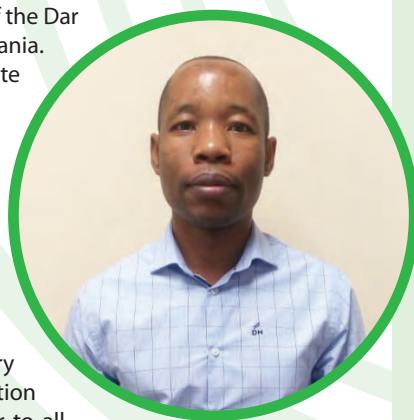
MR ELIMBOTO YOHANA

AIMS South Africa 2009

Mr Elimboto Yohana is an Assistant Lecturer at the Department of Physics, Mathematics and Informatics of the Dar Es Salaam University College of Education, a Constituent College of the University of Dar Es Salaam in Tanzania. He obtained his BEd Science from the University of Dar Es Salaam in 2008, he completed his Postgraduate Diploma in Mathematical Sciences at AIMS South Africa in 2009 and his Master's in Computational and Applied Mathematics (with distinction) from Wits in 2012.

He is currently pursuing a PhD in Applied Mathematics (Cosmology) at UKZN. His research is a synergy of Mathematics, Physical and Computational Sciences to address forecasting, analysis and the modelling challenges in surveying extremely large-scale structures of the universe with FAST, BINGO and SKA telescopes, to consequently, constrain various cosmological parameters, such as composition densities of dark energy and dark matter in the universe, and assess the universe's expansion and growth rates – one of the biggest puzzles in modern cosmology.

"I am very keen to promote and advance the status of education, science and technology in my country and the Africa continent in general. To achieve this, I founded the Tanzania Students and Scholars Foundation Limited (TSSFL). TSSFL is established on the notion that knowledge is not only power but the answer to all challenges, and must be applied to solve various societal problems. TSSFL serves as a platform to bring together people who are focused, disciplined, dedicated, and faithfully striving to achieve and utilise their full educational, science and technology potential to provide unprecedented solutions to various, social, economic, educational and developmental challenges." To realise the objectives of TSSFL, Elimboto launched an online platform, *Open Discussion Forums*, in 2014.



"I am passionate about using my skills to help dismantle barriers that keep women and the less privileged from entering the STEM domain."

Dr Omowunmi E Isafiade





RESEARCH

The AIMS Research Centre is supported by the Department of Science and Technology, South Africa; the Robert Bosch Foundation and the German Government (through the BMBF). The Research Centre is now 10 years old and hosts researchers working in several focus areas under the theme *Mathematical Modelling in a Multidisciplinary Context*. Regular conferences and workshops are held in collaboration with other national and international institutes.

RESIDENT RESEARCHERS

Dr Antoine Tambue and Dr Gaston Kuzamunu Mazandu completed their appointments as Junior Research Chairs during this period. Dr Tambue now holds an associate professor position in

Mathematics at Western Norway University of Applied Sciences and Dr Mazandu coordinates AIMS's role as a node for the H3ABionet Network Project.



Dr Bubacarr Bah, German Research Chair
Applied mathematics and data science



Prof. Cang Hui, South African Research Chair
Mathematical and Theoretical Biosciences (SU-AIMS)
Mathematical and theoretical physical biosciences



Prof. Bruce Bassett, Senior Resident Researcher
Cosmology and astrophysics



Dr Michelle Lochner, Resident Researcher
Statistics and machine learning applied to astronomy and cosmology.



Prof. Ronnie Becker, Senior Resident Researcher
Mathematical finance



Dr Gaston Kazamunu Mazandu, IDRC Junior
Research Chair
Biomathematics



Prof. Johan de Villiers, Senior Resident Researcher
Analysis and approximation theory



Dr Wilfred Ndifon, Resident Researcher
Biomathematics



Prof. Ian Durbach, Resident Researcher
Multi-criteria optimisation



Prof. Jeff Sanders, Senior Resident Researcher
Theoretical computer science



Dr Yabebal Fantaye, AIMS ARETÉ Junior Chair
Cosmology, Big Data and machine learning



Dr Mario Santos, South African Research Chair in
Cosmology with Multi-Wavelength Data
(UWC-SAAO-AIMS)
Cosmology and astrophysics



Dr Rejoyce Gavhi-Molefe, Resident Researcher
Computational mathematics: subdivision



Dr Simukai Utete, Senior Resident Researcher
Robotics



Prof. Barry Green, Senior Resident Researcher
Pure mathematics



ACHIEVEMENTS

- Dr Lochner has been appointed to co-lead the LSST Dark Energy Science Collaboration Observing Strategy Task Force. The Large Synoptic Survey Telescope (LSST) is an exciting optical telescope under construction in Chile, which is unique in that its science goals range from tracking asteroids all the way to understanding the mysterious accelerating force called dark energy. The LSST Dark Energy Science Collaboration (DESC) is an international collaboration of several hundred astronomers, focused on the cosmology science cases of LSST.
- Prof. Bassett accepted a part time appointment to head up the data science and machine learning efforts at SKA Africa.
- Prof. Alan Beardon received the 2017 G de B. Robinson Award for his paper on Non-discrete frieze groups published in the Canadian Mathematical Bulletin.
- Prof. Hui has developed a mathematical model which has proven to be the single best method from several tested worldwide for estimating the diversity of plants over a large area.

POSTDOCTORAL FELLOWS

AIMS researchers supervised 17 postdoctoral fellows during the period under review.

Name	Citizenship	Gender	Start date – end date	Research Field	Supervisor/ Host
Emmanuel Sarkodie Adabor	Ghana	M	20 March 2016 – 28 February 2018	Applied Mathematics	Dr W Ndifon
Shankar Agarwal	India	M	1 April 2018 – 30 June 2020	Data Science	Dr B Bah
Alberto Cazzaniga	Italy	M	1 January 2017 – 31 December 2018	Algebraic Geometry, pure mathematics	Prof. B Green
Siyabonga Chule	South Africa	M	1 October 2015 – 30 September 2017	Financial Mathematics	Prof. B Green
Pierre-Yves Lablanche	France	M	15 September 2015 – 30 October 2017	Cosmology and astrophysics	Prof. B Bassett
Pietro Landi	Italy	M	1 January 2015 – 31 December 2018	Evolution of time of maturation, fleet and fish stock dynamics, evolution of diapause	Prof. C Hui
Guillaume Francois Raymond Latombe	France	M	1 August 2017 – 31 December 2018	Development of novel measures of biodiversity accounting for the contribution of rare and common species.	Prof. C Hui
Andre Saint Eudes Mialebama Bouesso	Benin	M	15 January 2015 – 19 December 2017	Mathematical Foundations and pure mathematics	Prof. B Green
Henintsoa Onivola Minoarivelo	Madagascar	F	1 January 2016 – 31 December 2018	Ecological and evolutionary dynamics of mutualistic networks	Prof. C Hui
Frank Kalala Mutombo	Democratic Republic of Congo	M	1 February 2015 – 31 December 2017	Numerical analysis, complex networks, dynamical systems	Dr A Tambue
Olugbenga Oluseun Oluwagbemi	Nigeria	M	1 March 2018 – 28 February 2020	The development of mathematical and compartmental models for the control of HIV and for malaria elimination.	Prof. C Hui
Tahina Rakotoniaina	Madagascar	M	1 July – 31 December 2017	Applying computability theory to topology	Prof. J Sanders
Nantsoina Cynthia Ramarihamana	Madagascar	F	1 January 2017 – 31 July 2018	Foundations of mathematics, pure mathematics	Prof. B Green
James Gordon Rodger	South Africa	M	1 August 2017 – 31 December 2018	Understanding plant reproduction, especially the effects of plant density.	Prof. C Hui
Wolf-Christian Saul	Germany	M	1 April 2017 (ongoing)	Novel associations and eco-evolutionary dynamics in invaded myrmecochore seed-dispersal networks in the fynbos biome	Prof. C Hui
Nirina Tahiridimbisoa	Madagascar	M	1 May 2017 – 30 April 2019	Cataloguing African Big Data by use of Machine Learning	Dr Y Fantaye
Etienne Eben Vos	South Africa	M	1 September 2016 – 31 December 2017	Cosmology	Prof. B Bassett

POSTGRADUATE STUDENTS IN THE RESEARCH CENTRE

The number of students hosted by the AIMS Research Centre and supervised by AIMS resident researchers totalled 51 during the period under review. Twenty-three of these are PhD students. The 10 students who graduated in this period are asterisked in the tables below.

PHD STUDENTS

Name	Citizenship	Gender	Study duration	Supervisor/Host	Based at
David Attipoe	Ghana	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
Larisse Bolton*	South Africa	F	1 February 2015 – 31 March 2018	Prof. C Hui	SU/Free State
Abdo Elnaser Mahmmod Degoot	Sudan	M	10 March 2015 (ongoing)	Dr F Chirove and Dr W Ndifon	UKZN
Emmanuel Dufourq	South Africa	M	31 May 2015 (ongoing)	Prof. B Bassett	AIMS/UCT
Nolwazi Dube	Swaziland	F	1 January 2018 (ongoing)	Dr T van Zyl & Dr B Bah	Wits
Buri Gershom	Uganda	M	6 September 2016 (ongoing)	Dr W Ndifon	AIMS/SU
Ephifania Geza	Zimbabwe	F	24 August 2015 (ongoing)	Dr G Mazandu	AIMS/UCT
Zoe Gill	South Africa	F	17 May 2016 (ongoing)	Dr W Ndifon & Prof. M Nieuwoudt	SU
Samantha Jones	South Africa	F	1 January 2015 (ongoing)	Prof. R Becker	UCT
Martha Ndeyapeuomagano Kamkuemah	South Africa	F	1 July 2016 (ongoing)	Prof. J Sanders	AIMS/SU
Dieudonne Kabongo Kantu	Congo	M	1 November 2015 (ongoing)	Prof. I Durbach	UCT
Eli Kassai*	Namibia	M	1 March 2013 – December 2017	Prof. B Bassett	AIMS/UCT
Rock Stephane Koffi	Ivory Coast	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
Irene Kyomugisha	Uganda	F	1 March 2018 (ongoing)	Dr B Bah & Dr G Mazandu	AIMS/SU
Jordan Masakuna	Democratic Republic of Congo	M	7 February 2016 (ongoing)	Dr S Utete & Dr Steve Kroon	AIMS/SU
Luthando Mayekiso	South Africa	M	23 May 2017 (ongoing)	Prof. C Hui	SU
Mozzamil Mohammed	Sudan	M	21 September 2016 (ongoing)	Prof. C Hui	SU
Chinenye Assumpta Nnyakeni	Nigeria	F	1 January 2017 (ongoing)	Prof. C Hui	SU
Savannah Nuwagaba*	Uganda	F	1 February 2013 – March 2018	Prof. C Hui	SU
Rakgwahla Jessica Phalafala	South Africa	F	1 January 2018 (ongoing)	Dr B Bah	AIMS/SU
Dinna Ranirina*	Madagascar	F	1 January 2015 – March 2018	Prof. J de Villiers	AIMS/SU
Ethan Roberts	South Africa	M	1 March 2018 (ongoing)	Prof. B Bassett	AIMS/UCT
Neil Watson	South Africa	M	1 January 2016 (ongoing)	Prof. I Durbach	UCT

RESEARCH MASTER'S STUDENTS

Name	Citizenship	Gender	Study duration	Supervisor/Host	Based at
Innocenter Amima*	Kenya	F	15 January 2017 – March 2018	Dr G Mazandu	AIMS
Fatumah Atuhaire*	Uganda	F	1 October 2015 – December 2017	Prof. C Hui	AIMS
Curtly Blows	South Africa	M	1 January 2018 (ongoing)	Prof. B Bassett	AIMS/UCT
Gloria Burengengwa	Burundi	F	1 February 2018 (ongoing)	Prof. C Hui	SU
Blake Cunningham	South Africa	M	1 February 2018 (ongoing)	Prof. B Bassett	AIMS/UCT
Karimatou Djenabou	Cameroon	F	1 January 2017 (ongoing)	Prof. C Hui	SU
Gciniwe Dlamini	South Africa	F	1 January 2015 (ongoing)	Prof. I Durbach	UCT
Qobo Dube*	Zimbabwe	M	1 January 2015 – December 2017	Prof. I Durbach	UCT
Frieda Geldenhuys	South Africa	F	1 January 2016 – March 2018	Prof. C Hui	SU
Bantubakuthi Billy Haram	South African	M	1 July 2018 (ongoing)	Dr I Durbach	UCT
Hosenie Zafrah Benon*	Mauritius	F	1 February 2016 – July 2017	Dr N Oozeer & Prof. B Bassett	NASSP/UCT
Emmanuel Kabuga	Burundi	M	25 August 2017 (ongoing)	Prof I Durbach & Dr B Bah	AIMS
Mmatlou Kubyana	South Africa	M	1 January 2018 (ongoing)	Prof. C Hui	SU
Gilbert Langat	Kenya	M	1 January 2017 (ongoing)	Prof. C Hui	SU
Funmilayo Lydia Makinde	Nigeria	F	25 August 2017 (ongoing)	Dr G Mazandu	AIMS
Samuel Oforu Mensah	Ghana	M	25 August 2017 (ongoing)	Dr G Mazandu & Dr S Utete	AIMS
Mozzamil Mohammed*	Sudan	M	21 September 2016 – December 2017	Prof. C Hui	SU
Mvubu, Mhlasakululeka	South Africa	M	1 February 2017 (ongoing)	Prof. R Becker	AIMS
Alice Nyanzi	Uganda	F	15 January 2017 (ongoing)	Dr F Kalala Mutombo & Dr S Utete	AIMS
Kayode Olaleye	Nigeria	M	15 January 2017 (ongoing)	Dr Y Fantaye	AIMS
Nolubabalo Qokoqa	South Africa	F	1 April 2017 (ongoing)	Dr G Mazandu	AIMS
Kagiso Ramolotia*	South Africa	M	1 May 2016 – December 2017	Prof. C Hui	SU
Vhahangwele Cedrick Ramuada	South Africa	M	1 February 2017 (ongoing)	Prof. R Becker	AIMS
Ethan Roberts	South Africa	M	Upgraded to PhD March 2018	Prof. B Bassett	AIMS/UCT
Tremaine W Robertson	South Africa	M	1 January 2018 (ongoing)	Prof. C Hui	SU
Emily Shobana Muller	South Africa	F	15 January 2018 (ongoing)	Dr B Bah	AIMS
Kameel Sooknunan	South Africa	M	1 January 2018 (ongoing)	Dr M Lochner & Prof. B Bassett	AIMS/UCT
Asmaa Tbaeen	Sudan	F	1 October 2017 (ongoing)	Prof. C Hui	SU
Josephine Tetteh	Ghana	F	15 January 2017 (ongoing)	Prof. C Hui	SU

RESEARCH INITIATIVES

THEORETICAL FOUNDATIONS IN DATA SCIENCE COURSE



On-site workshop

This is a year-long PhD preparatory programme for students who are either contemplating registering for, or are in, their first year of doctoral study in Data Science. It is coordinated by Dr Bah (German Research Chair at AIMS) and Prof. Loyiso Nongxa (Wits) with funding provided by a Teaching Development Grant (DHET), and overseen by the University of Pretoria.

The objectives of this course are to:

- To bring together Data Science students in South African universities and senior academics in order to increase the students' breadth and depth of knowledge of their research areas.
- To give a more structured and guided approach that could help accelerate the process of acquiring the intellectual maturity and independence required for a successful PhD program.
- To create a community of PhD students working in the broad area of Data Science with similar or related topics, who can support one another during the course of their PhD studies

The 12 students on the programme have attended two workshops hosted at AIMS South Africa. A third will be held at Wits in December 2018.

SA-DISCNET



Data Science School

This is a training network in data science between universities in southern UK and partners in South Africa to help address the Sustainable Development Goals and the South African National Development Plan (NDP) priorities. The cornerstones of this network are the UK Science and Technology Facilities Council-funded 'Data Intensive Science Centre in SEPnet' (DISCnet) and AIMS South Africa. Together, they are piloting an innovative course of training and internships for the next generation of data analysts, with the goal of solving SDG-related questions in South Africa and other African countries, and acting as a driver of economic development and welfare. This initiative is coordinated by Prof. Bassett.

In this reporting period the network provided funding for a Data Science School from 13 to 15 June 2018 (see page 27 for more information) and two internships both held by UK students, Mr Ryan Hill and Mr Andrius Tamosiunas, who were based at AIMS South Africa, took place. They were supervised by Prof. Bassett and first worked with Dr Vinet Coetzee (University of Pretoria) and AIMS to deliver a machine learning algorithm to detect malaria with good accuracy from a hand scanner. Then, working with the Cape Town Transport and Urban Development Authority, they also delivered a working implementation of the IPF algorithm to generate synthetic populations for cities. In addition they created a GAN approach to the same problem that appears to be completely novel in the geospatial modelling community.

The Data Science Intensive (DSI) Programme which is an 8-weeks hands on data training programme, commenced in August 2018, with 13 students and three industry participants. A further seven three-month internships for students who have completed the DSI will also be commencing later in the year.



Data Science Intensive Programme

PRESENTATIONS AT WORKSHOPS & CONFERENCES

Throughout the year, AIMS Researchers and students attended various conference and workshops to present their work. These included the following:

- South Africa's first **Deep Learning Indaba** was held at Wits between 10 and 15 September. The event hosted approximately 300 students and practitioners from 22 African countries, the UK and the USA. The aim of the conference was to establish an understanding of the principles of machine learning and deep learning as well as foster new continental collaborations. Dr Bah was part of the Advisory Board and one of the speakers at the event. The workshop was also attended by postdoctoral fellows, Dr Lablanche and Dr De Vos; PhD students, Mr Dufourq and Mr Masakuna; and Master's students, Mr Mvubu, Ms Nanyazi, Ms Amina, Ms Hosenie and Mr Lebeso.
- Ms Nanyanzi, a research Master's student attended the **Probabilistic and Statistical Methods for Networks Summer School** which was held from 21 August to 1 September at the Berlin Mathematical School, TU Berlin.
- Prof. Bassett and Dr Lochner attended the **SKA Postgraduate Bursary Conference** from 27 November to 1 December. They were joined by SKA students Ms Hosenie and Mr Olorato Mosiane both co-supervised by Prof. Bassett.
- Prof. Bassett was on the scientific organising committee of **Astroinformatics 2017** held from 7 to 10 November 2017 and the **29th Texas International Symposium of Relativistic Astrophysics** held in Cape Town from 3 to 8 December. Dr Locher also gave a talk at the Symposium.
- Prof. Bassett was an invited speaker at the **Astronomy 9 Conference** from 14 to 17 November.
- Prof. Bassett and Dr Lochner attended the **IAU Symposium on Southern Horizons in Time-Domain Astronomy** held from 13 to 17 November. Prof Bassett gave a talk titled: 'Machine learning for transient astronomy.'
- Dr Lochner gave a lecture at the **European Space Agency Data Analysis and Statistics workshop** at the European Space Astronomy Centre in Madrid in November.
- Prof. Cang Hui's paper (co-authored), 'Allee effects in pollination: what do we still need to know?' was presented at the **South African Association of Botanists Conference** 9 to 12 January 2018 in Tshwane, South Africa.
- Members of the Cosmology Group at AIMS South Africa including Prof. Bassett, Dr Fantaye and Mr Sooknunan attended the **Summer School in Bayesian Inference Foundations and Applications** held from 17 to 27 January 2018 in Betty's Bay. Dr Fantaye was a member of the organising committee for the school.
- In February, Dr Bah attended the **February Fourier Talks 2018** conference organised by the Robert Wiener Centre for Harmonic Analysis and Application at the Department of Mathematics, University of Maryland, College Park.
- Prof. Bassett, who is also head of Data Science at SKA, was an invited speaker at the **SKA-Driven Big Data Challenge in Africa: Science, Innovation and Opportunity Conference** held from 28 to 31 May in Madagascar. His talk was titled: 'Introduction to AI in astronomy.' In addition, a JEDI workshop was held in parallel with students from across Africa learning to do research by working on open research problems in astronomy and health sciences.
- The **Field Arithmetic Conference** for 2018 was held at the Mathematisches Forschungsinstitut Oberwolfach, Germany, from 3 to 10 June. Dr Ramiharimanana attended the conference and gave a talk.

SEMINARS

The Journal Club continues to offer a forum for discussion of work-in-progress and current research by members of the Research Centre and visitors to AIMS. More than 25 talks on a range of subjects took place during the period under review.

Below are some highlights from members of the Research Centre:

- In October, Prof. Alan Beardon (University of Cambridge and AIMS) gave a talk titled: 'Riemann surfaces: old and new'.
- Dr Gavhi-Molefe, spoke on subdivision, in a talk given in November 2017 titled: 'One-Parameter Interpolatory Subdivision Convergence'.
- In April 2018, Dr Tahiridimbisoa, gave a talk titled: 'Symmetric group on the dynamic of Axelrod model for dissemination of cultures'.
- A number of PhD students also spoke during the reporting period, including Ms Kamkumemah who presented on: 'The net of devices using TCP'; Mr Dufourq who spoke on: 'Facial expression recognition using convolutional neural networks'; and Mr Degoot who spoke on: 'A Biophysical Model for Predictions of Peptide: HLA-DR Interactions Based on Genomic and Structural Data'.
- Fresh from the first Deep Learning Indaba, four research students who had attended reported back in October on highlights from the Indaba. Mr Mvubu, Ms Nanyanzi, Ms Amima and Mr Masakuna gave a joint talk titled: 'Deep Learning: Not a technique, but a powerful tool'.

Several external speakers, as well as visitors to the Research Centre, participated in the program.

- The 2018 schedule opened during the Week of the International Day of Women and Girls in Science. The speaker that week was Dr Diletta Martinelli (Edinburgh University) who was visiting the Research Centre, her talk was titled: 'A Gentle Introduction to the Minimal Model Program'.
- During the week of international Women's Day, in March 2018, Ms Lyndsay Kerr (University of Strathclyde) spoke on her research on 'Discrete Coagulation-Fragmentation Systems'.
- Dr Charles Maepa (University of Pretoria) gave a talk on, 'Lipschitz p-compact operators'.
- Speakers from SU during the reporting year included Dr Bruce Bartlett whose talk was titled: 'Generators and relations for the bicategory of 3-manifold'; Dr Ronald Benjamin, gave a talk titled: 'Connections between Fredholm Theory and Positivity in General Ordered Banach Algebras'; and Dr Dimbinaina Ralaivaosaona, spoke on: 'The average distance in randomly perturbed graphs'.
- Prof. Tim Gendron (Universidad Nacional Autónoma de México) spoke on: 'Quasicrystals and the Quantum Modular Invariant: Toward a Solution of the Real Multiplication Problem in Characteristic Zero'.

Highlights from this year's Cosmology Group Seminars:

- On 21 May, Dr Herman Kamper (Stellenbosch), gave a seminar titled: 'Learning from unlabelled speech, with and without visual cues.'
- On 17 June, Prof David Bacon (ICG, Portsmouth) gave a seminar titled: 'Probing the dark Universe with the Dark Energy Survey and Beyond.'

Other seminars for the year included:

- On 12 October, there were two seminars by visitors from the University of South Carolina: 'k-planar Crossing Numbers' by Prof. Laszlo Szekely; and 'Tangle Crossing Numbers' by Prof. Éva Czabarka.

- On 16 October, Dr Eddy Kimba Phongi, visiting researcher to AIMS presented 'KimbaJacks Maths Puzzle Game.'
- On 17 October Prof. Alan Beardon (Cambridge and AIMS) presented 'Believe it or not.'
- On 23 November, Dr Olalekan Obisesan, University of Ibadan, presented a seminar titled: 'Statistical Modelling in Environmetrics.'
- On 29 January, Prof. Balazs Szendroi from the University of Oxford and a member of the AIMS South Africa Council, gave a seminar titled: 'Islamic tilings and their symmetries: mathematics meets art.'
- Prof. Alan Beardon (Cambridge) gave two seminars on 26 and 27 February titled: 'Finding the zeros of a polynomial.'
- In his talk, 'Beginnings', presented on 4 February, Prof. Neil Turok described his own story, how he developed an interest in science, how he helped establish AIMS and how rewarding the journey has been.
- In March Prof. Howard Alper, a member of the AIMS-NEI International Board of Directors gave a series of talks to the AIMS students. The talks were titled: 'Entrepreneurship – An Initial Foray'; 'Innovation, Science, and Economic Development – Policy Advice to Shape the Future of a Nation'; 'Landscape of Business – University Partnerships'; and 'Leadership'.
- On 10 April, Dr Bah gave a talk titled 'Data Science Ethics (Data Security and Privacy)', as part of the Data Science Workshop. The talk was for workshop participants as well as researchers and students.
- On 10 July, Ms Louise de Villiers (i2i Deputy Lead), Mr Dumisani Dube, Manager (i2i Applications Lab) and Ms Mari-Lise du Preez (i2i Partnerships Manager) gave a talk titled: 'Data-for-good opportunities in the financial sector'.
- On 11 July, Dr Fantaye gave a talk titled: 'Humans vs PCA vs Deep Learning: Clustering of SNiA spectra.'
- On 12 July, Dr Vukosi Marivate (ABSA Chair of Data Science and Senior Lecturer at the University of Pretoria) gave a talk titled: 'Exploring data science for public good in South Africa.'
- On 27 July, AIMS South Africa hosted a talk by Prof. Vlady Ravelomanana (University of Paris 7) titled: 'Panorama and Perspectives of Some Phase Transitions'.



Prof. Szendroi



Prof. Ravelomanana



Prof. Turok

Machine Learning Talks

On 5 December, AIMS South Africa and the Machine Intelligence Institute of Africa (MIIA) hosted an evening of talks. These talks were organised by Dr Bah and funded through the German Research Chair programme:

- 'DIANA - Data, Insight, Analytics, Newness, Aspirations' by Prof Pete Grindrod, Oxford University.
- 'Reproducible Research' by Dr Sebnem, Statistical Sciences Department, UCT.
- 'AI in Africa – Shaping a better future in the Smart Technology Era' by Dr Jacques Ludik, Machine Intelligence Institute of Africa, Cortex Logic.
- 'Customer Lifetime Value based on Machine Learning methods' by Dr Thuso Simon, Data Science, Zoono.
- 'Computational Neuroscience - Thinking About Thinking' by Mr Chris Currin, PhD Computational Neuroscience candidate, UCT.

The audience totalled 62 and included a mix of members of MIIA, AIMS Research Master's students, and AIMS Master's students.

RESEARCH PROFILES

PROF. MARIO SANTOS

South African Research Chair in Cosmology with Multi-Wavelength Data (UWC-SAAO-AIMS)

Prof. Mario Santos was appointed as the SARChI in Cosmology with Multi-Wavelength Data on 1 January 2018. He completed his Master's in Physics/Mathematics at the University of Cambridge in 1999 and went on to complete his PhD in Physics at the University of Oxford in 2002.

His main area of research is Cosmology. In particular, he is studying how the next generation of large radio telescopes, such as MeerKAT in South Africa and the future SKA will be able to answer fundamental questions in Cosmology, from the nature of dark energy or the physics of the primordial Universe to the process of Reionization when the first stars and galaxies of the Universe were born. This research involves both analytical models and large scale numerical simulations as well as a good understanding of the telescopes setup. The huge volumes of data that will be provided by these experiments also allow for unique and exciting ways to develop novel statistical analysis techniques.

Prof. Santos is a member of UWC Postgrad Committee, a member of the SKA SA Science Committee, and the Director of the Centre for Radio Cosmology.



DR NANTSOINA CYNTHIA RAMIHARIMANANA

Postdoctoral Fellow

Dr Nantsoina Cynthia Ramiharimanana originally from Madagascar completed her undergraduate studies at the University of Antananarivo. In 2011-2012, she enrolled on the Postgraduate Diploma Programme at AIMS South Africa. After AIMS, she went to SU and completed her Master's in pure mathematics in 2013. She was then awarded a DAAD scholarship to complete her PhD at SU in close collaboration with Tel Aviv University. She obtained her PhD in December 2016. She was based at AIMS South Africa as a postdoctoral fellow from January 2017 to August 2018 after which she joined Clemson University, South Carolina, USA, as Assistant Professor. Her research is mainly on Field Arithmetic and Algebraic Number Theory.

During her time at AIMS, Dr Ramiharimanana was involved in many different activities including mentoring on the AIMSWIS mentoring programme, giving motivational talks for high school learners, and participating in the activities for National Science Week. She also hosted a mentee for a job shadow visit.

"AIMS has given me every opportunity to grow as a leader and as a mathematician. I have met great people through AIMS. Those people have inspired me a lot and have helped me to grow in every part of my life. I would like to thank AIMS for all of the support and great opportunities I have had."



MR EMMANUEL DUFOURQ

PhD Student

Mr Emmanuel Dufourq, born in Mauritius, moved to South Africa to pursue a Bachelor's in Computer Science and Applied Mathematics at UKZN. He graduated summa cum laude with an Honour's Degree in Computer Science and completed a Master's in Computer Science. In 2015 he registered for a PhD in Applied Mathematics at AIMS South Africa/UCT.

His research during the past three years at AIMS includes the development of machine learning methods which were inspired by biological evolution in nature. Together with his supervisor, Prof. Bassett, he has published a number of research articles in this area. He has attended a number of schools and workshops whilst at AIMS, including the Quantum Machine Learning Summer School, the Annual Conference of the South African Institute of Computer Scientists and Information Technologists, the Annual Symposium of the Pattern Recognition Association of South Africa and the Deep Learning Indaba 2017. He gave a public talk titled: 'Recent advances in machine learning' at the Big Data in Astronomy: A Potential Tool for Social Innovation 2017 and a talk titled: 'Facial expression recognition and convolutional neural networks' at the Deep Learning Indaba X in 2018.

In addition to focusing on academic research, he co-hosted a workshop on Machine Learning for Ecology at AIMS in collaboration with Prof. Durbach in 2017. Mr Dufourq also gave introductory lectures on deep learning – the state-of-the-art technique in computer vision research and industry – in collaboration with Dr Bah at AIMS in 2018. Furthermore, he has given a number of lectures on deep learning at the Theoretical Foundations of Data Science workshop held at AIMS. He has also tutored at various other short workshops and schools hosted at AIMS.

"AIMS has provided me with an amazing environment which has enabled me to focus on my research, engage with other researchers and foster my desire to teach and share my knowledge with others. There are constantly researchers visiting from other universities, local or abroad and this has allowed me to expand my knowledge in a cosy and friendly setting."



VISITING RESEARCHERS

In 2017/18 the Research Centre hosted 35 visiting researchers. Seventeen of these researchers were affiliated to African institutions and eight researchers were female. During their stay, visiting researchers collaborate with the AIMS resident researchers, interact with AIMS students and give talks in the AIMS Journal Club. Some of the visiting researchers are participants in the conferences or workshops held at AIMS.

Name	Nationality	Gender	Affiliation	Research Area	Dates of visit
Roumen Anguelov	Bulgaria	M	University of Pretoria	The Steenrod algebra; the five variable case.	1 – 6 October 2017
David Bacon	United Kingdom	M	ICG Portsmouth	Advanced Statistics	13 – 15 June 2018
Mapundi Kondwani Banda	Malawian	M	University of Pretoria	Numerical Analysis & Scientific Computing	9 July – 18 August 2017
Ehiab Bashier	Sudan	M	University of Khartoum	Numerical Methods for Differential Equations	1 – 29 August 2017
Janko Bohm	Germany	M	University of Kaiserslautern	AG Algebra, Geometrie und Computeralgebra	3 – 6 October 2017 5 – 28 March 2018
Jean-Luc Bouchot	France	M	RWTH Aachen	Mathematical signal analysis	4 – 18 April 2018
Sehun Chun	South Korea	M	Yonsei University, South Korea	Applied Mathematics	1 – 15 January 2018
Nolwazi Dube	Swaziland	F	University of Witwatersrand	Pure Mathematics	2 June – 20 July 2018
Jocelyn Gonessa	Central African Republic	M	University of Bangui	Mathematics	5 October – 5 November 2017
Matt Hilton	South Africa	M	University of KwaZulu-Natal	Software Carpentry	13 – 15 June 2018
Matthias Ihl	Germany	M	University of Porto	Physics	1 July – 31 December 2017
Kerstin Jordaan	South Africa	F	University of Pretoria	Special functions; orthogonal polynomials; approximation theory	8 – 26 January 2018
Abdul Hamid Kara	South Africa	M	University of Witwatersrand	Differential Equations	11 – 22 December 2017
Issa Karambal	Chad	M	Sheridan College, Canada	Machine Learning	26 November – 2 December 2017
Malesela Salthiel Maepa	South Africa	M	University of Pretoria	Functional Analysis	22 February – 30 June 2018
Magdalen Marais	South Africa	F	University of Pretoria	Computational Algebra; Algebraic Geometry, Ring Theory	2 – 6 October 2017 5 – 28 March 2018
Diletta Martinelli	Italy	F	Edinburgh University	Algebraic Geometry	12 – 27 February 2018
Dephney Mathebula	South Africa	F	University of Venda	BioMaths	20 June – 7 July 2018
Nyalleng Moorosi	Lesotho	F	University of Witwatersrand	Data Science	8 – 14 April 2018
Franck Mutombo Kalala	Democratic Republic of Congo	M	AIMS Senegal	Applied Mathematics	7 – 18 April 2018
Maurice Kenfack Nangho	Cameroon	M	University of Pretoria	Special Functions, Complex Analysis, Ordinary Differential Equations and Computer Algebra	8 January 2018
Kasso Okoudjou	Benin/USA	M	University of Maryland	Pure and Applied Harmonic Analysis	15 – 17 October 2017
Rakgwahla Phalafala	South Africa	F	University of Witwatersrand	Machine Learning	8 – 12 November 2017
Eddy Kimba Phongi	Democratic Republic of Congo	M	AIMS	Biomathematics	1 September – 31 October 2017
Holger Rauhut	Germany	M	RWTH Aachen	Applied and Computational Harmonic Analysis	31 March – 6 April 2018
Dimbinaina Ralaivaosaona	Madagascar	M	Stellenbosch University		5 – 7 November 2017
Antoine Tambue	Cameroon	M	University of Bergen, Norway	Applied Mathematics and Fluid Dynamics	5 – 25 July 2018
Ulrich Terstiege	Germany	M	RWTH Aachen	Applied Harmonic Analysis	30 April – 6 May 2018
Terence Van Zyl	South Africa	M	University of the Witwatersrand	Applied Mathematics	12 – 16 April 2018
Michel Waldschmidt	Paris	M	Sorbonne University	Number Theory	21 – 26 January 2018
Hans-Georg Zimmermann	Germany	M	Fraunhofer IBMT	System Identification and neural networks	12 January – 14 February 2018, 10 – 18 April 2018
Tobias Zingg	Switzerland	M	NORDITA	Theoretical Physics	4 – 14 December 2017
Willard Zvarevashe	Zimbabwe	M	University of Zululand	Mathematical Statistics	3 – 7 April 2018

RESEARCH OUTPUTS

LIST OF PUBLICATIONS

Authors	Title	Source title/Publisher	Volume	Issue	Art. No.	Pages
Up to August 2018 (39)						
Ade PAR, Aghanim N, Alves MIR, ..., Kunz M , et al.	Planck intermediate results XV. A study of anomalous microwave emission in Galactic clouds (vol 565, A103, 2014)	Astronomy and Astrophysics	610			
Agarwal S, Davé R, Bassett BA	Painting galaxies into dark matter haloes using machine learning	Monthly Notices of the Royal Astronomical Society	478	3		3410-3422
Aghanim N, Akrami Y, ..., Fantaye Y , et al.	Planck intermediate results LIII. Detection of velocity dispersion from the kinetic Sunyaev-Zeldovich effect	Astronomy and Astrophysics	617			
Bah B, Tanner J	On the Construction of Sparse Matrices From Expander Graphs	Frontiers in Applied Mathematics and Statistics	4			39
Broeckhoven C, De Kock C, Hui C	Sexual dimorphism in the dermal armour of cordyline lizards (Squamata: Cordylinae)	Biological Journal of the Linnean Society	125	1		30-36
Camilo F, Scholz P, Serylak M, ..., Oozer N , et al.	Revival of the Magnetar PSR J1622-4950: Observations with MeerKAT, Parkes, XMM-Newton, Swift, Chandra, and NuSTAR	Astrophysical Journal	856	2	180	
De Villiers J, Gavhi-Molefe MR	On Interpolatory Subdivision Symbol Formulation and Parameter Convergence Intervals	Journal of Computational and Applied Mathematics				in press
Diedericks G, Henriques R, ..., Hui C , et al.	Sleeping with the enemy: introgressive hybridization in two invasive centrarchids	Journal of Fish Biology	93	2		405-410
Di Valentino E, Melchiorri A, Fantaye Y , Heavens A.	Bayesian evidence against the Harrison-Zel'dovich spectrum in tensions with cosmological data sets	Physical Review D	98	6		
Djofack ZI , Tala-Tebue E, et al.	Quantum breathers associated with modulational instability in 1D ultracold boson in optical lattices involving next-nearest neighbor interactions	Optik	164			575-589
Djofack ZI , Tala-Tebue E, Nguenang J-P	Quantum breathers and intrinsic localized excitation associated with the modulational instability in 1D Bose-Hubbard chain	Communications in Nonlinear Science and Numerical Simulation,	69			134-147
Dufourq E, Bassett BA	Text Compression for Sentiment Analysis via Evolutionary Algorithms	2017 Pattern recognition Association of South Africa and Robotics and Mechatronics (PRASA-ROBMECH)				116-121
Ebert PA, Smith M, Durbach I	Lottery judgments: A philosophical and experimental study	Philosophical Psychology	31	1		110-138
Ekengoue CM, Kenfack SC , Fotué AJ, Fobasso MFC, Bawe GN Jr, Fai LC	Decoherence of cooled and trapped polariton under magnetic field	Computational Condensed Matter	14			106-113
Gallien L, Landi P, Hui C , Richardson DM	Emergence of weak-intransitive competition through adaptive diversification and eco-evolutionary feedbacks	Journal of Ecology	106	3		877-889
Gill Z, Nieuwoudt M, Ndifon W	The Hayflick Limit and Age-Related Adaptive Immune Deficiency	Gerontology	64	2		135-139
Grantz KH, Chabaari W, Samuel RK, Gershom B , et al.	Spatial distribution of leprosy in India: an ecological study	Infectious Diseases of Poverty	7			
Hassan S, Davé R , Mitra S, Finlator K, Ciardi B, Santos MG	Constraining the contribution of active galactic nuclei to reionization	Monthly Notices of the Royal Astronomical Society	473	1		227-240
Ipsier JC, Uhlmann A, Taylor P , Harvey BH, Wilson D, Stein DJ	Distinct intrinsic functional brain network abnormalities in methamphetamine-dependent patients with and without a history of psychosis	Addiction Biology	23	1		347-358
Kunin WE, Harte J, He F, Hui C , et al.	Upscaling biodiversity: estimating the species-area relationship from small samples	Ecological Monographs	88	2		170-187
Lin S, Shao L, Hui C , et al.	The effect of temperature on the developmental rates of seedling emergence and leaf-unfolding in two dwarf bamboo species	Trees - Structure and Function	32	3		751-763
Lin S, Shao L, Hui C , et al.	Uswhy does not the leaf weight-area allometry of bamboos follow the 3/2-power law?	Frontiers in Plant Science	9		583	
Łochowski R.M.	A new inequality for the Riemann-Stieltjes integrals driven by irregular signals in Banach spaces	Journal of Inequalities and Applications	2018		20	
Łochowski RM , Perkowski N, Prömel DJ	A superhedging approach to stochastic integration	Stochastic Processes and their Applications				
Lord GJ, Tambue A	A modified semi-implicit Euler-Maruyama scheme for finite element discretization of SPDEs with additive noise	Applied Mathematics and Computation	332			105-122
MacFadyen S, Zambatis N, Van Teeffelen AJA., Hui C	Long-term rainfall regression surfaces for the Kruger National Park, South Africa: a spatio-temporal review of patterns from 1981 to 2015	International Journal of Climatology	38	5		2506-2519
Mohammed HMA, Landi P, Minoarivelo HO, Hui C	Frugivory and seed dispersal: Extended bi-stable persistence and reduced clustering of plants	Ecological Modelling	380			31-39
Mukam JD, Tambue A	Strong Convergence Analysis of the Stochastic Exponential Rosenbrock Scheme for the Finite Element Discretization of Semilinear SPDEs Driven by Multiplicative and Additive Noise	Journal of Scientific Computing	74	2		937-978
Narayan G, Zaidi T, Soraisam MD, Wang Z, Lochner M , Matheson T, Saha A, Yang S, et al.	Machine-learning-based Brokers for Real-time Classification of the LSST Alert Stream	Astrophysical Journal Supplement Series	236	1		
Rafieferantsoa M, Davé R	MUFASA: The strength and evolution of galaxy conformity in various tracers	Monthly Notices of the Royal Astronomical Society	475	1	stx3293	955-973
Ranirina D, de Villiers J	On Hermite vector splines and multi-wavelets	Journal of Computational and Applied Mathematics				
Rodger, James G and Landi P, Hui C	Heterogeneity in local density allows a positive evolutionary relationship between self-fertilisation and dispersal	Evolution International journal of Organic Evolution	72	9		1784-100
Salako IG , Jawad A, Moradpour H	Anisotropic compact stars in non-conservative theory of gravity	International Journal of Geometric Methods in Modern Physics	15	6	2E+06	
Soufbaf M, Fathipour Y, Harvey JA, Hui C	Finish line plant-insect interactions mediated by insect feeding mode and plant interference: a case study of Brassica interactions with diamondback moth and turnip aphid	Insect Science	25	4		690-702
Stanishev V, Goobar A, ..., Bassett B, Fantaye YT , et al.	Type Ia supernova Hubble diagram with near-infrared and optical observations	Type Ia supernova Hubble diagram with near-infrared and optical observations	615		A45	

Authors	Title	Source title/Publisher	Volume	Issue	Art. No.	Pages
Tabi C	Dynamical analysis of the FitzHugh Nagumo oscillations through a modified Van der Pol equation with fractional-order derivative term	International Journal of Non-linear Mechanics	105			173-178
Toich JTF, Taylor PA , et al.	Functional connectivity alterations between networks and associations with infant immune health within networks in HIV infected children on early treatment: A study at 7 years	Frontiers in Human Neuroscience	11		635	
Vafaei Sadr A, Farhang M, Movahed SMS, Bassett B, Kunz M	Cosmic string detection with tree-based machine learning	Monthly Notices of the Royal Astronomical Society	478	1		1132-1140
Vafaei Sadr AV , Movahed SMS, Farhang M, Ringeval C, Bouchet FR	A multiscale pipeline for the search of string-induced cmb anisotropies	Monthly Notices of the Royal Astronomical Society	475	1	stx3126	1010-1022
Warton FL, Taylor PA , et al.	Prenatal methamphetamine exposure is associated with corticostriatal white matter changes in neonates	Metabolic Brain Disease	33	2		507-522
Zambou S , Azeutsap FM, Nuessli R, Magunje B, et al.	Switching alternating current (AC) using a fully screen-printed current-driven transistor	IET Power Electronics	11	1		168-174
2017(72)						
Aghanim N, Akrami Y, Ashdown M, ..., Kunz M , et al	Planck intermediate results: LI. Features in the cosmic microwave background temperature power spectrum and shifts in cosmological parameters	Astronomy and Astrophysics	607		A95	
Aghanim N, Ashdown M, Aumont J, ..., Fantaye Y , et al	Planck intermediate results: L. Evidence of spatial variation of the polarized thermal dust spectral energy distribution and implications for CMB B-mode analysis	Astronomy and Astrophysics	599		A51	
Akrami Y, Ashdown M, Aumont J, Baccigalupi C, ..., Fantaye Y , et al	Planck intermediate results: LII. Planet flux densities	Astronomy and Astrophysics	607		A122	
Assan B, Nyabadza F, Landi P, Hui C	Modeling the transmission of Buruli ulcer in fluctuating environments	International Journal of Biomathematics	10	5	2E+06	
Ballon-Bayona A, Ihl M , Shock JP, Zoakos D	A universal order parameter for Inverse Magnetic Catalysis	Journal of High Energy Physics	2017	10	38	
Bastien D, Oozeer N , Somanah R	Classifying bent radio galaxies from a mixture of point-like/extended images with Machine Learning	IOP Conference Series: Materials Science and Engineering	198	1	12013	
Belobo DB , Das T	Solitary and Jacobi elliptic wave solutions of the generalized Benjamin-Bona-Mahony equation	Communications in Nonlinear Science and Numerical Simulation	48			270-277
Broeckhoven C, du Plessis A, Hui C	Functional trade-off between strength and thermal capacity of dermal armor: Insights from girdled lizards	Journal of the Mechanical Behavior of Biomedical Materials	74			189-194
Broeckhoven C, du Plessis A, ..., Hui C , et al.	Beauty is more than skin deep: a non-invasive protocol for in vivo anatomical study using micro-CT	Methods in Ecology and Evolution	8	3		358-369
Brown T, Catinella B, Cortese L, Lagos CD, Davé R .	Cold gas stripping in satellite galaxies: from pairs to clusters	Monthly Notices of the Royal Astronomical Society	466	2		1275-1289
Cartier R, Sullivan M, Firth RE, ..., Bassett B, Kasai EK , et al.	Early observations of the nearby Type Ia supernova SN 2015F	Monthly Notices of the Royal Astronomical Society	464	4		4476-4494
Cheng L, Hui C , Reddy GVP, Ding Y-L, Shi P-J	Internode morphometrics and allometry of Tonkin Cane <i>Pseudosasa amabilis</i>	Ecology and Evolution	7	22		9651-9660
Corasaniti PS, Agarwal S , Marsh DJE, Das S	Constraints on dark matter scenarios from measurements of the galaxy luminosity function at high redshifts	Physical Review D	95	8	83512	
Danga JE, Sadem CK , Jipdi MN, Fotué AJ, Fai LC	Landau-Zener tunneling and magnetic control of spin qubit in a quantum wire: Dynamic matrix approach	Physica B: Condensed Matter	515			75-81
Davé R , Rafeferantsoa MH, Thompson RJ	MUFASA: the assembly of the red sequence	Monthly Notices of the Royal Astronomical Society	471	2		1671-1687
Daverio D , Dirian Y, Mitsou E	A numerical relativity scheme for cosmological simulations	Classical and Quantum Gravity	34	23	237001	
de Souza RS, Dantas MLL, ..., Killeddar M, Lablanche P-Y , et al.	A probabilistic approach to emission-line galaxy classification	Monthly Notices of the Royal Astronomical Society	472	3		2808-2822
Djoufack ZI , Kenfack-Jiotsa A, Nguenang J-P	Quantum signature of breathers in 1D ultracold bosons in optical lattices involving next-nearest neighbor interactions	International Journal of Modern Physics B	31	20	2E+06	
du Plessis L, Paul RH, Hoare J, Stein DJ, Taylor PA , et al.	Resting-state functional magnetic resonance imaging in clade C HIV: within-group association with neurocognitive function	Journal of NeuroVirology	23	6		875-885
Dufourq E, Bassett BA	Automated problem identification: Regression vs classification via evolutionary deep networks	ACM International Conference Proceeding Series	Part F130806		a12	
Dufourq E, Bassett BA	Automated classification of text sentiment	ACM International Conference Proceeding Series	Part F130806		a11	
Dufourq E, Bassett BA	EDEN: Evolutionary Deep Networks for Efficient Machine Learning	2017 Pattern recognition Association of South Africa and Robotics and Mechatronics (PRASA-ROBMECH)				110-115
Durbach I , Merven B, McCall B	Expert elicitation of autocorrelated time series with application to e3 (energy-environment-economic) forecasting models	Environmental Modelling and Software	88			93-105
Fan J, Taylor PA , Jacobson SW, et al.	Localized reductions in resting-state functional connectivity in children with prenatal alcohol exposure	Human Brain Mapping	38	10		5217-5233
Finlator K, Prescott MKM, Oppenheimer BD, Davé R , et al.	The minimum halo mass for star formation at z = 6-8	Monthly Notices of the Royal Astronomical Society	464	2		1633-1639
Gao M, Wang XX, Hui C , et al.	Assembly of plant communities in coastal wetlands-the role of saltcedar <i>Tamarix chinensis</i> during early succession	Journal of Plant Ecology	8	5		539-548
Haelewaters D, Zhao SY, Clusella-Trullas S, ..., Hui C , et al.	Parasites of <i>Harmonia axyridis</i> : current research and perspectives	BioControl	62	3		355-371
Hassan S, Davé R , Finlator K, Santos MG	Epoch of reionization 21 cm forecasting from MCMC-constrained semi-numerical models	Monthly Notices of the Royal Astronomical Society	468	1		122-139
Heavens A, Fantaye Y , et al.	No Evidence for Extensions to the Standard Cosmological Model	Physical Review Letters	119	10	101301	
Hindmarsh M, Lizarraga J, Urrestilla J, Daverio D , Kunz M	Scaling from gauge and scalar radiation in Abelian-Higgs string networks	Physical Review D	96	2	23525	
Hui C , Fox GA, Gurevitch J	Scale-dependent portfolio effects explain growth inflation and volatility reduction in landscape demography	Proceedings of the National Academy of Sciences of the United States of America	114	47		12507-12511
Hui C , Richardson DM, Visser V	Ranking of invasive spread through urban green areas in the world's 100 most populous cities	Biological Invasions	19	12		3527-3539

Authors	Title	Source title/Publisher	Volume	Issue	Art. No.	Pages
Hui C, Richardson DM	Setting the scene	Invasion Dynamics				1-17
Jawad A, Rani S, Salako IG , Gulshan F	Pilgrim dark energy models in fractal universe	International Journal of Modern Physics D	26	6	2E+06	
Katsikopoulos KV, Durbach IN , Stewart TJ	When should we use simple decision models? A synthesis of various research strands	Omega (United Kingdom)				
Keet J-H, Ellis AG, Hui C , Le Roux JJ	Legume-rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness	Annals of Botany	119	8		1319-1331
Kenfack SC , Ekengoue CM, et al.	Laser cooling and trapping of polariton	Computational Condensed Matter	11			47-54
Kenfack SC , Fotué AJ, Fobasso MFC, Bawe GN Jr, Fai LC	Shannon entropy and decoherence of polaron in asymmetric polar semiconductor quantum wire	Superlattices and Microstructures	111			32-44
Kenfack SC , Fotue AJ, et al.	Quantum transition and decoherence of levitating polaron on helium film thickness under an electromagnetic field	Indian Journal of Physics	91	12		1525-1531
Latombe G, Hui C , McGeoch MA	Multi-site generalised dissimilarity modelling: using zeta diversity to differentiate drivers of turnover in rare and widespread species	Methods in Ecology and Evolution	8	4		431-442
Latombe G, Pyšek P, Jeschke JM, ..., Hui C , et al.	A vision for global monitoring of biological invasions	Biological Conservation	213			295-308
Le Roux JJ, Hui C , Keet J-H, Ellis AG	Co-introduction vs ecological fitting as pathways to the establishment of effective mutualisms during biological invasions	New Phytologist	215	4		1354-1360
Levick J , Kribs DW, Pereira R	Quantum privacy and Schur product channels	Reports on Mathematical Physics	80	3		333-347
Lord JS, Mthomboti Z, Lagat VK, Atuhaire F , Hargrove JW	Host-seeking efficiency can explain population dynamics of the tsetse fly <i>Glossina morsitans morsitans</i> in response to host density decline	PLoS Neglected Tropical Diseases	11	7	e0005730	
Moradpour H, Heydarzade Y, Darabi F, Salako IG	A generalization to the Rastall theory and cosmic eras	European Physical Journal C	77	4	259	
Mosiane O, Oozeer N, Aniyana A, Bassett BA	Radio Frequency Interference Detection using Machine Learning.	IOP Conference Series: Materials Science and Engineering	198	1	12012	
Mosiane O, Oozeer N, Bassett BA	Machine learning for radio frequency interference mitigation using polarization	2017 IEEE Radio and Antenna Days of the Indian Ocean, RADIO 2017				1-2
Mugo JW, Geza E , Defo J, Elsheikh SSM, Mazandu GK , et al.	A multi-scenario genome-wide medical population genetics simulation framework	Bioinformatics	33	19		2995-3002
Nuwagaba S, Zhang F, Hui C	Robustness of rigid and adaptive networks to species loss	PLoS ONE	12	12	e0189086	
Owerre SA	Noncollinear antiferromagnetic Haldane magnon insulator	Journal of Applied Physics	121	22	223904	
Owerre SA	Topological magnon bands in ferromagnetic star lattice	Journal of Physics Condensed Matter	29	18	185801	
Owerre SA	Topological magnetic excitations on the distorted kagomé antiferromagnets: Applications to volborthite, vesignieite, and edwardsite	EPL	117	3	37006	
Owerre SA	Magnon Hall effect without Dzyaloshinskii-Moriya interaction	Journal of Physics Condensed Matter	29	3	03LT01	
Owerre SA	Topological thermal Hall effect in frustrated kagome antiferromagnets	Physical Review B	95	1	14422	
Rabemananjara TR , Horowitz WA	Computing the $q\bar{q} \rightarrow q\bar{q}$ cross section using the BCFW recursion and introduction to jet tomography in heavy ion collisions via MHV techniques	Journal of Physics: Conference Series	889	1	12021	
Rekart ML, Ndifon W , Brunham RC, et al.	A double-edged sword: Does highly active antiretroviral therapy contribute to syphilis incidence by impairing immunity to <i>Treponema pallidum</i> ?	Sexually Transmitted Infections	93	5		374-378
Roigé M, McGeoch MA, Hui C , Worner SP	Cluster validity and uncertainty assessment for self-organizing map pest profile analysis	Methods in Ecology and Evolution	8	3		349-357
Sadjo B, Tabi CB , Edongue H, Mohamadou A	Coupled energy patterns in zigzag molecular chains	Wave Motion	72			342-353
Shi P, Chen Z, Reddy GVP, Hui C , Huang J, Xiao M	Timing of cherry tree blooming: Contrasting effects of rising winter low temperatures and early spring temperatures	Agricultural and Forest Meteorology	240-241			78-89
Soufbaf M, Fathipour Y, Harvey JA, Hui C	Finish line plant-insect interactions mediated by insect feeding mode and plant interference: A case study of Brassica interactions with diamondback moth and turnip aphid	Insect Science				
Soufbaf M, Fathipour Y, Hui C	Artificial diversity of plant-insect communities and modern crop stoichiometry in small closed patches in greenhouse	Journal of Agricultural Science and Technology	19	6		1291-1302
Tabi CB , Etémé AS, Mohamadou A	Frequency mode excitations in two-dimensional Hindmarsh-Rose neural networks	Physica A: Statistical Mechanics and its Applications	474			186-198
Tabi CB , Motsumi TG, Bansi Kamdem CD, Mohamadou A	Nonlinear excitations of blood flow in large vessels under thermal radiations and uniform magnetic field	Communications in Nonlinear Science and Numerical Simulation	49			1-8
Tabi CB , Tankou E, Mohamadou A	Nonlinear coupled mode excitations in microtubules	Chaos, Solitons and Fractals	95			187-194
Tran K-VH, Alcorn LY, Davé R , et al.	Zfire: Similar stellar growth in ha-emitting cluster and field galaxies at $z \sim 2$	Astrophysical Journal	834	2	101	
Van Schalkwyk H, Potgieter L, Hui C	The development of a spatio-temporal model for water hyacinth biological control strategies	Mathematical and Computational Forestry and Natural-Resource Sciences	9	1		30-42
Vaz AS, Kueffer C, Kull CA, ..., Hui C , et al.	The progress of interdisciplinarity in invasion science	Ambio	46	4		428-442
Vimercati G, Davies SJ, Hui C , Measey J	Does restricted access limit management of invasive urban frogs?	Biological Invasions	19	12		3659-3674
Vimercati G, Hui C , Davies SJ, Measey GJ	Integrating age structured and landscape resistance models to disentangle invasion dynamics of a pond-breeding anuran	Ecological Modelling	356			104-116
Wilsenach J, Landi P, Hui C	Evolutionary fields can explain patterns of high-dimensional complexity in ecology	Physical Review E	95	4	42401	
Yacouba S, Tambue A	Null controllability and numerical method for Crocco equation with incomplete data based on an exponential integrator and finite difference-finite element method	Computers and Mathematics with Applications	74	5		1043-1058
Yocgo RE, Geza E , Chimusa ER, Mazandu GK	A post-gene silencing bioinformatics protocol for plant-defence gene validation and underlying process identification: Case study of the <i>Arabidopsis thaliana</i> NPR1	BMC Plant Biology	17	1	218	

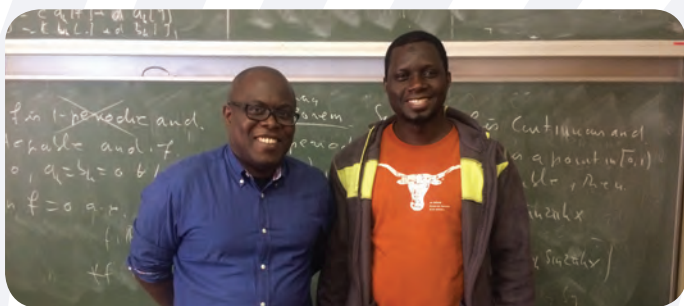
WORKSHOPS & CONFERENCES

During the period under review researchers at AIMS hosted 16 workshops and conferences with 12 of these being held at AIMS South Africa. Many of these were held in collaboration with other organisations including: Wits, SACEMA, SU, UCT and DISCnet, UK.



Deep Learning JEDI

The Cosmology Group Deep Learning JEDI was held from 3 to 6 October at Fynbos Estate in Malmesbury. This JEDI focused on deep learning methods and was a follow-up to the one held in February 2017. Cosmology students and researchers had the opportunity to work and finish off both individual research projects and student theses. The participants were Prof. Bruce, Dr Lochner, Dr Fantaye, Mr Roberts, Mr Olaye, Dr de Vos, Ms Hosenie, Dr Agarwal and Dr Vafaei.



Applied Harmonic Analysis short course

This course held on 16 October was organised by Dr Bah. The presenter was Prof. Kasso Okoudjou from the University of Maryland, Department of Mathematics. There were 16 attendees which included members of the AIMS Research Centre as well as January intake students.



Workshop on Machine Learning for Ecology

This 3-day workshop was held from 20 to 22 November 2017. The aim of the workshop was to give a practical introduction to the use of machine learning methods for classification problems in ecology. It was also aimed at ecologists doing some form of classification - either manually or model-based - in their own research work, especially those classifying images or audio/acoustic data. The workshop covered two machine learning methodologies: tree-based methods, and neural networks. All analysis was done with R, using existing packages for tree-based methods (rpart, randomForest, gbm) and neural networks (keras). The workshop was organised by Prof. Durbach and there were 25 participants.



Workshop on Topology and Topological Groups

This 2-day workshop was held from 6 to 7 December 2017. The workshop focused on recent developments in the area of topological groups, due to the presence of new connections between measure theory, combinatorics and homology in the theory of topological groups. There were 23 participants.



African Regional Workshop of the Gender Gap in Science Project

From 1 to 2 December 2017 the regional workshop in Africa for the project 'A Global Approach to the Gender Gap in Mathematical and Natural Sciences: How to Measure It, How to Reduce It?' was hosted at AIMS South Africa. Gender equality and inclusion is of vital importance to the work of AIMS, where 30% of all graduates are women. AIMS believes that women can, and will, play a key role in the achievement of the Sustainable Development Goals if they are given equal access to a quality education in the STEM fields; as women constitute half of Africa's brain capacity. The objectives of the workshop were to provide information about the project including its three tasks; to make contacts with people that are instrumental for the project; and to get input from Africa to adjust to local realities. The workshop was organised by Dr Igle Gledhill and Prof. Marie Françoise Ouedraogo. The 42 participants were women working in the various parts of Africa that were nominated by the unions and organisation members of the project, as well as a few people from the coordination team.



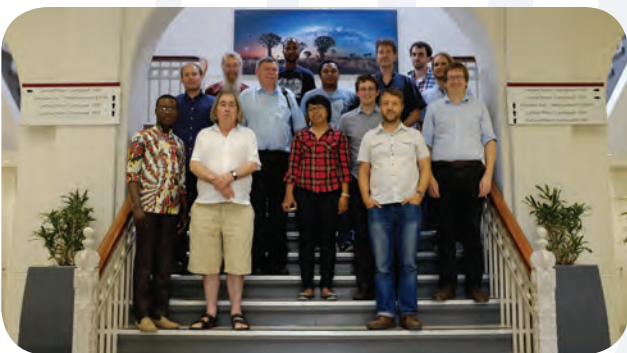
Workshop for African Women in Discrete Mathematics and its Applications

This workshop hosted at AIMS South Africa from 24 to 26 January and featured talks by women on their research in various areas of graph theory, combinatorics, and discrete optimisation - each including some introduction for the non-expert. The main goals of the workshop were to build a network of African women with common mathematical interests and to increase the visibility of women in mathematics to African students, researchers, and professors. It is hoped that the network created will later provide support to participants as they advance through their graduate work and their careers. The workshop was organised by Dr Nancy Ann Neudauer, Pacific University. There were 51 participants, including 38 AIMS Master's students.



Mathematics in Industry Study Group 2018

This study group was held at Wits from 10 to 19 January. Prof. Jeff Sanders, Academic Director, lectured at the school and the following AIMS Master's students attended the school: Mr Yasser Salah Boucharreb, Mr Nkosinathi Hlophe, Mr Vincent Langat, Ms Rojo Fanamperana Randrianomentsoa and Ms Sandra Tsoirintsoa.



Stellenbosch/AIMS South Africa Number Theory Day

On 22 January 2018, a Stellenbosch/AIMS Number Theory Day was held in the Mathematical Science Department at SU. Speakers included Prof. Michel Waldschmidt (Paris), Prof. Peter Stevenhagen (Leiden), Prof. Harry Schmidt (Manchester) and Dr Ramiharianana (AIMS).



11th Summer School in Mathematical Finance

AIMS South Africa hosted this school from 21 to 23 February. The school brought to South Africa several leading academic exponents in the fast growing field of Mathematical Finance. Local practitioners, academics and students had the opportunity to interact with international leaders in Mathematical Finance on current topics and modelling techniques in the South African and international financial markets. Speakers included Dr Roger Lord, Prof. Thomas McWalter and Dr Jörg Kienitz. There were 51 participants including nine AIMS students.



Data Science and Theoretical Foundations Workshop

The annual AIMS Data Science Workshop was held from 9 to 13 April. This year the workshop also included participants completing the year-long Theoretical Foundations Course. This workshop introduced participants to Data Science algorithms - a topical area of research and application both in academia and industry. Participants were also exposed to the mathematical underpinnings, computational tools, and practical applications of the Data Science algorithms. More focus was given to coding in Python and parallel computing than in the workshop held last year. The workshop was organised by Dr Bah and sponsors included the DHET and Training and the German Federal Ministry of Education and Research through the Alexander von Humboldt Foundation. There were 46 participants.

SANUM 2018

The 42nd SANUM conference took place at SU from 4 to 6 April. A special Data Science session composed of talks on the mathematics, computations and applications of Data Science was organised by Dr Bah. Attendees from the AIMS South Africa Research Centre included: postdoctoral fellow, Dr Tahiridimbisoa; PhD students, Ms Phalafala, Mr Koffi and Mr Attipoe; and Research Master's student Ms Muller.



Deep Learning IndabaX

AIMS South Africa Research Master's and PhD students, Mr Olayeye, Mr Gershom and Mr Mensah formed part of the organising team for the Deep Learning Indaba X, Western Cape 2018 that took place on 6 April 2018. The focus of the Indaba was Machine Learning and Artificial Intelligence. This was a combined event by AIMS South Africa, UCT, UWC and SU. Speakers included Prof. Bassett and Mr Dufourq. Eleven AIMS students and tutors also attended the event hosted at UCT.



Theoretical Foundations Workshop

The second workshop in the year-long Theoretical Foundations in Data Science programme being hosted at AIMS South Africa was held from 2 to 13 July. The courses and instructors included Probability & Statistics for Data Science (Dr Terence van Zyl, Wits); Deep Learning (Mr Dufourq and Dr Bah, AIMS); and Network Analytics (Dr Franck Kalala Mutombo, AIMS/University of Lubumbashi and Dr Bah, AIMS).



AIMS-DISCNet Data Science School

AIMS South Africa, in partnership with UK-based DISCnet, hosted a Data Science School from 13 to 15 June at AIMS South Africa. The school was aimed at Master's and PhD students from all fields involving data intensive research. The school was highly interactive, focusing on a mixture of lectures and tutorials. Topics covered Machine Learning, taught by Dr Lochner (AIMS/SKA SA); Software Carpentry, taught by Dr Matt Hilton (UKZN); and Advanced Statistics taught by Prof. David Bacon (ICG Portsmouth). There were 40 participants from local and national universities including nine AIMS students.



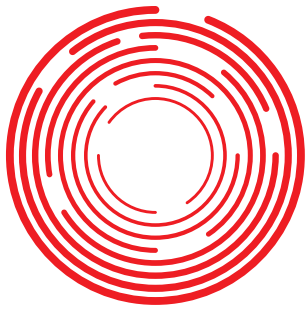
Topics in Ring Theory 2018

The CIMPA Research School, 'Topics in Ring Theory' was held at AIMS South Africa from 16 to 28 July. The school was aimed at Master's and PhD students, as well as young researchers, who wanted to learn about and engage in some active areas of contemporary algebra. Topics included Non-associative algebras; Graph algebras and groupoid algebras; Computational algebra and Representation theory. Thirty students attended the workshop - including 15 local students affiliated to UCT, UNISA, UKZN, and SU. There were nine international speakers: Prof. Pilar Benito Clavijo and Prof. Jesús Laliena both from the Universidad de la Rioja, Spain; Prof. Murray Bremner, University of Saskatchewan, Canada; Prof. Yolanda Cabrera Casado, Prof. Cristina Draper Fontanals, Prof. Dolores Martín Barquero, Prof. Cándido Martín González and Prof. Mercedes Siles Molina all from Universidad de Málaga, Spain; Prof. Lisa Orloff Clark, Victoria University of Wellington, New Zealand; and Prof. Roozbeh Hazrat, Western Sydney University, Australia.



Clinic on Meaningful Modeling of Epidemiological Data

The 9th annual Clinic on the Meaningful Modeling of Epidemiological Data (MMED) was held from 28 May to 8 June at AIMS South Africa. MMED is a 2-week modelling clinic that emphasises the use of data in understanding infectious disease dynamics. Participants conduct modeling projects informed by epidemiological data that address practical questions in a meaningful way.



AIMS SCHOOLS ENRICHMENT CENTRE (AIMSSEC)

PROFESSIONAL DEVELOPMENT FOR IN-SERVICE MATHEMATICS TEACHERS

AIMSSEC conducts blended learning, professional development courses for primary and secondary mathematics teachers, subject advisers and field trainers at disadvantaged rural and township schools, concentrating on deepening mathematical content knowledge and introducing effective teaching strategies. The Mathematical Thinking (MT) short course – AIMSSEC’s flagship programme – has been presented 29 times over a 15-year period to 1,895 teachers. The MT course is endorsed by the South African Council for Educators (SACE) for professional development points.

Mathematical Thinking Courses

From 3 to 13 January 2018 AIMSSEC presented the **28th Mathematical Thinking Course** at Stellenbosch High School. Sixty-one teachers from the Eastern Cape (33), Limpopo (20) and KwaZulu-Natal (8) provinces engaged in learner-centred, practical ways of teaching mathematical content and strategies. The teachers were drawn from three phases, FET, Senior and Intermediate and participants engaged in plenary sessions on topics cutting across the different phases.

Lectures were presented by the local team supported by an international team of retired educationalists who volunteer their time and expertise for improving mathematics pedagogy in under-resourced parts of the country. The lecturing staff was supported by dedicated teaching assistants including AIMSSEC alumni Ms Althea Baartman, Mr Jonathan Fischer, and Mr Stephen Basvi; AIMS South Africa research students Mr Mhlakhululeka Mvubu, Mr Buri Gershom and Ms Frieda Geldenhuys.

From 1 to 11 July 2018 AIMSSEC presented the **29th Mathematical Thinking Course** at Stellenbosch High School. Sixty teachers from the Eastern Cape (34), Limpopo (16), KwaZulu-Natal (6) and Mpumalanga (4) provinces attended this course.

The academic lecturers were supported by a team of dedicated teaching assistants (Ms Andiswa Mpuhlu, Ms Thelma Van Vught, (alumnae of AIMSSEC); and Ms Emily Muller (AIMS Master’s student). The Information Technology lecturing team was supported by Mr Trust Chibawara (Business Analyst AIMS-NEI) and Ms Boluwatife Akinola (MIT student). AIMSSEC is very proud of Mr Jonathan Fischer who participated in the AIMSSEC FaSMEd project and took part in the MT 28 course as a teaching assistant; for stepping up to the academic team and lecturing the Number Sense and Algebra topics to the MT 29 SP group together with Ms Ingrid Mostert who was an investigator on the FaSMEd Project and currently pursuing a PhD in Mathematics Education.



MT28 teachers taking part in learner centered activities



MT29 Course participants

RESULTS OF THE MATHEMATICAL THINKING COURSE OVER THE LAST 6 YEARS

Course	Date	# attended	% passed	Average mark
MT 19	Jan 2013	29	87%	62%
MT 20	July 2013	53	85%	63%
MT 21	Jan 2014	69	88%	68%
MT 22	July 2014	97	80%	62%
MT 23	Jan 2015	57	93%	63%
MT 24	July 2015	134	92%	63%
MT 25	Jan 2016	143	92%	62%
MT 26	July 2016	134	87%	63%
MT 27	April 2017	67	98%	66%
MT 28	Jan 2018	61	90%	63%
MT 29	July 2018	60	In progress	In progress
6 Year Total		904	892/10=89,2%	635/10 = 63,5%

Advanced Certificate in Teaching (ACT)

The ACT Senior Phase (Mathematics specialisation) was developed in collaboration with North-West University (NWU). AIMSSEC and NWU will be jointly responsible for delivering the programme, although the ownership of the programme lies within NWU. The programme's mode of delivery is both contact and open distance learning and by using innovative technologies (for example, Interactive White Boards and Moodle), the programme also addresses the NWU's vision of innovative teaching, which provides an opportunity for professional development to a wider spectrum of the community.

The ACT is a qualification for Continuing Professional Development of qualified teachers and focuses on the target group of teachers in possession of a three-year (or longer) teaching qualification who would like to upgrade to REQV 14/NQF6. It is the only programme students with a National Diploma in Education can follow in order to continue their studies.

AIMSSEC and NWU are negotiating a further three year memorandum of agreement to jointly deliver the ACT and the Advanced Diploma in Education courses.



Short courses for Metro Central Education District

Other short courses

Each course in our new seven-course sequence has a different educational focus addressing contemporary challenges that teachers experience. In Phase 1 the first three courses focus on (i) mathematical thinking, (ii) catering to all abilities in large mixed ability classes, and (iii) language (as teaching mathematics in English as a second language is a serious problem, particularly in rural areas where English is seldom spoken outside the classroom). Successful participants of the first three courses will take four more courses in Phase 2. These courses will be endorsed by the SACE for professional development points. The four additional courses are: (i) teaching mathematics to build skills for the 21st century, (ii) conceptual development and planning for transitions in education, (iii) action research, and (iv) training future leaders in mathematics education.

AIMSSEC presented short courses on three separate Saturdays for Metro Central Education District (MCED) at their offices in Cape Town. The target group was Grade 8 and 9 mathematics teachers interested in Professional Learning Communities. The topics, selected by MCED, were mainly chapters from the AIMSSEC book *Mathematical Thinking in the Lower Secondary Classroom* and other topics selected according to the needs of the attendees. After very good feedback, AIMSSEC delivered similar three day training during the third term of 2018 for the same group covering mainly geometry topics.

ICT AT AIMSSEC

AIMSSEC continually strives to research and introduce the latest educational technologies that are critical for teaching and learning. AIMSSEC explores, engages and empowers teachers with the latest and best mathematical software and applications that help teachers to deliver effective, engaging and exciting lessons. From the research, AIMSSEC also makes recommendations to teachers, schools and departments on relevant software, hardware, and supporting infrastructure, and thereafter offers training and support to them. To empower the teachers, foster collaboration, and promote sharing, AIMSSEC has created Professional Learning Networks in the form of blogs, mobile applications, and Social Media. This has helped transform some South African classrooms into fun, interactive, engaging, inquiry-based learning environments. (<https://aiminghigh.aimssec.ac.za/>).

HOUSE OF SCIENCE FOR THE WESTERN CAPE

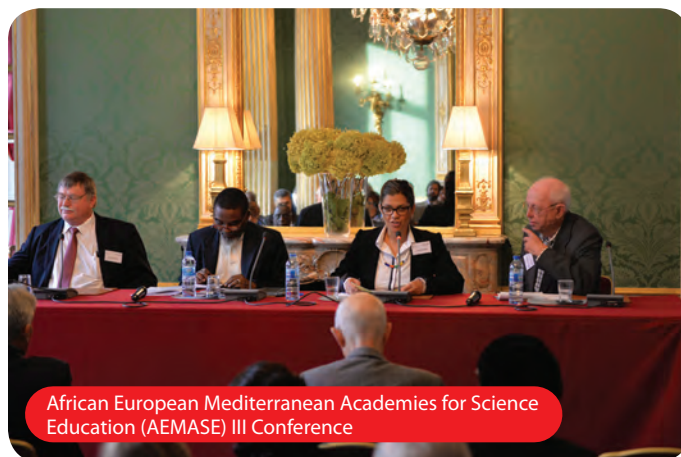
An exciting opportunity was made possible when AIMS South Africa and the Academy of Science of South Africa forwarded a joint expression of interest to host a Centre for Education in Science for Africa, the Mediterranean and Europe (CESAME) for teachers. The centre will be known as the House of Science for the Western Cape.

From 3 to 4 October 2017, Prof. Barry Green, Prof. Fritz Hahne and Ms Sinobia Kenny presented talks in support of the CESAME Centre at the African European Mediterranean Academies for Science Education III Conference at the Institute of France in Paris. The talks were well received and a CESAME in South Africa was approved by the Steering Committee. The CESAME will run in collaboration with like-minded institutions from South Africa and the international community. The key component of the teacher training at the CESAME will be inquiry-based learning which, for perhaps the first time, will merge mathematics, science and human sustainable development in South African schools.

The project is for the whole African, Mediterranean and European region in order to support and improve school science and mathematics education from grades 1 to 9. The objective is to build up a network of international centres for the professional development of in-service training of educators. Experts agree that science (including mathematics) is often inadequately taught in schools and consequently unable to raise the interest of learners.

An Inquiry-Based Science and Mathematics Education (IBSME) interest group in the Western Cape has been formed which so far consists of AIMSSEC, the Primary Science Programme, UWC, UCT and Western Cape Education Department (WCED).

It is hoped that by grouping together NGOs and higher education institutions this will result in greater impact and increase the possibility of receiving funding for the project.



African European Mediterranean Academies for Science Education (AEMASE) III Conference

EDUCATIONAL RESEARCH

Dr Lindiwe Tshuma of AIMSSEC contributed a chapter to the book which has been compiled from MISTRA's research report *The Pedagogy of Mathematics in South Africa: Is There a Unifying logic?*. The report was launched at the **Science Forum South Africa** from 6 to 8 December 2017. The project investigates the best pedagogical methods for nurturing of mathematical talent amongst young people.

The **26th conference of the Southern African Association for Research in Mathematics, Science and Technology Education** was held at the University of Botswana in Gaborone from the 16 to 20 January 2018. The theme of the conference was 'Pursuing sustainable and inclusive quality education through research informed practice in Mathematics, Science and Technology' based on Sustainable Development Goal (SDG) Number 4 of the 2030 Agenda for Sustainable Development. At the conference, AIMSSEC was represented by Dr Tshuma who co-presented two symposiums entitled 'Mathematical Inclusion in four SADC Countries' and 'Determining Success of Mathematics Education Interventions.'

The **Primary Teacher Education (PrimTEd) Project** is a four-year project of the Department of Higher Education and Training (DHET) that forms a part of a suite of projects in the Teaching and Learning Development Capacity Improvement Programme that covers areas of primary teacher education, TVET and Community College lecturer education, inclusive education and early childhood care and education. It is managed by the Chief-Directorate for Teaching and Learning Development in the DHET. The programme is supported by the European Union. AIMSSEC has been involved in the PrimTEd Project since 2016 in the National Working Committee sessions, and recently in the Assessment Working Group. The Assessment Working Group is currently developing and administering baseline tests focused on language and mathematics skills as students begin their first year of teacher training. A second set of tests is administered in the last year of their teacher training. AIMSSEC will be administering the baseline assessments on in-service mathematics teachers, as an extension to the tests administered to pre-service teachers. AIMSSEC participated in a workshop for the Assessment Working Group which was held in Johannesburg from 23 to 24 April 2018. Data collected from the administration of the tests will be developed into journal articles presented at provincial and national conferences.

On the 13 March 2018, Dr Tshuma presented a talk titled: 'Multiple levels and aspects of language competency in English and Intermediate Phase mathematics teachers: An analysis of case of the Eastern Cape Province', at the **AIMS South Africa Journal Club**. "Mathematics education begins and proceeds in a language, it advances and stumbles because of language and its outcomes are often accessed in a language".



CONFERENCES



AIMSSEC attended the **Education Week Conference** in Cape Town from 4 to 5 October 2017. The aim of the conference was to target education development in the Western Cape, and included talks regarding leadership management, teacher training, and digital disruptions in the classroom. Speakers included teachers, technology developers, and WCED officials; the variety of professionals made for interesting debates regarding the future of educational development in the province.

The **4th Annual e-Learning Conference** was held by the MCED on 14 April 2018 at the Cape Teaching and Leadership Institute (CTLI) in Kuilsriver. Around 350 teachers attended the full programme. The focus of the conference this year was to demonstrate the resources that are available in the MCED institutions, in a practical and experiential way. AIMSSEC presented four sessions on 'How to use the GeoGebra software' in the FET and GET Mathematics classroom.

The **La Main à La Pâte 9th International Seminar on Science and Mathematics Education** was held in Sevres, France and AIMSSEC was represented by Dr Tshuma. The seminar was attended by 45 teacher educators and decision makers in teacher education from various countries across the globe. The Foundation La main à La Pâte aims to improve the quality of science and technology teaching in primary and middle schools. The Foundation's activities are carried out within France and internationally, providing assistance and professional development for teachers. Programmes are designed to help them implement inquiry-based learning which stimulates a scientific spirit in pupils, understanding of the world and capacities for expression.

AIMSSEC and PSP's participation in the seminar is aimed at kick-starting the IBSME programme for the Western Cape Province. The IBSME programme will work in collaboration with the House of Science, coordinated by AIMS South Africa. A follow up seminar will be held in Trieste in Italy and IBSME is geared to improving the quality of science and mathematics education, specifically at primary school level by incorporating inquiry based teaching methods.

"AIMSEC is constantly aware of the vital role that teacher training plays within the South African and African landscapes. We will tirelessly endeavour to support programmes to improve mathematics education in South Africa and other AIMS centres in Africa so that all learners on the African continent can compete on an equal playing field with their peer group across the globe."



PUBLIC ENGAGEMENT

EVENTS AND EXHIBITIONS

AIMS South Africa Women in Science (AIMSWIS)

The mentoring programme for the academic year 2017-2018 kicked off in October with a 'meet and greet' event which aimed to introduce students (both male and female) to the initiative.

The objectives of the mentoring programme are to:

- encourage women and girls to pursue careers in the STEM;
- provide a diverse environment for networking with successful female professionals in STEM including AIMS alumni;
- provide a platform for AIMS South Africa (both male and female) students to actively engage in the community by mentoring at local schools;
- regularly provide information to students outlining career and funding opportunities; and
- create a safe space where female students can obtain support from caring senior students who listen to them, serve as good role models and help them develop their life skills, and build self-confidence and self-esteem.



AIMSWIS South Africa mentoring event

On 18 November 2017, a mentoring event consisting of a talk and a panel discussion was held. Thirty-nine women attended the event including 19 current women students, two researchers, three tutors and 15 alumni currently completing their Master's and PhDs at local universities. The panel consisted of three AIMS alumni, Ms Eva Liliane Ujeneza, Ms Asmaa Tbaeen, and Ms Savannah Nuwagaba, as well as Ms Makinde Funmilayo Lydia (Research Master's student), Ms Julia Borchardt and Ms Zoe Hamel (tutors). They talked about choosing career paths, supervisors, life after AIMS, the importance of giving back, opportunities for Master's and PhD studies in South Africa, Europe and the USA and the importance of communication skills as a scientist.

As part of the African Regional Workshop of the Gender Gap in Science which took place in December, a special women's mentoring session was organised by AIMSWIS South Africa. The theme of the session was 'Phenomenal Women in Science' which aligned with the workshop goals. The session was aimed at providing AIMS women students and researchers with an informal opportunity to interact with workshop delegates who are leading professionals in science.

AIMSWIS South Africa members Dr Gavhi-Molefe, Ms Innocenter Amima and Ms Bathata Masego attended the South African Women in Science and Engineering Association Annual General Meeting which took place on 4 December 2017, at the South African Astronomical Observatory auditorium in Cape Town. The theme was evolution with a suggested title 'Evolution: From prehistoric to intergalactic'.

International Day of Women and Girls in Science was celebrated on 11 February 2018, through an AIMS social media campaign aimed at inspiring young girls to pursue careers in science. It was done under the theme #BreakingBoundaries. Students took part in a photoshoot by writing one word that describes how they have broken boundaries in their lives.



The month of March was filled with events led by the AIMSWIS team to celebrate International Women's Day. On 6 March 2018, a mentoring lunch was held for AIMS female students, staff members, researchers and tutors. This was followed by a talk led by a visiting lecturer, Dr Roberta Guadagni (University of Pennsylvania), who spoke about the challenges she faced (and overcame) being the only female in a male-only mathematics department.

On International Women's Day, 8 March 2018, AIMSWIS organised a screening of the movie 'Queen of Katwe'. The movie was based on the true story of a female chess prodigy, Phiona Mutesi, originally from the slums of Katwe, Uganda, who went on to receive the prestigious Woman Candidate Master title.

Ms Emily Muller, a Research Master's student led a workshop on 'How to apply for funding' on 27 March 2018. The workshop was aimed at helping students find funding opportunities as well as showing them how to compose the required application letters.

On 10 April 2018, a movie night was held to commemorate the death of Winnie Madikizela-Mandela. The film “Winnie” a movie based on her life was shown.

In order to gauge the success of the AIMSWIS programme, a year-end function was hosted at a local restaurant. The event objectives were to:

- To find out what the students’ plans are after graduation and offer additional support applying for opportunities, if required.
- To assess the success and obstacles associated with the programme’s implementation and discuss how the programme could be improved in future.



AIMSWIS Lunch

“The programme was educative, inspiring and fun. I think it was a necessary programme and met my expectations,” noted one of the participants.

School outreach

AIMSSEC arranged two school visits for Ms Lucy Hawking (Prof. Stephen Hawking’s daughter) to promote literacy and numeracy amongst primary school learners. On 17 October staff of AIMS South Africa accompanied by Ms Hawking and Dr Carole Bloch (Director of PRAESA) read alongside Grade 5 learners at Inukhanyo Primary School in Masiphumelele. Dr Eddy Kimba Phongi demonstrated a mathematics educational game to encourage the inquisitive minds of learners to engage with problem solving puzzles in mathematics.



Ms Lucy Hawking with Grade 5 learners at Inukhanyo Primary School in Masiphumelele

Dr Gavhi-Molefe presented a talk on career opportunities in the mathematical sciences and the use of mathematics in a computer-aided design application areas, such as animated movies, at the Young Ladies in STEM Seminar. The event was hosted by AmaQawe ngeMfundo (Heroes through Education) and held in Khayelitsha as part of the 2017 National Women’s Month celebrations.

Six AIMS representatives including Mr Mhlasakhululeka Mvubu, Ms Munira Jowaheer, Ms Julia Borchardt, Ms Zoe Hamel, Ms Noluvuyo Hobana and Ms Innocenter Amima visited Masiphumelele High School on 12 March 2018. The visit was part of a school outreach initiative aimed at encouraging learners to pursue STEM careers. Addressing 200 Grade 11 learners, the speakers spoke of their personal journeys and the valuable lessons they had learned along the way. The recurring themes were the importance of identifying role models and the real-life applications of mathematics and physics. The learners were also provided with information regarding university and bursary applications.



Masiphumelele High School

SAMF Maths Olympiad Preparation

Sixteen school learners and four coaches from the Western Cape and Gauteng visited AIMS South Africa from 3 to 6 April, to take part in the South African Maths Foundation’s preparation for the International Maths Olympiad.



Maths Olympiad learners and coaches

Job shadowing

Three Grade 11 learners from the Waldorf School, Ms Ciara Rattue, Mr Joshua Sello and Ms Saskia van der Want, volunteered in the Cosmology Group from 11 to 22 September. The students had a keen interest in mathematics and this visit formed part of their required job shadowing experience.

As part of AIMS South Africa’s contribution to Mandela Month, a Job Shadow Week for high school learners and university students was hosted at the centre from 2 to 6 July 2018. Learners and undergraduate students from local high school and universities were matched with scientists (mentors) based at AIMS for a five day workplace visit during the school holidays. This year AIMS hosted two mentees: Mr Thomas Britton, a Grade 11 learner at Heathfield High School and Mr Ashley Sikweza from Khayelitsha, currently doing his BSc degree in Computer Sciences at UWC, who wants to specialise in the field of Artificial Intelligence after completing his degree. The programme involved the mentees job shadowing Dr Fantaye, Dr Ramiharimanana, Mr Koffi and Dr Gavhi-Molefe.

Africa Code Week



Africa Code Week was held across Africa from 18 to 25 October 2017 with the goal of enabling 500 000 young Africans across 35 African countries to learn coding basics. AIMS South Africa was one of the host institutions in South Africa and hosted five interactive coding sessions with learners from local schools. The workshop was a great success and 132 learners and 6 educators from

four schools and one NGO from Khayelitsha participated. The key focal points of the workshop were to introduce learners to coding/programming using Scratch Software; to inspire and stimulate interest in learners to pursue computer science and maths careers at a tertiary level; and to show learners that coding through real applications can be fun and exciting.



Africa Code Week

Taking Mathematics tutoring to the township

A group of AIMS alumni embarked on a volunteer mission at the start of 2018 to help matriculants from Joe Slovo High School in Khayelitsha, Cape Town, prepare for their 2018 matric examinations. The team views this as a way of giving back to the community and bringing one more child closer to realising their dream. "We have all been fortunate to receive top class postgraduate education for free. Taking two hours to help one more child believe and eventually receive their education is invaluable." The team is dedicated to ensuring that learners on this programme do well and excel through Mathematics - #BuildingAfrica #GivingBack #Thumamina #HelpingOurPeople. To mark the end of term, the students were teamed up to compete in a mini mathematics Olympiad. Thanks to the non-profit organisation AmaQawe ngeMfundo, with whom the alumni are collaborating, each learner was given a gift, and the top team earned an opportunity to job shadow during their June vacation school break.



AIMS Alumni with the matriculants

Python User Group

On 19 May, the Cape Town Python User Group hosted their monthly meeting at AIMS South Africa. There was a talk by Jeremy Thurgood titled: 'Elixir for Pythoners.' This group holds monthly discussions, talks and demonstrations of whatever's currently interesting in the Python world.

Empowering the future workforce of South Africa with STEM knowledge and 21st-century skills

As part of its contribution to National Youth Month, AIMS South Africa hosted a free full-day electrical engineering hands-on workshop for middle school learners and educators on 25 and 26 June 2018. This workshop was organised in partnership with the United States Military Academy (also known as Westpoint) Center for Leadership and Diversity in STEM (CLD STEM). The mission of CLD STEM is to increase the recruitment and retention of underrepresented minority and disadvantaged youth populations in STEM by focusing on learners at the pre-college and university level to increase the number of learners who intend to major in STEM.

Prof. Green opened the 2-day workshop which served 75, Grade 6 to 9 learners, from Khayelitsha, Mitchells Plain, Eastridge, Heathfield and Rondebosch. The workshop focused on developing and improving their STEM-based knowledge and skills, which are in high demand in the modern economy, as well as their interest in pursuing these fields. During the workshop, the learners were introduced to the Arduino platform (an open source, low-cost introductory tool for electrical engineering) and worked with scientists from CLD STEM and AIMS South Africa to build a series of projects, such as a mood lamp and distance detector. These exercises gave the learners insight into the machines they use every day and the role they could potentially play in developing such devices.



School STEM Workshop

Learners from Kulani High School visit AIMS

On 9 June, 50 learners from Kulani High School visited AIMS South Africa. These grade 10, 11 and 12 learners have been tutored in mathematics by AIMS South Africa's Master's students for 13 Saturdays from February to June. The visit was an opportunity to motivate the learners to study further and to let them work on the computers in the computer lab to search the net and apply for tertiary study and bursaries. The day started with guest speakers



Kulani High School Visit

giving motivational talks. Dr Simukai Utete, Senior Researcher at AIMS talked about 'What you can do with mathematics', Mr MacDonald Chapwanya, Programme Coordinator talked about 'How to choose a career', and Mr Mhla Mvubu, a Research Master's student at AIMS gave a talk titled: 'What I did with mathematics.' AIMSSEC coordinated the tutoring programme and organised the special visit to the AIMS centre. The Saturday tutoring project at Kulani High School was sponsored by GrandWest Casino and Entertainment World under the auspices of Sun International Socio-Economic Development.

National Science Week Launch 2018



National Science Week Launch

AIMS South Africa participated in the launch of 2018 National Science Week (NSW) hosted by the University of Mpumalanga in Nelspruit on 28 July 2018. During the launch, the Honorable Minister of Science and Technology, Ms M Kubayi-Ngubane encouraged learners to use technology to inform their future. The focus week took place from 30 July to 4 August 2018.

Dr Fantaye and Mr Tshikare, an AIMS Master's student, hosted a booth during the event and exposed learners and the general public to the wonders of artificial intelligence, machine learning, electronics and the basic mathematics or logic behind them focusing on this year's theme "Deepening our democracy through science and technology".

PUBLIC LECTURE SERIES

During the period under review, AIMS South Africa presented a series of public lectures. They were attended by members of the public and AIMS students. The following lectures took place in the period under review:

- AIMS South Africa in association with the Muizenberg Festival and the Zandvlei Trust, hosted two public talks: 'The eco benefits of industrial hemp as an agricultural crop', presented on 3 October by **Mr Tony Budden (Hemporium)**; and 'Lessons from the Dodo' on 5 October by **Prof. Mike Bruton**, author scientist and one of the leading fish biologists of South Africa.
- On 10 October the **Muizenberg Scitizen Dialogues** hosted an evening of informal talks and facilitated dialogue surrounding the central and pertinent issue of water. Invited guests from several research institutions in Cape Town were given an



Scitizen Dialogues

opportunity to engage with each other and most importantly with members of the public through a mediated conversation.

- On 6 February 2018, the AIMS South Africa Public Lecture Series presented a talk by **Dr Hans Georg Zimmermann** titled: 'Understanding Artificial Intelligence'.
- On 5 June 2018, **Dr Jonathan Dushoff, McMaster University Department of Biology**, titled: 'Math and rabies control'.



Dr Zimmermann



Dr Dushoff

MEETINGS ATTENDED

Prof. Green visited the International Centre for Theoretical Physics (ICTP) in Italy on 8 September to discuss possible collaborative projects.

The 13th edition of the Institute of Electrical and Electronic Engineers (IEEE) AFRICON conference was held in Cape Town from 18 to 20 September. Prof. Green gave a talk on the first day, titled 'The AIMS Educational Ecosystem.'

From 12 to 18 November, Prof. Green visited Tohoku University, Sendai and Tokyo University in Japan. The visit was facilitated by Prof. Motoko Kotani, the Director of the Advanced Institute for Materials Research at Tohoku University, and President of the Mathematical Society of Japan. At Tokyo University Prof. Green was hosted by Prof. Tomohide Terasoma, and discussions were held with the Vice President of Tokyo University. The purpose of these visits was to explore possible interactions of Japanese mathematicians with AIMS through teaching and opportunities for students post AIMS and AIMS researchers in Japan.

Prof. Green attended the DAAD Network Meeting with Higher Education Institutions from Sub Saharan Africa in Bonn, Germany from 25 to 26 November. AIMS South Africa was recently selected as one of the institutions DAAD supports by offering PhD scholarships and the meeting was for members of all the selected institutions. The aim of the meeting was to review the planned framework of the In-Country/In-Region Scholarship Programme whilst engaging the partner institutions actively in cooperation with DAAD in order to strengthen the effectiveness and efficiency of the programme. The meeting also helped facilitate the creation of links between partner institutions and provided a platform for exchange and discussions.



Mr Budden



Prof. Burton

The Science Forum South Africa 2017 took place at the CSIR International Convention Centre in Pretoria in December 2017. AIMS was one of the winners of the Science Diplomacy Award in 2016, which is designed to recognise outstanding achievements in South Africa's international STI cooperation as well as global contributions to harnessing STI for international peace, solidarity and sustainable development. Prof. Green was an invited plenary speaker on the panel "Science Diplomacy Helping Africa Develop." He was joined by the other 2016 winners.

Prof. Green, Dr Bah and the other German Research Chairs based at AIMS Centres attended the annual meeting of the Alexander von Humboldt Foundation from 27 to 29 June. Prof. Green also attended a meeting led by Prof. Peter Gritzmann and Dr Andrea Binder to discuss the new German Research Chairs that will be hosted at AIMS Centres.

On 29 June, Prof. Green, attended the General Assembly and Governing Board of CIMPA in his capacity as President.

From 18 to 19 July, the German Federal Ministry of Education and Research hosted a workshop titled: 'New Impetus for the German-African Cooperation in Science and Education.' Many African scientists and policy advisors attended this meeting including Prof. Green who represented AIMS.

VISITORS



Students from the University of Limpopo

On 21 September, 72 students from the University of Limpopo, visited AIMS South Africa. They were welcomed by Prof. Green and given an overview of the academic programmes at AIMS by Prof. Sanders. Ms Sihle Ncube, AIMS Master's student, gave a talk on studying at AIMS. The visitors were also given tea and a tour of the facilities.

Mr Frithjof A Maennel, Deputy Director General, International Cooperation, Federal Ministry of Education and Research, Germany, (BMBF) visited AIMS South Africa on 20 November. Mr Maennel was taken on a tour of the facilities, and discussions about the ongoing collaboration between AIMS and the BMBF were held with Prof. Green and Dr Bah.

On 5 February, Mr Ryan Ravens, CEO, Accelerate CT visited AIMS South Africa. He had a meeting with Prof. Neil Turok to discuss possible ways for AIMS and Accelerate CT to collaborate in the future. A special tea was held for Mr Ravens to meet staff and students and he gave a short address.



Mr Ravens addresses the students

Dr S Krishnannair Acting HOD: Mathematical Sciences, University of Zululand visited AIMS South Africa from 27 to 28 February to explore the establishment of a partnership between AIMS and Zululand.

Ms Susan Oakes from the London Mathematical Society visited on 28 February to view the centre and find out more about AIMS activities.

AIMS students attended a special event on 10 March when the Executive MBA (EMBA) class of ESMT Berlin visited AIMS South Africa. The visiting EMBA students are practising managers of various German and international companies as well as entrepreneurs and managers at NGO's with lots of experience in business and management. They shared information about business skills and aimed to motivate the students to consider a career in business after they graduate. The event also gave the EMBA students an opportunity to learn from the AIMS students about their perspectives on business-related issues in Africa.



Executive MBA (EMBA) class of ESMT Berlin

On 13 April, Mr Livhuwani Masevhe from the DST and Ms Thandamanzi Mtsweni from South African Agency for Science and Technology Advancement visited AIMS South Africa. They had a meeting with Prof. Green and Dr Gavhi-Molefe to discuss initiatives at AIMS including the new House of Science Programme.



Mr Masevhe and Ms Mtsweni with Prof. Green and Dr Gavhi-Molefe

Ambassador Tatsuo Arai, Director for Special Missions and Ms Takako Shibata, Department of International Affairs of the Japan Science and Technology Agency (JST) visited on 22 June 2018. They met with Prof. Sanders, Academic Director, Dr Gavhi-Molefe, and Ms Linda Camara, Communications Manager. Prof. Green joined the meeting via Skype. During the meeting the guests were given a presentation on AIMS South Africa. This was followed by Ambassador Arai expanding on the reason for the visit which was to exchange information on existing cooperation and ideas for future cooperation between the JST with the African continent.



Ambassador Arai, Ms Camara, Ms Shibata, Dr Gavhi-Molefe and Prof. Sanders



THE AIMS NETWORK



AIMS Cameroon Graduation 2018

GRADUATIONS

Across the network, 149 students graduated from their respective centres. This brings the total number of alumni to 1682 from 44 African countries, with 32% of them being women.

- On 20 June 2018, AIMS Cameroon graduated their fifth cohort of students. Thirty-six students (including 11 women) from 14 African countries graduated.
- On 22 June, thirty-five students from 11 countries graduated in the second graduation ceremony at AIMS Rwanda.
- On 30 June 2018, AIMS Ghana graduated its 6th cohort of students. Thirty-seven students (including 11 women) from 11 countries graduated.

AIMS alumni are working in academia and industry the others have progressed to Research Master's and PhD studies as outlined in the table below.

Post AIMS Studies

Status	PhD			Research Master's		
	Female	Male	Total	Female	Male	Total
Completed	57	196	253	164	357	521
In progress	95	215	309	65	120	185



AIMS Rwanda Graduation 2018

NETWORK UPDATES

African Development Bank commits to support AIMS' drive to train Africa's mathematical scientists & innovators

In meetings held from 16 to 17 April, the African Development Bank (AfDB), led by President Dr Akinwumi Adesina, and AIMS, led by Patron of the High-Level Advisory Council and former President of Nigeria, Olesegun Obasanjo, initiated a ground breaking relationship to build an industry-led research institution.

The meeting was held at AfDB headquarters in Abidjan, Cote d'Ivoire. AfDB and AIMS discussed a 10-year partnership proposal to build mathematical and scientific capacity in Africa, strengthen industry linkages, and create a competitive industrial and innovative space.



AIMS Ghana Graduation 2018



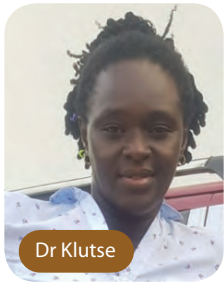
Across the network, 149 students graduated from their respective centres. This brings the total number of alumni to 1682 from 44 African countries, with 32% of them being women.

First cohort of Women in Climate Change Science Fellows

On 15 May, the AIMS Next Einstein Initiative announced the first cohort of Women in Climate Change Science Fellows (pictured from left to right): Dr Jessica Nosizwe Paula Thorn, a South African national living in the United States, Dr Nana Klutse from Ghana and Dr N'Datchoh Evelyne Toure from the Ivory Coast.



Dr Thorn



Dr Klutse



Dr Toure

Research Chairs

In January 2018, AIMS welcomed Dr Marc Sedjro who took up an appointment as the German Research Chair at AIMS Tanzania, the fifth German Research Chair in the AIMS Network. Prior to joining AIMS he completed a postdoctoral fellowship at RWTH-Aachen and King Abdullah University of Science and Technology (KAUST). Dr Sedjro obtained his doctorate in Mathematics from the Georgia Institute



Dr Sedjro

of Technology in 2012. His research interests lie in the fields of Partial Differential Equations and the Calculus of Variations. More specifically, he is interested in using optimal transport theory to give new perspectives on some challenging problems in Fluid Mechanics and, more recently, the stationary problem in Mean-Field Games. At AIMS Tanzania, Marc is establishing a research group to explore problems such as the multi-dimensional compressible Euler and gas dynamics equations and the almost axisymmetric flows that arise in meteorology. He plans to promote a research environment that facilitates regular interaction with other Tanzanian research institutions and significant interaction with international researchers especially researchers in Germany.

Honorary Officer of the Order of Canada

Prof. Neil Turok, AIMS Founder and Chair of the International Board of Directors, was named an Honorary Officer of the Order of Canada on 29 June 2018. The Order of Canada was established in 1967 by Her Majesty Queen Elizabeth II. It recognises outstanding achievement, dedication to the community and service to the nation. Since its creation, more than 6000 people from



Prof. Turok

all sectors of society have been invested into the Order. It is one of the highest honours that Canada confers. The award recognises Prof. Turok's "substantial contributions as a scientist to the field of theoretical physics and cosmology, providing new models that test fundamental theories of the universe".



NEF Ambassadors



NEF Fellows

NEXT EINSTEIN FORUM GLOBAL GATHERING 2018

Over 1600 scientists, businesspersons, policymakers and other stakeholders attended the Next Einstein Forum Global Gathering 2018 held under the patronage of H.E. Paul Kagame, President of the Republic of Rwanda, in Kigali from 26 to 28 March. An initiative of AIMS, in partnership with the Robert Bosch Stiftung and supported by Johnson & Johnson, NEF Global Gatherings are unique, international science fora with a strong focus on Africa. The meeting was held under the theme 'Connecting Science to Humanity' and 50% of the participants were under 42 years and 40% were women. Some of the subthemes tackled in the three-day forum included; 'Connectivity'; 'Ubiquity and Mobility'; 'Climate'; 'Energy'; 'Food and Growth'; 'Precision Health'; and 'Building Africa's Scientific Capacity'.

Attendees from AIMS South Africa included Dr Fantaye, who was selected as a NEF Fellow; Prof. Green and Prof. Bassett who are members of the Scientific Programme Committee; and Dr Bah, who hosted a breakfast meeting that focused on the German Research Chairs in the AIMS Network. Two AIMS Master's students, Ms Kelebogile Phatsimo Baliki and Ms Rojo Fanamperana Randrianomentsoa attended the event as volunteers. AIMS South Africa Council Member, Prof. Louise Warnich, Dean of Science at SU, also attended the event.



GOVERNANCE & ADMINISTRATION

TRUST

The AIMS South Africa Trust meeting took place on 31 January 2018. Members of the AIMS Trust are Ms Nasima Badsha, Prof. Fritz Hahne, Prof. Brian O'Connell, Prof. Daya Reddy, Prof. Ben Turok and Prof. Neil Turok (Chair)



AIMS South Africa Council Meeting

COUNCIL

AIMS South Africa Council members met on 31 January 2018. Council members are Prof. Daya Reddy (Chair, UCT), Prof. Cheryl de la Rey (Pretoria), Prof. Thandi Mgwebi (Tshwane University of Technology), Prof. Grae Worster (Cambridge), Prof. Stéphane Ouvry (Paris-Sud), Prof. Balazs Szendroi (Oxford), Prof. Neil Turok (Perimeter Institute) and Prof. Louise Warnich (Stellenbosch).

ADVISORY BOARD

The AIMS South Africa Advisory Board which advised on strategic and academic aspects of the AIMS programme, in particular, its integration with existing courses and research projects in South African and other African universities, is currently being revised.

EXECUTIVE TEAM

The AIMS South Africa Executive Team assists the Director and Academic Director with the selection of students for the Master's programme and facilitates the relationship between AIMS and the three participating universities. Members during this period were Dr Hannes Kriel and Prof. Ingrid Rewitzky (SU), Prof. Nicola Mulder and Prof. Henri Laurie (UCT), and Prof. Kailash Patidar and Dr Sylvain Halindintwali (UWC).

STAFF

Prof. Barry Green, Director, is assisted by the Management Team consisting of Dr Barrie Barnard (AIMSSEC Manager), Jan Groenewald (IT Manager), Igsaan Kamalie (Facilities Manager), Prof. Jeff Sanders (Academic Director) and Deborah Wilsnagh (Finance and Human Resources Manager).

During the period under review, four valued colleagues decided to follow other opportunities: Ms Sinobia Kenny, AIMSSEC Senior Programme Coordinator; Mr MacDonald Chapwanya, AIMSSEC IT Manager; Ms Liesl Felix, AIMS Finance Office; and Dr Lindiwe Tshume, AIMSSEC Primary Mathematics Specialist.

In July, Dr Tejumade Ogundipe joined the AIMSSEC team as IT Coordinator, Mr Björn Pieterse accepted an appointment as Project Accountant in our Finance Department, beginning in September 2018, and Ms Lynn Evon was appointed as a Finance Officer in October 2018.



Tutors

TUTORS

Tutors for the period under review were Mr Georg Anegg (Austria), Ms Julia Borchardt (Germany), Ms Mirette Fawzy (Egypt), Ms Zoe Hamel (France), Mr Romeo Mandanirina (Madagascar), Mr Jordan Masakuna (DRC), Dr Patrice Oukouma (Gabon), and Mr Andriamanankasina Ramanantoanina (Madagascar).

COMMUNICATIONS REPORT

During the period under review our social media sites have grown exponentially. The YouTube channel has more than 6 500 subscribers reaching a majority of the demographic age group 18-34 with the top three viewing countries being USA, India and UK.

Videos done with the students in this period include "What's so special about my Research Project?" and "15 Years of Excellence - 15 Years of Building Science in Africa!" which were both well received. We ran a Facebook campaign titled: '#breakingboundaries' for International Day of Women and Girls in Science.

Our archive of professional photographs is ever expanding. Public lectures, journal club talks, visiting researchers, visiting students, workshops, seminars, roadshows, and the recognition of achievement ceremony are some of the events which have been documented. In addition we have done staff portraits, graduation portraits and corporate headshots of the students for employability purposes. The photos are used for our website and other online campaigns and at the graduation ceremonies.

The continuous documentation of people, activities and events at AIMS South Africa, are made available to relevant groups for digital and print usage. All links to photo albums are shared on a monthly basis with everyone on campus.

Newsletters continue to be sent out on a monthly basis and other marketing literature such as posters, websites, certificates, etc. have been created to support workshops and events at the centre. A new welcome guide for students and visitors was also developed in collaboration with the AIMS Network Communications Team.



INFORMATION TECHNOLOGY

In the reporting period the AIMS South Africa IT department's focus was on continued server virtualisation using LXC and KVM, and work on self-registration for network access. The main network file servers were rebuilt from scratch, with increased performance and backup capabilities on far more affordable hardware than before. Extensive support was also provided to workshops and researchers.

Tutor Manana Ramanantoanina and research Master's student Mhlasakululeka Mvubu assisted in the IT department and with teaching duties. Tejumade Ogundipe started as IT co-ordinator and lecturer at AIMSSEC, and Jonathan Carter continued as Systems Architect.

In February the international internet connectivity was increased from 14.5M to 24.17M at the same cost, due to TENET price decreases.

The 130 campus desktops are 8 years old, with incremental replacements planned for 2018-19. Two HP Microservers with 4x4TB disks and 32G RAM were purchased as network file servers, with an additional purchase planned. The new servers implement ZFS on Linux and user accessible backups have now improved from only one copy at 4am the previous morning, to read-only snapshots of 4x 15 minutes, 24x hourly, 4x weekly, and thereafter 12x monthly!

All websites moved to free auto-renewed certificates from Let's Encrypt. Secondary out-of-domain DNS services generously provided by Rhodes University IT for years have moved to BuddyNS. Print, file, and time services have been virtualized. Our main UPS batteries were replaced, and the computer lab PA system repaired. Wireless configuration tweaks improved our performance under heavy load such as visiting workshops.

An additional video conferencing system was purchased with funding from the AIMS-ESMT Industry Immersion programme. This system will run AIMS Desktop, and include support for Google Hangouts, Skype, Vidyo, Blue Jeans, Zoom, and many web-based platforms.

Jonathan Carter travelled to AIMS Rwanda to assist with a computer lab upgrade and miscellaneous fixes on the network. Shortly after he attended the annual Debian Developer conference, DebConf 18, in Taiwan.

Classes in Computing and LaTeX, AIMS Desktop, online collaboration, revision control, and in the software development with python were taught to the AIMS South Africa August and January Structured Masters intakes.

FACILITIES

In 2018 AIMS South Africa acquired three new vehicles as part of the vehicle programme at SU. The Quantum (16 seater), Etios (5 seater) and Avanza (8 seater) will greatly benefit our programmes as they will be used by the facilities team for transporting students and lecturers, airport transfers etc.

Upgrades and improvements were made to the St Claire ground floor accommodation which have been renovated to become offices for AIMSSEC.

Due to the water crisis experienced in Cape Town various measures were implemented which included amongst others the installation of eco-shower heads; removing of excess geysers, reduced water temperature and pressure and the installation of rainwater tanks.

FINANCIAL OVERVIEW

FINANCIAL REPORT 2017-18

By formal agreement, Stellenbosch University provides financial management services to AIMS South Africa. An independent trust was established in 2002, called The AIMS Trust, whose financial information has also been consolidated into these financial statements.

Figure 1: Total income per main component

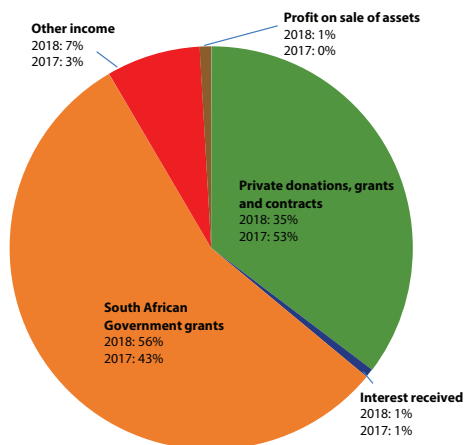


Figure 1: shows the comparison of AIMS South Africa's income per main component as well as the relative ratio to total income

Total income increased by 4% to R38,359 million from R36,864 million. Variance is as a result of the grant from the Department of Higher Education and Training: National Skills Fund commencing in July 2017.

South African Government grants for the 2018 and 2017 years are as follows:

Department	Programme	2018	2017
Department of Higher Education and Training	Academic Programme	R 5 526 000	R 5 265 000
Department of Science and Technology	Academic Programme, Research Programme and Post AIMS Bursaries	R 3 469 643	R 3 350 000
National Research Foundation	Research Programme	R 6 325 750	R 5 298 844
National Skills Fund	Teacher Training Academic Programme, South African Taught Master's and Teacher Training bursaries	R 5 978 824	R 1 805 937
Total South African Government Grants		R 21 300 217	R 15 719 781

Private donations, grants and contracts, is comprised mainly of funding from MasterCard Foundation towards the Taught Master's Programme, The Robert Bosch Foundation towards the first and second ARETÉ Junior Chairs and grant from The Alexander Von Humboldt Foundation towards the German Research Chair.

Private donations, grants and contract income for the 2018 and 2017 years are as follows:

Department	Programme	2018	2017
IDRC Main Grant	Taught Master's Programme	R -	R 4 452 675
IDRC Research Grant	Research Programme	R 906 467	R 2 180 781
Mastercard Foundation	Taught Master's Programme and Teacher Training Bursaries	R 3 824 722	R 3 423 414
The Alexander Von Humboldt Foundation	German Research Chair	R 1 980 436	R 1 334 343
The Robert Bosch Foundation	Research Programme	R 1 308 429	R 3 186 887
The Oppenheimer Memorial Trust	Teacher Training Programme	R 600 000	R 900 000
DAAD	Bursaries/Scholarships	R 2 415 457	R 1 711 499
Other private donations	Taught Master's Programme and Teacher Training	R 2 511 786	R 861 276
Total Private donations, grants and contract income		R 13 547 297	R 18 050 875

Figure 2: Total expense per main component

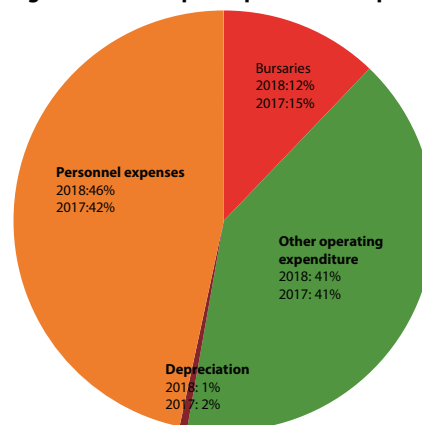


Figure 2: shows the comparison of AIMS South Africa's expenditure per main component as well as the relative ratio to total expenditure

Total expenditure for 2018 decreased by 3% from R41,098 million to R39,789 million, as a result of chair activities for the IDRC Chairs and 1st ARETÉ Junior Chair ending.

Bursaries comprises bursaries to AIMS Research Centre students, DAAD and post AIMS bursary recipients.

Other operating expenditure includes all costs related to the Taught Master's Programme.

A 5% annual cost of employment adjustment was approved for all qualifying staff, however, overall personnel costs only increased by 1% due to employment contracts ending for the IDRC Chairs and 1st ARETÉ Junior Chair at varying times during the financial year.

Expenditure is monitored carefully, within prescribed limits.

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

Financial Statement for the year ended 31 December 2017

	General		Taught		Honours		Endowed	PRIOR YEAR
	Overhead	Academic	Masters	Post AIMS	Programme	Programme	Scholarships	31/12/2016
TOTAL	Costs	Programme	Programme	Bursaries	Bursaries	Bursaries		
INCOME	R 22 811 326	R 6 640 154	R 6 626 000	R 6 529 969	R 2 883 283	R -	R 137 153	R 21 254 841
DAAD	R 2 255 352	R -	R -	R -	R 2 255 352	R -	R -	R 2 058 000
Department of Higher Education (2016/17)	R 5 526 000	R -	R 5 526 000	R -	R -	R -	R -	R 5 265 000
Department of Science and Technology	R 2 550 000	R 900 000	R 1 100 000	R -	R 550 000	R -	R -	R 2 550 000
ESMT	R 870 263	R -	R -	R 870 263	R -	R -	R -	R -
Foreign Exchange Profit	R 1 194	R 1 194	R -	R -	R -	R -	R -	R 3 579
Give and Gain	R 2 061	R -	R -	R 2 061	R -	R -	R -	R 1 688
IDRC/MasterCard Foundation	R 4 687 645	R -	R -	R 4 687 645	R -	R -	R -	R 7 464 095
Martin Rees (Endowed Scholarship)	R 85 000	R -	R -	R 85 000	R -	R -	R -	R 85 000
National Skills Fund	R 2 228 450	R 1 508 450	R -	R 720 000	R -	R -	R -	R 1 799 178
Stephen Hawking (Endowed Scholarship)	R 85 000	R -	R -	R 85 000	R -	R -	R -	R 85 000
Sundry Income	R 1 605 211	R 1 527 280	R -	R -	R 77 931	R -	R -	R -
The Paul G. Allen Family Foundation (Endowed Scholarship)	R 80 000	R -	R -	R 80 000	R -	R -	R -	R 80 000
Workshops and Conferences	R 1 411 475	R 1 411 475	R -	R -	R -	R -	R -	R 1 292 939
Other income: Contribution by AIMS Research Centre	R 1 423 675	R 1 291 755	R -	R -	R -	R -	R 131 920	R 548 634
							R 5 233	R 106 728
EXPENDITURE	R 23 195 578	R 5 786 385	R 7 009 733	R 7 103 627	R 2 946 683	R 179 150	R 170 000	R 21 094 078
Accommodation (General Overhead Levy)	R -62 050	R -2 373 100	R 616 665	R 1 599 360	R -	R 95 025	R -	R -
Administration Fees (General Overhead Levy)	R -	R -1 495 000	R 720 000	R 775 000	R -	R -	R -	R -
Advertising: Posts	R 12 882	R 12 882	R -	R -	R -	R -	R -	R 4 365
Audit Fee	R 253 963	R -	R 82 079	R 171 884	R -	R -	R -	R 214 451
Affiliation, Registration, Membership and Subscriptions	R 148 145	R -	R 6 470	R 141 675	R -	R -	R -	R 160 230
Bank costs	R 3 534	R 3 534	R -	R -	R -	R -	R -	R 3 940
Book and periodicals	R 7 118	R -	R 7 118	R -	R -	R -	R -	R 6 782
Building, Building Refurnish Costs, Equipment & Furn	R 281 318	R 281 318	R -	R -	R -	R -	R -	R 284 135
Bursaries	R 3 116 683	R -	R -	R -	R 2 946 683	R -	R 170 000	R 2 637 665
Catering	R 4 262 919	R 1 895 559	R 314 755	R 1 975 680	R -	R 76 925	R -	R 3 603 725
Computer Materials	R 42 356	R 42 356	R -	R -	R -	R -	R -	R 181 331
Consultation Fees and Services	R 629 254	R -	R 629 254	R -	R -	R -	R -	R 602 044
Consumable Materials	R 210 710	R 210 710	R -	R -	R -	R -	R -	R 208 966
Copying, Printing and Stationery	R 218 556	R 218 556	R -	R -	R -	R -	R -	R 202 479
Courses	R 9 100	R 9 100	R -	R -	R -	R -	R -	R -
General Office Expenses	R 54 907	R 54 907	R -	R -	R -	R -	R -	R 28 536
General Vehicle Expenditure	R 273 057	R 273 057	R -	R -	R -	R -	R -	R 260 407
Insurance	R 124 951	R 124 951	R -	R -	R -	R -	R -	R 125 199
Interest Paid	R 4 597	R -	R -	R 4 597	R -	R -	R -	R 2 490
Internet Expenses	R 246 350	R 19 708	R 78 832	R 147 810	R -	R -	R -	R 269 507
Medical Expenses	R 294 910	R -	R 20 382	R 274 528	R -	R -	R -	R 227 022
Municipal Expenses	R 2 214 448	R 2 214 448	R -	R -	R -	R -	R -	R 1 715 454
Remuneration	R 8 006 315	R 3 736 766	R 3 945 958	R 323 591	R -	R -	R -	R 7 067 882
Repairs & Maintenance (Equipment)	R 12 932	R 12 932	R -	R -	R -	R -	R -	R 16 946
Student Stipends	R 480 160	R -	R -	R 472 960	R -	R 7 200	R -	R 1 039 620
Telephone and Cell Phone Costs	R 72 885	R 72 885	R -	R -	R -	R -	R -	R 61 171
Travel Expenses	R 2 275 578	R 470 816	R 588 220	R 1 216 542	R -	R -	R -	R 2 169 731
NET INCOME(SHORTFALL) OVER EXPENDITURE	R -384 252	R 853 769	R -383 733	R -573 658	R -63 400	R -179 150	R -32 847	R 160 763
ACCUMULATED FUNDS AT 1 JANUARY 2017	R 3 468 995	R -1 158 878	R 1 857 150	R 1 658 128	R 804 263	R -443 907	R 752 239	R 3 308 232
FUNDS AVAILABLE AT 31 DECEMBER 2017	R 3 084 743	R -305 109	R 1 473 417	R 1 084 470	R 740 863	R -623 057	R 719 392	R 3 468 995

AIMS RESEARCH CENTRE

Financial Statement for the year ended 31 December 2017

	<u>The Alexander Von Humboldt Foundation (German Research Chair)</u>							<u>The Robert Bosch Stiftung (ARETE Chairs)</u>	<u>Workshops</u>	<u>PRIOR YEAR 31/12/2016</u>
	TOTAL	NRF	DST	IDRC (Joint Development Chairs)	(German Research Chair)	The Robert Bosch Stiftung (ARETE Chairs)	Workshops		PRIOR YEAR 31/12/2016	
INCOME	R 13 352 800	R 5 000 000	R 950 000	R 1 136 467	R 1 931 144	R 3 395 322	R 939 867	R 11 686 269		
NRF	R 5 000 000	R 5 000 000	R -	R -	R -	R -	R -	R 5 565 000		
DST	R 950 000	R -	R 950 000	R -	R -	R -	R -	R 800 000		
IDRC	R 1 136 467	R -	R -	R 1 136 467	R -	R -	R -	R 2 114 207		
The Alexander Von Humboldt Foundation	R 1 931 144	R -	R -	R -	R 1 931 144	R -	R -	R 860 775		
The Robert Bosch Stiftung	R 3 395 322	R -	R -	R -	R -	R 3 395 322	R -	R 2 257 919		
Workshop Income	R 939 867	R -	R -	R -	R -	R -	R 939 867	R -		
Interest received	R -	R -	R -	R -	R -	R -	R -	R 88 368		
	R 15 049 081	R -								
EXPENDITURE	R 15 049 081	R 6 648 078	R 1 298 247	R 1 113 343	R 2 216 638	R 2 833 047	R 939 728	R 11 049 501		
Accommodation and Catering	R 925 162	R 52 842	R 81 920	R 15 800	R -	R 42 600	R 732 000	R 171 551		
Administrative Fees	R 210 000	R 130 000	R -	R 20 000	R -	R 60 000	R -	R 155 000		
Affiliation and Registration Expenses	R 68 217	R 15 163	R -	R -	R 22 254	R 30 800	R -	R 27 318		
Books	R 44 667	R 1 830	R -	R -	R 42 837	R -	R -	R 1 500		
Bursaries (Postdocs, PhD & MSc)	R 2 626 613	R 1 177 811	R 719 832	R 270 664	R -	R 458 306	R -	R 2 465 508		
Consultation Fees	R 874 731	R 531 717	R 212 000	R 38 125	R -	R 64 389	R 28 500	R 636 687		
Consumables	R 61 748	R 29 805	R -	R -	R 31 943	R -	R -	R 38 533		
Furniture & equipment	R 701 677	R 30 310	R -	R 29 802	R 523 997	R 117 568	R -	R 34 698		
General Office Expenses	R 64 831	R 43 096	R -	R -	R 21 735	R -	R -	R 115 181		
Internet	R 138 735	R 31 500	R 35 000	R 18 000	R 6 235	R 48 000	R -	R 138 249		
Interest paid	R 140 213	R 92 207	R -	R 24 003	R -	R 24 003	R -	R 11 781		
Medical Expenses	R 38 143	R 38 143	R -	R -	R -	R -	R -	R 36 541		
Remuneration: Research Staff	R 5 819 748	R 2 850 065	R -	R 492 172	R 1 013 731	R 1 463 780	R -	R 4 497 554		
Remuneration: Support Staff	R 1 169 662	R 754 662	R -	R 135 000	R -	R 280 000	R -	R 1 134 676		
Rent of premises	R 253 500	R 145 000	R -	R 31 500	R -	R 77 000	R -	R 183 250		
Special Events and Conferences	R 285 151	R -	R 139 742	R -	R 145 409	R -	R -	R -		
Travel Expenses	R 1 626 283	R 723 927	R 109 753	R 38 277	R 408 497	R 166 601	R 179 228	R 1 401 474		
NET INCOME/(SHORTFALL) OVER EXPENDITURE	R -1 696 281	R -1 648 078	R -348 247	R 23 124	R -285 494	R 562 275	R 139	R 636 768		
ACCUMULATED FUNDS AT 1 JANUARY 2017	R 3 847 040	R 3 043 944	R 794 169	R -454 776	R 460 607	R 3 096	R -	R 3 210 272		
FUNDS AVAILABLE AT 31 DECEMBER 2017	R 2 150 759	R 1 395 866	R 445 922	R -431 652	R 175 113	R 565 371	R 139	R 3 847 040		

Financial Statement for the year ended 31 December 2017

	TOTAL		SU Cost centre R268		NSF		PRIOR YEAR 31/12/2016	
INCOME	R	2 099 661	R	727 236	R	1 372 425	R	6 158 595
Donations								
Comburs Foundation	R	88 000	R	88 000	R	-	R	39 000
Grandwest International	R	-	R	-	R	-	R	117 000
Give and Gain	R	356	R	356	R	-	R	19 183
Mastercard Foundation	R	-	R	-	R	-	R	210 096
St John's College, Cambridge	R	16 339	R	16 339	R	-	R	22 521
The Oppenheimer Memorial Fund	R	600 000	R	600 000	R	-	R	600 000
National Skills Fund	R	1 372 425	R	-	R	1 372 425	R	3 570 892
EC FASMED	R	10 766	R	10 766	R	-	R	1 508 498
Department of Education: Eastern Cape	R	7 045	R	7 045	R	-	R	-
Department of Education: Metro Central	R	-	R	-	R	-	R	52 675
Interest Received	R	4 730	R	4 730	R	-	R	17 405
Sundry Income					R	-	R	1 325
EXPENDITURE	R	3 531 065	R	2 226 342	R	1 304 723	R	7 777 788
Accommodation and Catering	R	212 903	R	176 376	R	36 527	R	336 361
Administration Costs	R	100 187	R	100 187	R	-	R	162 753
Affiliation and Registration Fees	R	6 660	R	6 660	R	-	R	41 631
Bursaries	R	-	R	-	R	-	R	1 147 409
Computer Materials	R	-	R	-	R	-	R	12 273
Consultation Fees and Services	R	2 122	R	2 122	R	-	R	3 235
Consumable Materials	R	10 501	R	10 501	R	-	R	7 331
General Office Expenses	R	49 844	R	49 844	R	-	R	105 768
Interest paid	R	3 466	R	3 466	R	-	R	4 048
IT Services (Telematic and course IT)	R	470	R	470	R	-	R	101 572
Medical Expenses	R	-	R	-	R	-	R	3 565
Printing and Stationery	R	35 958	R	35 958	R	-	R	67 232
Postage	R	1 364	R	1 364	R	-	R	3 755
Remuneration	R	2 583 520	R	1 315 324	R	1 268 196	R	4 086 639
Rental of Equipment	R	21 330	R	21 330	R	-	R	14 800
Rent of Premises	R	66 432	R	66 432	R	-	R	75 100
Travel Expenses	R	436 308	R	436 308	R	-	R	1 604 316
NET (SHORTFALL)/ INCOME OVER EXPENDITURE	R	-1 431 404	R	-1 499 106	R	67 702	R	-1 619 193
ACCUMULATED FUNDS AT 1 JANUARY 2017	R	1 577 909		1 577 587	R	322	R	3 197 102
FUNDS AVAILABLE AT 31 DECEMBER 2017	R	146 505	R	78 481	R	68 024	R	1 577 909

SUPPORTERS FOR PERIOD UNDER REVIEW

AIMS SOUTH AFRICA DONORS

AIMS Endowed Scholarships contributors

- Avery Tsui Foundation
- Neil Turok
- Paul G Allen Family Foundation
- Peter Kellner
- Victor Rothschild Memorial Fund

Alexander von Humboldt Foundation

DST-NRF CoE in Mathematical and Statistical Sciences (CoEMaSS)

European School of Management and Technology (ESMT Berlin)

German Academic Exchange Service (DAAD)

German Federal Ministry of Economic Cooperation and Development (BMZ)

German Federal Ministry of Education and Research (BMBF)

Google Inc.

Government of Canada - through International Development Research Centre (IDRC)

Government of South Africa:

- Department of Higher Education and Training (DHET)
- The National Skills Fund (NSF)
- Department of Science and Technology (DST)
- National Research Foundation (NRF)

Government of the United Kingdom, Department for International Development (DFID)

The Mastercard Foundation Scholars Program

Perimeter Institute for Theoretical Physics

Robert Bosch Stiftung

Science & Technology Facilities Council, UK (SA-DISCNet Collaboration)

Stellenbosch University

Université Paris-Sud

University of Cambridge

University of Cape Town

University of Oxford

University of Pretoria

University of the Western Cape

University of Illinois at Urbana-Champaign (Depts of Mathematics, Physics and the Graduate College)

US Fulbright Specialist Program

AIMS South Africa would like to thank the following lecturers for donating their honoraria to AIMS in this period:

- Neville Fowkes
- Steve Bradlow
- Joan Simon Soler
- Grae Worster
- Richard Katz

For a list of all AIMS South Africa supporters, please visit:

<https://www.aims.ac.za/en/support/supporters>

AIMSSEC IS GRATEFUL TO ITS SPONSORS FOR SUPPORTING ITS PROGRAMMES. THE FOLLOWING SPONSORS DONATED MORE THAN R30 000:

Comburse Foundation

Department of Education: Eastern Cape

Department of Education: Western Cape, Metro South District and Metro Central

European Commission FP7 FASMED

Government of South Africa DHET through the National Skills Fund

The MasterCard Foundation

Nuffield Foundation

Oppenheimer Memorial Trust

Sun International GrandWest Casino

St John's College, Cambridge

Victor Rothschild Memorial Fund

FOREXCELLENCE PROGRAM

The ForExcellence Program finds fitting ways for academic partners to support Africa's most promising mathematical science students. These include: faculty guest-lecturers at AIMS Centres; scholarships to support AIMS students; post-graduate students providing teaching support at AIMS centres; funding to support research and operation of centres; collaborations on research projects, internships and other employment opportunities for graduates.

For more information please visit www.nexteinstein.org/connect/for-excellence-program/

- Atlantic Association for Research in Mathematical Sciences
- Atlantic Leadership Development Institute
- The Fields Institute for Research in Mathematical Sciences
- Lappeenranta University of Technology
- Michigan State University
- Research in Motion
- Royal Statistical Society
- Simon Fraser University
- University of British Columbia
- University of Cambridge
- University of Chicago
- University of Glasgow
- University of Guelph
- University of Illinois
- Université de Moncton
- University of Ottawa
- Université Paris Sud
- University of Regina
- University of Southampton
- University of Victoria
- University of Waterloo



AIMS | African Institute for
Mathematical Sciences
SOUTH AFRICA

African Institute for Mathematical Sciences

6 MELROSE ROAD | MUIZENBERG | CAPE TOWN 7945 | SOUTH AFRICA

TEL: +27 (0)21 787 9320

EMAIL: info@aims.ac.za | WEB: www.aims.ac.za