



$a^{-n} = 1a^n [a_0]$   
 $a_n = \frac{1}{a_1 + (n-1)d}$   
 $S_n = \frac{n}{2} [2a_1 + (n+1)d]$   
 $\arcsch(z) = \ln(1 + \sqrt{(1+z^2)})/z$   
 $S_n = \frac{a_1}{1}$   
 $(a \times b)^n = a^n \times b^n$   
 $\log_n m = \frac{\log m}{\log n}$   
 $\tan h(z) = -i \tan(iz)$   
 $S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{N}}$   
 $P_{n,r} = \frac{n!}{(n-r)!}$   
 $a^{-n} = 1a^n [a_0]$   
 $a^0 = 1 [a_0]$   
 $a^{-n} = 1a^n [a_0]$   
 $\operatorname{csch}(z) = \cos(iz)$   
 $b^2 = (a+b)^2$   
 $a^{-n} = 1a^n [a_0]$   
 $\operatorname{arcsech}(z) = \ln \frac{1 + \sqrt{1-z^2}}{z}$   
 $\cosh(x) = \frac{1}{2}(\e^x + \e^{-x})$   
 $a^{-n} = 1a^n [a_0]$   
 $a^{-n} = 1a^n [a_0]$   
 $\operatorname{sech}(z) = \operatorname{Sec}$   
 $y_0 = b$   
 $V(-2,0)$   
 $F(-2,4)$   
 $1. P \rightarrow q$   
 $2. P \quad \} q$



**AIMS** | African Institute for  
Mathematical Sciences  
**SOUTH AFRICA**

# ANNUAL REPORT

# 2017

# ABOUT US

## AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES



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 2016 to 31 July 2017. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2016 calendar year.

Since AIMS South Africa opened in 2003, 706 students from 37 different African countries have graduated from its core academic programme. The alumni include 239 women.

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 that hosts regular workshops and conferences.
- Professional development programmes for teachers.
- Public engagement activities.

\* AIMS Next Einstein Initiative, Kigali, Rwanda  
Email: [info@nexteinstein.org](mailto:info@nexteinstein.org). For further information, see [www.nexteinstein.org](http://www.nexteinstein.org)

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# FOREWORD

Barry Green, Director



*As we move into our 15<sup>th</sup> year, it is encouraging to take note of how AIMS has grown from its humble beginning as a single institute offering a postgraduate diploma, to a pan-African network of six centres for postgraduate training, research and public engagement, with the newest centre opening in Kigali, Rwanda in August 2016.*

Each year, AIMS South Africa admits 50 to 60 Master's students in the mathematical sciences and across the AIMS Network between 250 and 300 students are admitted. These students are selected from a pool of more than 4500 applicants. We are proud that 706 students have graduated from this centre and over 250 courses have been delivered, of which more than 200 have been taught by international lecturers. More than 2600 scientific visitors have spent time at AIMS, either as visiting researchers or workshop participants.

Our Schools Enrichment Centre (AIMSSEC) has offered professional development courses to more than 1750 teachers and has been widely recognised for its work, receiving the UNESCO-Hamdan Prize (edition 2011–2012) for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers in developing countries within marginalised or disadvantaged communities. In 2016, the first of its teaching-aid books, *Mathematical Thinking in the Lower Secondary Classroom*, was published by Cambridge University Press. The success of its work has led to a new partnership offering courses with North-West University in 2016 and to involvement with the AIMS-Mastercard Teacher Training Programme in Cameroon.

AIMS South Africa is now firmly established as a South African educational and research institution and is pleased to be included in and to contribute to a number of important national initiatives, such as the initiative to develop a South African Graduate Academy for the Mathematical and Statistical Sciences and the Basic Sciences Infrastructure Platform of the Department of Science and Technology (DST).

A number of special workshops and events were held in the period under review. These included the 10<sup>th</sup> Summer School in Mathematical Finance; a Data Science Workshop, organised by our new German Research Chair, Dr Bubacarr Bah; and the Clinic on Meaningful Modelling of Epidemiological Data, organised with the South African Centre for Epidemiological Modelling and Analysis (SACEMA).

AIMS South Africa was selected to be one of the host institutions for National Science Week 2017. This event was led by Dr Rejoyce Gavhi-Molefe, and held at the Oliver Tambo Community Hall in Khayelitsha. All departments at AIMS South Africa contributed to its success. The event was attended by more than 1350 learners and also focussed on women in the fields of Science, Technology, Engineering and Mathematics (STEM) in celebration of National Women's Day.

With more than 50 students graduating each year from AIMS South Africa and over 250 from the AIMS Network of Centres, we are aware that many of our alumni will contribute to Africa's growth and development through industry related activities. Therefore AIMS and the European School of Management and Technology (ESMT) launched an Industry

Immersion Programme at our centre in Muizenberg in July 2017. Twenty-three suitably qualified and industry-inclined AIMS Master's graduates from across Africa were given the opportunity to participate in the fully-funded 20-week residential and industry programme. We gratefully acknowledge the effort of Mr Mark Heerden from AIMS, Mr Nick Barniville, Associate Dean of Programs, ESMT Berlin, and Emeritus Professor Wulff Plinke, the Founding Dean of the ESMT, who established this valuable new programme. Funding support from the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD) as well as from participating industry partners is also gratefully acknowledged.

During the past year, a number of excellent new appointments have been made at the AIMS Research Centre. Dr Michelle Lochner joined our research centre on a shared appointment with the Square Kilometre Array (SKA). Dr Rejoyce Gavhi-Molefe was appointed as a researcher with a special outreach portfolio. Dr Yabebal Fantaye (with a research focus on machine learning) was appointed as the second AIMS ARETÉ Chair and is generously supported by the Robert Bosch Foundation. Dr Bubacarr Bah was appointed as the German Research Chair at AIMS South Africa, generously supported by the German Federal Ministry of Education and Research (BMBF) through the Alexander von Humboldt Foundation. His research is in the mathematics of data science and we are excited about the growth of this field at our centre.

The success of AIMS South Africa depends on the excellent support by our three local partner universities, in particular Stellenbosch University; the South African Departments of Higher Education and Science and Technology; and international governments and donors. We have a very dedicated group of people working at the centre and lecturers contributing to our programme. It is a pleasure to acknowledge them all in this annual report.

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

**T**his year, we have again been fortunate to be able to offer exciting, innovative and popular courses. This is due to enthusiastic international and South African interest, combined with the support of a strong team of tutors.

The outcome has been another year run according to the AIMS model, which is designed to graduate independent-thinking students with a broad mathematical and IT foundation and entrepreneurial edge, committed to solving the problems confronting Africa.

The academic programme balanced the themes of Physics, Pure and Applied Maths, Statistics and Computer Science. A key feature was the prominent position of Data Science – a result of the course given by Prof. Pete Grindrod (Oxford) whose lectures included exciting theory and applications reflecting his experience from working in industry. The topic meshed well with our entrepreneurial outlook. He also worked with Dr Bubacarr Bah, including him in his own local industrial meetings, and suggesting plans to incorporate AIMS in work with the Turing Institute of the United Kingdom.

Another feature was the course on entrepreneurial case studies (some from his own experience) presented by Prof. Stefan Jähnichen, TU Berlin. Two lecturers withdrew at the last minute but fortunately their replacements were highly successful.

As usual, a high success rate resulted from AIMS' use of the tutorial system in which students requiring help are identified weekly. The scheduled academic programme was augmented to include three essential on-going topics to promote AIMS values: Language and Communications; IT and LaTeX; and the Scientific Environment (anti-plagiarism, gender issues, managing research, reading and writing mathematics, ethics, professional talks, job opportunities, etc.)

There has been further emphasis this year on providing the Master's students with essential, effective communication skills related to digital, verbal and non-verbal communications. This course, developed by Ms Yasmin Hankel, the New Media Specialist, in collaboration with the English and Communications teacher, Ms Noluvuyo Hobana, provides students with an effective communication toolkit, which helps them to confidently voice their work for maximum impact. The module covered: presentation skills, branding, CV writing, audience engagement, collaboration, scientific writing, preparation for the workplace, as well as voice and speech. A key objective of the course was to prepare the students for industry using a start-up project, pitching scenarios and doing job interview simulations.

## GIVEBACK PROGRAMME

This year, many students participated in several voluntary activities arranged as part of the AIMS South Africa outreach programme. Between March and June 2017, students, together with AIMSSEC staff, assisted with weekly tutorial lessons at False Bay College and Muizenberg High School. Ten students also took part in Muizenberg beach cleanup events in February and April.



Communications Course



Beach Cleanup

Period	Lecturer	Course	MSc Jan 2016	MSc Aug 2016	MSc Jan 2017	Hons Biomaths 2017
<b>2016</b>						
22 Aug – 24 Nov	Noluvuyo Hobana, AIMS South Africa	English and Communication Skills		x		
22 Aug – 24 Nov	Jan Groenewald, AIMS South Africa	Computing and LaTeX		x		
29 Aug – 16 Sept	AIMS South Africa Staff	The Scientific Environment		x		
29 Aug – 16 Sept	Florian Breuer & Dimbinaina Ralaivaosaona, Stellenbosch	Mathematical Problem Solving		x		
29 Aug – 16 Sept	Jeff Sanders, Yae Gaba & Jordan Masakuna, AIMS South Africa	Python		x		
19 Sep – 7 Oct	Evans Ocansey, Johannes Kepler University	Experimental Mathematics with Sage	x	x		
19 Sep – 7 Oct	Kaja Jasinska, Yale	Statistics using R		x		
10 – 21 Oct	Jonathan Marks, GIBS	Entrepreneurship Skills	x	x		
10 – 28 Oct	David Aschman, Cape Town	Concepts and Problem Solving in Physics		x		
7 – 25 Nov	Karin Therese Howell, Stellenbosch	Algebra		x		
7 – 25 Nov	Patrick Dorey, Durham	Differential Equations		x		
28 Nov – 16 Dec	Gareth Boxall, Stellenbosch	Model Theory		x		
28 Nov – 16 Dec	Pete Grindrod, Oxford	Data Analytics		x		
28 Nov – 16 Dec	Ronnie Becker, AIMS South Africa	Financial Mathematics		x		
<b>2017</b>						
9 – 27 Jan	David Aschman, Cape Town	Quantum Mechanics		x		
9 – 27 Jan	Grae Worster, Cambridge & Richard Katz, Oxford	Fluid Dynamics		x		
9 – 27 Jan	Eric Ould Dadah Andriantiana, Rhodes	Experimental Mathematics with Sage			x	x
9 – 27 Jan	Jordan Masakuna, AIMS South Africa	Python			x	
9 – 27 Jan	Stéphane Ouvry, Paris Sud	Introduction to Random Systems, Information Theory and related topics		x	x	x
11 – 27 Jan		Mathematics in Industry Study Group			x	
30 Jan – 17 Feb	Alan Beardon, Cambridge	GPS and Geometry			x	
30 Jan – 17 Feb	Sigrid Böge, Heidelberg	Mathematical Problem Solving		x		
30 Jan – 17 Feb	Wilson Lamb, Strathclyde	Analytical Techniques in Mathematical Biology		x	x	x
30 Jan – 17 Feb	Theis Lange, Copenhagen	Statistics			x	
30 Jan – 17 Feb	Douw Steyn, British Columbia & Stefano Galmarini, Institute for Environment and Sustainability, Italy	Atmospheric Modelling		x	x	
27 Feb – 3 Mar	Stefan Jähnichen, Berlin	Entrepreneurship case studies			x	
27 Feb – 3 Mar	Paulo Zuliani, Newcastle	Bioinformatics		x	x	x
27 Feb – 17 Mar	Wolfram Decker and Gerhard Pfister, Kaiserslautern	Computational Algebra		x	x	
27 Feb – 17 Mar	Costas Zoubos, Pretoria	General Relativity		x	x	
20 Mar – 7 Apr	Lyonell Boulton, Heriot-Watt	The Numerical Solution of Differential Equations		x	x	
20 Mar – 7 Apr	Matt Macauley, Clemson	Algebraic Biology		x	x	
20 Mar – 7 Apr	Robert de Mello Koch, Witwatersrand	Introduction to Quantum Field Theory		x	x	
17 Apr – 5 May	Michael Grinfeld, Strathclyde	Asymptotics			x	
17 Apr – 5 May	Juerg Weber, Western Australia	Insurance Economics			x	
8 – 19 May	Bubacarr Bah and Franck Kalala Mutombo, AIMS South Africa	Data and Networks			x	
22 – 26 May	Steve Bellan, Austin & Rebecca Borchering, Florida	Mathematical Modelling in Medicine			x	x
29 May – 9 June	Steve Bellan, Austin & Rebecca Borchering, Florida	Meaningful Modelling of Epidemiological Data			x	x
12 – 30 June	Montaz Ali, Witwatersrand	Discrete Optimization in Big Data			x	
12 – 30 June	Jeff Sanders, AIMS South Africa	Designing Algorithms			x	

## MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2016 INTAKE)

Twelve students undertook this programme, including ten South Africans, one Egyptian and one Kenyan. All graduated and six research projects in Financial Mathematics, five in Applied Mathematics/Statistics and one in Pure Mathematics were produced. Of those, ten were graded as "Good", while two received a "Pass" grade. One student was required to submit a revised research project and did so to the satisfaction of the examiners.

## MASTER'S IN MATHEMATICAL SCIENCES (AUGUST 2016 INTAKE)

There were 49 students from 16 countries in the August intake, of whom 39% were women. About 20% of the students chose research projects in Data Science compared with none last year. Furthermore, students organised a weekly evening seminar on Data Science and a team worked on a competition problem in the December break. Data Science is expected to be an important research area in the foreseeable future, both for our Master's students and in the Research Centre.

All students graduated – 25% with distinction, 57% were graded as "Good" and 18% received a "Pass" grade. One student was required to submit a revised research project, and did so to the satisfaction of the examiners.

Students	Gender	Origin	Research Project Title	Supervisors
1 Mxolisi Mlondolozu Nelson Bhengu	M	South Africa	Pricing a European Option by Fast Fourier Transforms and COS Method when the Underlying is a Geometric Brownian Motion.	S Mataramvura, Cape Town
2 Waleed Khaled Khalaf Hassaan	M	Egypt	Elliptic curves and modular forms	F Breuer, Stellenbosch
3 Maropeng Ronny Makgatho	M	South Africa	Pricing a Zero Coupon Bond in a Two Factor Mixed Vasicek Model	S Mataramvura, Cape Town
4 Sthabiso Siphamandla Mbongwa	M	South Africa	Pricing a Zero Coupon Bond in a Two Factor CIR Model	S Mataramvura, Cape Town
5 Sibonelo Saselihle Mlambo	M	South Africa	Models for The Optimal Control of Fisheries	JM Ngnotchouye, KwaZulu-Natal
6 Cebisile Innocentia Mthabela	F	South Africa	Deterministic and Stochastic Epidemiological Models	K Govinder, KwaZulu-Natal
7 Zuko Mthwesi	M	South Africa	Using distance sampling to infer animal density and abundance of Cape long-claw species in South Africa	I Durbach, AIMS/ Cape Town
8 Ndivhuwo Millicent Mudzudzanyi	F	South Africa	Principal Component Analysis in Finance	R Becker, AIMS
9 Mhlasakuleka Mvubu	M	South Africa	Stock Market Prediction using Artificial Neural Networks and Support Vector Machines	R Becker, AIMS
10 Siboniso Confrence Nkosi	M	South Africa	Pricing European options: A model-free approach	FJ Mhlanga, Limpopo
11 Vhahangwele Cedrick Ramuada	M	South Africa	Bayesian Estimation of the GARCH(1,1) Stochastic Volatility Mode	R Becker, AIMS
12 Josline Adhiambo Otieno*	F	Kenya	Using Agent-Based Simulation Models to Explore the Link Between the Degree Distribution of Recent Sexual Relationships and the HIV Incidence Rate Among 15-30 year old women	W Delva, SACEMA

\*Mastercard Foundation Scholar

There were 49 students from 16 countries in the August intake, of whom 39% were women.

**MR SIBONISO NKOSI**

AIMS South Africa 2016

Mr Siboniso Nkosi is from Mpumalanga Province, South Africa. He grew up in a village called Avontuur, where he had to walk a distance of about six kilometres each day to school and back for five years. His primary school maths teacher had at a very young age instilled a passion of mathematics and science in him.

He holds a BSc degree in Mathematics and Computer Sciences (2014) and a BSc Honours in Applied Mathematics (2015), completed at the University of Limpopo. He joined AIMS South Africa in January 2016 for the structured Master's degree.

He states that during his time at AIMS South Africa his knowledge of and capacity for the mathematical sciences grew as he was forced out of his comfort zone and pushed to his limits by the programme. However, the support structure at AIMS and his resilience pulled him through.

"To be taught and mentored by professors and doctors from all over the globe was an inspiration. I was deeply moved when I met one of the great researchers, Prof. Rafal Lochowski, in the discipline of financial mathematics, as I had been citing his papers."

"It would be a mistake not to mention the lifetime friendships and connections. I went to AIMS to study and I left with a family, one that will be close to my heart forever."

He is currently pursuing a research Master's degree in Financial Mathematics at the University of Limpopo, with the support of post-AIMS half-bursary funding.

**MS FUNMILAYO LYDIA MAKINDE**

AIMS South Africa 2017

Ms Funmilayo Lydia Makinde, from Nigeria, graduated from the University of Jos (Nigeria) with a BSc Honours in Mathematical Sciences. "As an undergraduate, my exposure to different fields of mathematics was interesting, but what was more enthralling to me was my exposure to modelling biological systems. For me it was very real and relevant to society. I saw the possibility of using my mathematical ingenuity to transform society, either by developing models that can help understand and tackle diseases or through some other substantive techniques."

Being awarded a scholarship to study at AIMS South Africa in 2016 was a dream come true as she believes AIMS equipped her with both the scientific and technical skills needed to fulfil her dream, and she was able to join the struggle against cancer in the process. Her research project was titled: 'Investigating Cancer Evolution Based on Tumor Micro-Environment Dynamics' under the supervision of Dr Gaston Kuzamunu Mazandu, the IDRC Junior Research Chair, based in the AIMS South Africa Research Centre.

"AIMS made us see how important mathematics is to our society, be it in industry, finance, data analysis, or biomathematics, and it has equipped us with different skills such as problem solving, scientific computing, English proficiency, presenting, entrepreneurship and research, to mention but a few. Another lovely experience was working with people with diverse cultures and backgrounds, the friendly atmosphere created by both academic and non-academic staff of AIMS and being taught by renowned lecturers from all over the world, who are experts in their respective fields. I'm so glad to be part of the AIMS family. Thank you AIMS for making me a better person, a better scientist and together we shall make Africa better."

She will be pursuing a research Master's in the AIMS South Africa Research Centre.

**MS CHINENYE JANE ANI**

AIMS South Africa 2017

Ms Chinenye Jane Ani from Nigeria, holds a BSc degree in Mathematics, completed at the University of Jos, Nigeria, in 2015. During her undergraduate studies, her lecturer, Dr Tokunbo Akinola, who is an AIMS 2005 alumnus, told her about AIMS. On completing her undergraduate studies, she was awarded a Mastercard Foundation Scholarship to study at AIMS South Africa where she graduated with distinction. She is currently a research Master's student at UCT.

"My time at AIMS was exciting and productive. AIMS provided an opportunity for me to live and learn with people from diverse cultures and to be taught by world-class scientists. I was taught mathematics from a different perspective. I realised that mathematics is beyond theorems and proofs, solving equations and mastery of mathematical formulas. Its beauty lies in its priceless role as a tool for solving real life problems."

She believes the AIMS writing club, headed by Ms Noluvuyo Hobana created an opportunity for her rebirth as a scientific communicator. "I was given the confidence to participate in the writing category of the Young Science Communicators Competition (2017) and my article 'The fall of mathematics: A blessing or a curse?' was commended. I discovered that, as a scientist, my scientific knowledge should be communicated beyond the scientific community."

She has a strong desire to give back what she was given and plans to do what AIMS is doing: starting an NGO which makes primary education accessible to children in rural communities in Nigeria. "I strongly believe that this dream of mine will come to pass because, before AIMS, I was an African woman but I left AIMS as an extraordinary African woman."

# RESEARCH PROJECTS PHASE

	Students	Gender	Origin	Research Project Title	Supervisors
1	Bashirat Omobolaji Abdullahi	F	Nigeria	Machine Learning using $k$ Nearest Neighbours in Customer System and Sensor Applications	S Utete, AIMS
2	Evelyn Aboagye	F	Ghana	Recursive Functions and Incompleteness	G Boxall, Stellenbosch & G Anegg, AIMS
3	Tawakalt Aboosed Alade	F	Nigeria	Models of Within Host Virus Infection With Equine Infectious Anemia Virus (EIAV)	EJ Schwartz, Washington State
4	Chinenye Jane Ani*	F	Nigeria	Chaotic Behaviour of Hamiltonian Systems: Application to Plasma Physics	H Skokos, Cape Town
5	Nigist Getachew Beyene*	F	Ethiopia	Analytical tools for the study of Cepheid and other variable stars	L Leeuw, UNISA & P Okouma, UWC/UNISA
6	Gloria Burengengwa*	F	Burundi	Valid Inequalities for the Quadratic Knapsack Problem	TDV Satyanaraya & FD Fomeni Lancaster University Management School, UK
7	Gekonga Wanchoke Chacha	M	Tanzania	Ducci Sequences	F Breuer, Stellenbosch
8	Prudence Djabga	M	Benin	Nearfields	KT Howell, Stellenbosch
9	Stephen Dzaka	M	Ghana	Dynamical Systems on Geometric Structures	FG Russo & D Erwin, Cape Town
10	Samuel Asuquo Edet	M	Nigeria	Recurrent Neural Networks in Forecasting S&P 500 index	R Becker & B Bah, AIMS
11	Ehsan Khalid Nasr Elameen*	F	Sudan	Cosmological Evolution in a Chaplygin Gas Dominated Universe	A Abebe, North-West
12	Reem Omer Mohammed Elmahdi*	F	Sudan	Detecting Outliers in Datasets Using Machine Learning	M Lochner, AIMS
13	Exavery Philemon Enoch	M	Tanzania	Ordinals and Cardinals	G Boxall, Stellenbosch & G Anegg, AIMS
14	Daniel Aricho Gaenore	M	Ethiopia	Linearization and convexification of binary quadratic programming	M Ali, Witwatersrand
15	Mahouco Anicet Hounkanrin	M	Benin	Non-standard Analysis	G Boxall, Stellenbosch & G Anegg, AIMS
16	Abdulrahman Adebola Iyaniwura	M	Nigeria	Compressed Sensing: Exploiting Redundancy in Data	B Bah, AIMS
17	Jacob Emanuel Joseph	M	Tanzania	Information Theoretical Approach in Quantification of DNA Storage Device Capacity	W Ndifon, AIMS
18	Harun Humphrey Kabalika	M	Tanzania	CO <sub>2</sub> Dispersion in the Atmospheric Boundary Layer	S Galmarini, EC/ Joint Research Centre
19	Emmanuel Kabuga	M	Burundi	Predicting Next Purchase Probabilities using Random Survival Forests	I Durbach, AIMS/Cape Town
20	Timothy Kiprotich Langat	M	Kenya	Survival Analysis in Statistical Modelling	VA Djeundje Biatat, Edinburgh
21	Annour Abdallah Mahamat	M	Chad	Optical Character Recognition and Analysis of Historic Data	BM Herbst, Stellenbosch
22	Funmilayo Lydia Makinde	F	Nigeria	Investigating Cancer Evolution Based on Tumor Micro-Environment Dynamics	GK Mazandu, AIMS
23	Thabang Michael Mathonsi	M	South Africa	Estimating Integrated Volatility and its Applications	RM Łochowski, AIMS/Warsaw School of Economics & E Aidoo, Barclays Africa Group
24	Boitumelo Bridgette Matlapeng	F	South Africa	The Vanna Volga Method in Equity Options Market	D Ikpe & E Aidoo, UNISA
25	Janeth Pancras Mchwampaka*	F	Tanzania	Modelling the End-Stage Renal Disease Epidemic among HIV-Infected Individuals in South Africa	EJ Schwartz, Washington State
26	Mostafa Abdelrehim Abdelkader Mohamed	M	Egypt	Modelling of Diffusion during Solidification of an Fe-C Alloy	N Mohamed, Stellenbosch
27	Nosiba Tagalsir Alhassan Mohammed*	F	Sudan	A computer program that calculates the activity in the decay series of Radon-220 using the Bateman equation	R Lindsay, Western Cape
28	Desiree Taliane Mpassi Mahinga*	F	Congo Brazzaville	Dispersion of Chemically Reactive Species in the Atmospheric Boundary Layer	S Galmarini, EC/Joint Research Centre
29	Cikala Joslain Mpiana	M	DRC	Trust In Semantic Mapping With Social Media Data	S Utete, AIMS
30	Emily Shobana Muller	F	South Africa	A Dynamic Approach for Longitudinal Network Analysis: the Stochastic Actor-Oriented Model	FK Mutombo, AIMS/Cape Town/ Lubumbashi
31	Morris Macharia Musyoka	M	Kenya	Machine Learning Techniques Used in the Study of Brain MRI Scans	J Shock, Cape Town
32	Brave Mwanza	M	Malawi	Generalised Linear Models Using Markov Chains Monte Carlo Method	VA Djeundje Biatat, Edinburgh
33	Samuel Ofosu Mensah	M	Ghana	Investigating Relationship Between Expressed Cancer Related Genes and Patient Survival	GK Mazandu & S Utete, AIMS
34	Oluwafunmilola Oluwatobiloba Olusanya	F	Nigeria	Optimal Stopping Problems Under Partial Information with Applications in Finance	D Ikpe, UNISA
35	Tanjona Radonirina Rabemananjara	M	Madagascar	Radiative Gluon Emission via MHV Techniques	WA Horowitz, Cape Town
36	Dimbinaiana Soanasolo Rafanoharana	M	Madagascar	Probing the Underlying Event in Z Boson Events at $\sqrt{s} = 7$ TeV Using Event Shape Variables with PYTHIA8 and MadGraph5_aMC@NLO	D Kar, Witwatersrand
37	Avotra Elie Rakotoarisoa	M	Madagascar	On the Estimation of Oceanic Inertial Oscillations	GPJ Diedericks & MF Maritz, Stellenbosch
38	Andriamahenina Ramanantoanina	M	Madagascar	The cubic surface and its lines	B Szendrői, Oxford & A Cazzaniga, AIMS/Stellenbosch
39	Valimbavaka Hosana Ranaivomanana*	F	Madagascar	Categorical Equivalence Between 2d TQFTs and cFAs	B Bartlett, Stellenbosch
40	Faratiana Brice Razakarinaro	M	Madagascar	Primes in Arithmetic Progressions	F Breuer & D Ralaivaosoa, Stellenbosch
41	Nihal Bahaa Anwer Razk*	F	Egypt	Jets in Switzerland	S Meehan, Washington & S Yacoub, Cape Town
42	Rita Sianga*	F	Zambia	RNA Evolutionary Models in Population-level Phylogenetic Analysis of HIV: Examining Assumptions and Limitations	W Delva & D Niyukuri, SACEMA
43	Felix Silwimba	M	Zambia	Parking Availability Prediction	SL Tilahun, Zululand
44	Asmaa Omer Tiraab Tbaeen*	F	Sudan	The Effect of Different Definitions of Community Matrix on the Stability of Ecological Networks	C Hui, AIMS/Stellenbosch & L Pietro, Stellenbosch
45	Mbuyi Theophile Tshibangu	M	DRC	Microbial Enhanced Oil Recovery: Modelling and Simulations	A Tambue, AIMS
46	Bernard Musyoki Wambua	M	Kenya	Model Theory of Real-Closed Fields	G Boxall, Stellenbosch & G Anegg, AIMS
47	Evans Yeboah	M	Ghana	Modelling Consumer Choice using Compositional Data Analysis	I Durbach, AIMS/Cape Town
48	Smegnsh Demelash Yeruk*	F	Ethiopia	Intersection of Ideals in Polynomial Rings over a Field	ASE Mialebama Bouesso, AIMS
49	Mohammed Hamid Dodeh Younis	M	Sudan	The topology of the nonabelian tensor square of groups	FG Russo & D Erwin, Cape Town

\*Mastercard Foundation Scholar





## MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2017 INTAKE)

Once again, twelve students are undertaking this programme, with 11 from South Africa and one from Nigeria. One student withdrew after a couple of months and will return for the next academic year. Students are currently undertaking research projects: four in Financial Mathematics; six in Applied Mathematics/Statistics/Data Science; and two in Pure Mathematics. Oral examinations will be conducted in November 2017.

Students	Gender	Country	Previous Institution
Tasiu Yusuf Abdullahi	M	Nigeria	Amaru Musa Yaradua
Mncedisi Comfort Ketwa	M	South Africa	Fort Hare
Thabang Doreen Lebeso	M	South Africa	Witwatersrand
Daniel Mashishi	M	South Africa	Limpopo
Oratilwe Penwell Mokoena	M	South Africa	Sefako Makgatho
Ndamulelo Mudau	F	South Africa	Venda
Boipelo Sihle Ncube	F	South Africa	Sefako Makgatho
Mulalo Netshithuthuni	M	South Africa	Limpopo
Rendani Emmanuel Tshisikule	M	South Africa	Venda
Shane Van Graan	F	South Africa	North-West
Noluvuyo Yumata	F	South Africa	Rhodes

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

For the past nine years, AIMS South Africa has collaborated 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 taking extra courses and undertaking their research projects.

The five students enrolled in the 2017 programme are: Jeremy Luke Bingham, Tremaine W Robertson, Matlou Simeon Kubyana, Wynand van Staden and Melissa RA Jacobs. The future of this programme is currently under discussion with its other stakeholders, SU and the South African Centre for Epidemiological Modelling and Analysis (SACEMA).



Six students graduated at the end of 2016, with final defences of a particularly high standard.

## THE AIMS ESMT INDUSTRY IMMERSION PROGRAMME

In July, AIMS and ESMT Berlin launched the AIMS ESMT Industry Immersion Programme (AIMS ESMT IIP) at AIMS South Africa. The general level of preparedness of graduates from universities in Africa for positions in industry is low, as universities do not always see practical training as part of their role. The goal of the programme is to enable highly intelligent, scientifically trained African graduates to contribute to the economic transformation of Africa by immersing them in a practical, skills-based employability programme.

The programme is supported by the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD).

Thirty applicants from ten countries were selected from more than 220 applications and 23 of these enrolled at the start of the immersion programme. This first cohort has completed the first module of the programme at AIMS South Africa and are now doing their internships across Africa.



Companies represented are Siemens, B.Braun, Bosch, Evo-nik, Hatch, Khonology, Silvertree Capital, ENEO (Cameroon), Cameroon Development Corporation, Ghana Energy, IPMC Ghana and Kouaba (Cote d'Ivoire).



Recognition of Achievement Ceremony 2016

## JANUARY 2016 INTAKE

AIMS South Africa acknowledged the success of its fifth group of January-intake students at a special Recognition of Achievement Ceremony held on 22 November 2016. Eleven students (including nine South Africans) received their certificates. One student completed the programme during 2017.

Prof. Lerothodi Leeuw, School of Interdisciplinary Research and Graduate Studies, UNISA, was the main speaker. He told the students, "Mathematics and science is in your genes and it is part of your heritage. Don't let anyone tell you that science is not African. Look to find the joy in what you do and use the analytical tools that you have learnt to help change Africa and your own lives. The skills that this broad-based MSc has provided you with are very sought after in the world and, importantly, AIMS has not only provided you with mathematical skills but communication skills as well."

Mr Siboniso Nkosi, one of the student speakers, described his experience at AIMS as very challenging. Ms Millicent Mudzudzanyi advised her fellow students, "AIMS has transformed you, now it is time for you to use the skills that you have learnt and transform Africa."

Students officially graduated at their respective universities in 2017.



Prof. Leeuw



Ms Mudzudzanyi and Mr Nkosi

## AUGUST 2016 INTAKE

The 14<sup>th</sup> AIMS South Africa Graduation took place at the Muizenberg Pavilion on 20 June 2017 where 50 students (including 20 women) from 17 African countries were awarded a Master's in Mathematical Sciences.

The invited speaker at the event was Ms Naadiya Moosajee, Women-Eng Co-Founder, who encouraged the students to dream audacious dreams. "What you have now is a toolbox but what you do with the toolbox is up to you. The world is changing so quickly and we are living in unprecedented times. Every one of you can literally go and do anything you choose. I am so proud, as an African, to see the light shining through all of you today."

The ceremony was officiated by Prof. Vivienne Lawack, Deputy Vice-Chancellor Academic, University of the Western Cape; Prof. Wim de Villiers, Rector and Vice-Chancellor, Stellenbosch University; and Dr Max Price, Vice-Chancellor, University of Cape Town.

## AIMS ENDOWED SCHOLARSHIPS

AIMS Endowed Scholarships were awarded to a number of top achievers: Mr Tanjona Radonirina Rabemananjara from Madagascar, who received the Stephen Hawking Scholarship; Ms Funmilayo Lydia Makinde, from Nigeria, who received the Martin Rees Scholarship; Mr Morris Macharia Musyoka, from Kenya, who received the Paul G. Allen Scholarship; and Ms Emily Shobana Muller, from South Africa, and Ms Oluwafunmilola Oluwatobiloba Olusanya, from Nigeria, who each received a Victor Rothschild Scholarship.



AIMS South Africa Graduation 2017

"Coming to AIMS has changed our lives for good. Before AIMS, life for some of us was all about competition. AIMS taught us that the beauty of life is collaboration. Together, we stand to win, not just the battle but the war against indiscipline, corruption, poverty and underdevelopment in Africa." - Ms Chinenye Jane Ani (Nigeria).



AIMS Choir



Prof. Green, Mr Musyoka, Ms Makinde, Ms Muller, Mr Rabemananjara, Ms Olusanya and Prof. Mgwebi

Student	Gender	Country of Origin	Institution	Programme
<b>Graduates from January 2016 intake</b>				
Mxolisi Mlondolozu Nelson Bhengu	M	South Africa	Still exploring opportunities	
Waleed Khaled Khalaf Hassaan	M	Egypt	Still exploring opportunities	
Maropeng Ronny Makgatho	M	South Africa	Still exploring opportunities	
Sthabiso Siphamandla Mbongwa	M	South Africa	Still exploring opportunities	
Sibonelo Saselihle Mlambo	M	South Africa	Still exploring opportunities	
Cebisile Innocentia Mthabela	F	South Africa	Council for Scientific and Industrial Research	Robotics intern
Zuko Mthwesi	M	South Africa	Nelson Mandela University	PhD
Ndivhuwo Millicent Mudzudzanyi	F	South Africa	Still exploring opportunities	
Mhlasakululeka Mvubu	M	South Africa	Still exploring opportunities	
Siboniso Confrence Nkosi*	M	South Africa	University of Limpopo	Research Master's
Josline Adhiambo Otieno	F	Kenya	Kenya Methodist University	Lecturer
Vhangwele Cedrick Ramuada	M	South Africa	AIMS Research Centre/Stellenbosch	Research Master's
<b>Graduates from August 2016 intake</b>				
Bashirat Omobolaji Abdullahi	F	Nigeria	Still exploring opportunities	
Evelyn Aboagye	F	Ghana	University of Ghana	Graduate Assistant
Tawakalt Abosedo Alade	F	Nigeria	Still exploring opportunities	
Chinenye Jane Ani*	F	Nigeria	Cape Town	Research Master's
Nigist Getachew Beyene	F	Ethiopia	Still exploring opportunities	
Gloria Burengengwa	F	Burundi	Still exploring opportunities	
Gekonga Wanchoke Chacha	M	Tanzania	Still exploring opportunities	
Prudence Djangba*	M	Benin	Stellenbosch	PhD
Stephen Dzaka	M	Ghana	Still exploring opportunities	
Samuel Asuquo Edet	M	Nigeria	AIMS Research Centre/Stellenbosch	Research Master's
Ehsan Khalid Nasr Elameen	F	Sudan	Still exploring opportunities	
Reem Omer Mohammed Elmahdi*	F	Sudan	Stellenbosch	Research Master's
Exavery Philemon Enock	M	Tanzania	University of Dar es Salaam	Master's
Daniel Arficho Gaenore	M	Ethiopia	Still exploring opportunities	
Mahouclo Anicet Hounkanrin*	M	Benin	Cape Town	Research Master's
Abdulrahman Adebola Iyaniwura	M	Nigeria	Still exploring opportunities	
Jacob Emanuel Joseph	M	Tanzania	Still exploring opportunities	
Harun Humphrey Kabalika	M	Tanzania	Ardhi University	Tutor
Emmanuel Kabuga	M	Burundi	Still exploring opportunities	Research Master's
Timothy Kiprotich Langat	M	Kenya	University of Nairobi	Research Master's
Annour Abdallah Mahamat	M	Chad	Still exploring opportunities	
Funmilayo Lydia Makinde	F	Nigeria	AIMS Research Centre/Stellenbosch	Research Master's
Thabang Michael Mathonsi	M	South Africa	Still exploring opportunities	
Boitumelo Bridgette Matlapeng	F	South Africa	Still exploring opportunities	
Janeth Pancras Mchwampaka	F	Tanzania	Eastern Africa Statistical Training Centre	Assistant Lecturer
Mostafa Abdelrehim Abdelkader Mohamed	M	Egypt	Still exploring opportunities	
Nosiba Tagalsir Alhassan Mohammed	F	Sudan	Still exploring opportunities	
Desiree Taliane Mpassi Mahinga	F	Congo Brazzaville	Still exploring opportunities	
Cikala Joslain Mpiana	M	DRC	Still exploring opportunities	
Emily Shobana Muller	F	South Africa	AIMS Research Centre/Stellenbosch	Research Master's
Morris Macharia Musyoka*	M	Kenya	Cape Town	Research Master's
Brave Mwanza	M	Malawi	University of Livingstonia, Malawi	Lecturer
Samuel Ofosu Mensah	M	Ghana	AIMS Research Centre/Stellenbosch	Research Master's
Oluwafunmilola Oluwatobiloba Olusanya	F	Nigeria	Durham University	Taught Master's
Tanjona Radonirina Rabemananjara*	M	Madagascar	Cape Town	Research Master's
Dimbiniaina Soanasolo Rafanoharana*	M	Madagascar	Witwatersrand	Research Master's
Avotra Elie Rakotoarisoa*	M	Madagascar	Stellenbosch	Research Master's
Andriamahenina Ramanantoanina	M	Madagascar	CEU Budapest	Research Master's
Valimbavaka Hosana Ranaivomanana*	F	Madagascar	Stellenbosch	Research Master's
Faratiana Brice Razakarino	M	Madagascar	University of Padova, Italy/ Stellenbosch	ALGANT Master's
Nihal Bahaa Anwer Razk	F	Egypt	Still exploring opportunities	
Rita Sianga	F	Zambia	Cape Town	Research Master's
Felix Silwimba*	M	Zambia	Zululand	Research Master's
Asmaa Omer Tiraab Tbaeen	F	Sudan	Stellenbosch	Research Master's
Mbuyi Theophile Tshibangu	M	DRC	Cartesian Bilingual International School, Kinshasa	Teacher
Bernard Musyoki Wambua	M	Kenya	Kenya Electricity Generating Company	Finance Department
Evans Yeboah	M	Ghana	SIEMANS Ghana	AIMS-ESMT internship
Smegnsh Demelash Yeruk	F	Ethiopia	Still exploring opportunities	
Mohammed Hamid Dodeh Younis	M	Sudan	Still exploring opportunities	

## 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 studies at South African universities. This year, AIMS South Africa awarded ten such bursaries for Master's

study and one for doctoral studies. Recipients of these bursaries are asterisked in the table on page 10. A further five students who will be supported in the AIMS Research Centre are also noted.

## DAAD BURSARIES FOR DOCTORAL STUDY

This year, the German Academic Exchange Service (DAAD) generously awarded ten scholarships within its DAAD/AIMS agreement, which was signed in 2008. According to the agreement, in-region scholarships

are awarded annually and based on AIMS' review of applicants from sub-Saharan Africa (excluding South Africa) who have registered for PhD studies in the Mathematical Sciences at a South African university.

Students	Gender	Country of Origin	University
Denis Awamy	M	Uganda	Cape Town
Ife Elegbeleye	M	Nigeria	Venda
Bourgeois Biova Irénée Gadjagboui	M	Benin	Witwatersrand
Godfrey Kabungo Gakingo	M	Kenya	Stellenbosch
Elie Danien Rajaobelina Iarilala	M	Madagascar	Witwatersrand
Aweke Abebaw Mitku	F	Ethiopia	KwaZulu-Natal
Ayman Mohamed Elhadi Mohamed Kudoda	M	Sudan	Witwatersrand
Juliet Nagawa	F	Uganda	Cape Town
Chinenye Assumpta Nnakenyi	F	Nigeria	Stellenbosch
Nneka Ozioma Umeorah	F	Nigeria	North-West

In addition to the new awards, scholarships of 13 DAAD scholars in their second and third year of study were renewed.

Thirteen students who were awarded DAAD scholarships in previous years graduated.

## AIMS ALUMNI UPDATES

**Mr Lesiba Charles Galane**, an AIMS alumnus who is currently completing his PhD and lecturing at the University of Limpopo, won third prize at SAMS, hosted this year by UWC.

**Dr Serges Zambou**, (AIMS South Africa 2011) completed his PhD at the University of Cape Town and graduated on 20 December 2016. He is affiliated to the University of Yaounde 1 and was a visiting researcher in the AIMS South Africa Research Centre from 1 December to 20 January.

**Dr Nsonde Nsayi Jissy** (AIMS South Africa 2010) from Congo Brazzaville, graduated with a PhD in Pure Mathematics (Topology) on 19 September at the UNISA, Florida Campus. He was supervised by Prof. Themba Dube.

The following alumni are all studying at the University of British Columbia: **Ms Sarafa Iyanewura** (completed Master's, starting PhD, Mathematics), **Ms Mekdes Tessema** (PhD Geophysics), **Ms Jummy David** (PhD, Mathematics) and **Mr Felix Ogenekowho** (PhD, Geophysics).

**Dr Prosper Ngabonziza** (AIMS South Africa 2010) graduated with a PhD, from the University of Twente, the Netherlands, on 2 September.

**Dr Nouridine Siewe** (AIMS South Africa 2010) graduated with a PhD from Howard University, US, under the supervision of Prof. Abdul-Aziz Yakubu and Prof. Avner Friedman. He is now a postdoctoral fellow at the National Institute for Mathematical and Biological Synthesis (NIMBioS).

**Dr Guy Moise Dongho Nguimdo**, (AIMS South Africa 2012) graduated with a PhD from Wits University under the supervision of Prof. Daniel Joubert. He also completed a year working as a physics tutor at AIMS Cameroon. "I would like to take this opportunity to thank AIMS South Africa and DAAD for their financial support during my studies."



### MS XOLISILE THUSINI AIMS South Africa 2014

Ms Xolisile Thusini is currently completing her Research Master's in Particle Physics under the supervision of Dr Andrew Hamilton at UCT. Her research focuses on the discovery of the Higgs Boson and its properties. In 2016 she won the Tata Africa Master's Scholarship at the Women in Science Awards.

Enterprising from an early age, Xolisile began selling snacks during school breaks in her community of Nquthu in KwaZulu-Natal, South Africa, after her secondary school teacher explained how to count accumulated profit. "I wanted to generate my own profit," she says with a smile.

Xolisile remembers her community as always focusing on 'doctor' or 'engineer' as career options: "These options seem to be the most discussed options, particularly in rural areas but my first-year maths lecturer convinced me to choose maths and physics as careers in their own right."

It was not always easy, in fact, it was a "scary monster" at times. "Maths can be very challenging if there is no-one around with mathematical problem-solving skills. But no matter how difficult a subject, you can always find a way if you surround yourself with positive and encouraging people."

At AIMS, she discovered that it does not matter where you come from, what your gender is or how brilliant you were in your previous school – it is about dedication, hard work and loving what you do. She was impressed by the way the AIMS students worked together, talked about maths and proposed innovative ideas on how to apply it.

As a high-energy physicist, Xolisile is trying to understand the universe at the smallest scale, searching for the answers to 'What are the fundamental building blocks of nature?' and 'What is real mass?' "The impact of particle physics has gone beyond the textbook and laboratories," she says. "Research has revolutionised the way we think about the world around us, providing us with a better understanding of physics and chemistry. It has also had a great impact on other scientific fields and will help to equip the next generation of scientists with good computing skills."

As one of a growing group of black African women involved in scientific research, she hopes to empower and encourage many more young Africans to choose science.



### MR GIZAT DEREBE AMARE AIMS South Africa 2010

Recalling his introduction to mathematics during his childhood in Ethiopia, Mr Gizat Derebe Amare says "the game started" in grade four. His teacher that year piled math homework on the students every weekday and even more on the weekends. Some students may have been overwhelmed, but for Gizat this intensive experience was the time when he started loving the beautiful subject of mathematics.

Gizat was admitted to study at AIMS South Africa in 2009. He found the teaching methods completely different: the learning environment was more supportive than ever before. As he did in the fourth grade, Gizat thrived on the high intensity workload. In the end, he emerged with a better appreciation of the role of mathematics.

Following his graduation from AIMS, Gizat has joined the Arctic University of Tromsø, Norway, where his research applies mathematics to arctic safety. Using differential equations, he models the responses of platforms installed in the Arctic Ocean to wind, waves, currents and ice. This information is then used by engineers to create more reliable designs and improve the operational safety of the platforms. Just as recent technology has brought self-driving cars and drones, Gizat's field is now changing rapidly with the advent of autonomous marine vehicles. In addition to his work on marine platforms, he is exploring dynamic routings for autonomous marine vehicles in the arctic.

Few mathematicians can boast of careers spanning from the southern tip of Africa to the furthest northern reaches of Europe. Gizat's pursuit of mathematics, he says, "has been just a joyful journey."



### MS SARA ABASS AIMS South Africa 2008

Solar power holds the promise of revolutionising electricity in Africa. More than any other continent, Africa has a limitless supply of sunlight and land on which to build solar farms. Typically, power grid infrastructure has been poor, resulting in a lack of electrification in remote rural areas. In Ms Sara Abdelazeem Abass' home country of Sudan, only 35% of the population has access to electricity and for rural areas this figure drops to 21%. Although the Nile and its tributaries generate hydroelectricity for Sudan, many Sudanese still rely on diesel power generators for the distribution of power within Sudan, making it both a dirty and expensive form of electricity. Ensuring a future where Africa's growing population will have their electricity needs met demands innovative solutions both to reach the continent's least served areas and to transition to more sustainable power sources. Sara's research in solar power physics is a part of a push from African scientists to make this future a reality.

Sara grew up in northern Sudan. For as long as she can remember, she was extremely enthusiastic about studying mathematics. From her first simple introduction to numbers and learning to count in primary school, to studying calculus in preparation for university, the subject was always her main academic interest. She describes the challenge of mathematical thinking and how the process of logic always attracted her to mathematical problems, however difficult and regardless of the form in which they came. As she advanced to higher level study, she became increasingly intrigued by the applications of mathematics in the real world.

She attained her first degree in physics from the University of Khartoum. In 2007, she was accepted to study at AIMS South Africa. Her past experience with mathematics pedagogy had often left much to be desired, as students were expected to commit to rote learning or adherence to methodology. AIMS allowed students to explore their own ways of using mathematics and fostered their creativity. "I discovered my potential and what I am capable of. AIMS helped me to shape my purpose in life."

For her final AIMS research project, she studied electrical resistivity in semiconductors using the Van der Pauw method. Understanding the electric properties of semiconductors is fundamental to designing the most efficient photovoltaic cells in solar panels.

Sara is now pursuing a joint-PhD at the University of Khartoum and the International Centre for Theoretical Physics in Trieste, Italy, with a thesis topic exploring the energy applications of solar cells. Her passion for solar energy comes at a time when humans are realising that fossil fuels are finite, and measurements showing the increasing concentration of carbon dioxide in the atmosphere are alerting society to the severity of greenhouse gas emissions. In this context, she says, "securing safe and sustainable sources of energy is a key challenge for the future of humankind."

# RESEARCH

**T**he AIMS South Africa Research Centre was launched in May 2008. With support from the DST (through the NRF), the Canadian government (through the IDRC), the Bosch Foundation and the German government (through the BMBF), the centre has become well-established, with researchers working in several focus areas. With its focus on the basic sciences, AIMS plays a key role in scientific research and innovation in South Africa. The main, and unifying, theme of the centre is Mathematical Modelling in a Multidisciplinary Context.

## RESIDENT RESEARCHERS

The AIMS Research Centre currently hosts 16 resident researchers, including two NRF South African Research Chairs, two IDRC-AIMS Joint Junior Chairs and two AIMS ARETE Junior Research Chairs (funded by the Robert Bosch Foundation). Four new research appointments were made during this period: Dr Bubacarr Bah was appointed as the German Research Chair with a specialisation in Data Science; Dr Yabebal Fantaye was appointed as an ARETE Junior Research Chair in Applied Statistical Methods, Cosmology and Big Data; and Dr Rejoyce Gavhi-Molefe and Dr Michelle Lochner were appointed as resident researchers.

The researchers and administrative staff of the AIMS South Africa Research Centre held a meeting on 12 September. Discussions focused on the growth of the centre and attracting students.

In May, Dr Wilfred Ndifon was appointed as Research Director for the AIMS-NEI Network based in Kigali.



Researchers and students

	Name	Area of research		Name	Area of research
	Dr Bubacarr Bah, German Research Chair	Applied mathematics and computer science		Prof. Barry Green, Director	Algebra and Number Theory
	Prof. Bruce Bassett, Senior Resident Researcher	Cosmology and astrophysics		Prof. Cang Hui, South African Research Chair Mathematical and Theoretical Biosciences (SU/AIMS)	Mathematical and theoretical physical biosciences
	Prof. Ronnie Becker, Senior Resident Researcher	Mathematical finance		Dr Michelle Lochner, Resident Researcher	Statistics and machine learning applied to astronomy and cosmology
	Prof. Romeel Davé, South African Research Chair in Cosmology with Multi-wavelength Data (UWC/SAAO/AIMS)	Cosmology and astrophysics		Dr Gaston Kuzamunu Mazandu, IDRC Junior Research Chair	Biomathematics
	Prof. Johan de Villiers, Senior Resident Researcher	Analysis and approximation theory		Dr Wilfred Ndifon, IDRC, Junior Research Chair/Research Director, AIMS	Biomathematics
	Prof. Ian Durbach, Resident Researcher	Multi-criteria optimisation		Dr Antoine Tambue, AIMS ARETÉ - Junior Chair	Modelling with partial differential equations
	Dr Yabebal Fantaye, AIMS ARETÉ Junior Chair	Cosmology, big data and machine learning		Prof. Jeff Sanders, Academic Director	Theoretical computer science
	Dr Rejoyce Gavhi-Molefe, Resident Researcher	Computational mathematics: subdivision		Dr Simukai Utete, Senior Resident Researcher	Robotics

## ACHIEVEMENTS

- Prof. Green was elected president of CIMPA, the International Centre for Pure and Applied Mathematics, at a special meeting of its Governing Board in Nice at the end of January. The new Vice President, Prof. Annie Raoult (Paris) Secretary General, Prof. Iván Area (Ourense) and Treasurer, Prof. Marc Aubry (Nice), were elected at the same meeting. CIMPA is a (Category 2) Centre, founded in 1978 and based in Nice, France. Prof. Green takes over from Prof. Tsou Sheung Tsun (Oxford), who has also been closely involved with AIMS South Africa and is a former Council member.
- Mr Gershom (PhD student) was the winner of the Best Poster Presentation Award at the Annual Congress of the South Africa Mathematical Sciences Association, held from 21 to 24 November 2016 at the University of Pretoria.
- Prof. Bassett reached two milestones in the past year. He now has 100 papers with at least ten citations and two more of his papers also crossed the 500 citations mark at the end of 2016. A new book has been published in the Springer Series in Astrostatistics for which Prof. Bassett is a series editor. The book is titled: *Bayesian Methods for the Physical Sciences*.
- Mr Mootoaloo (Master's student) was awarded an Imperial College of London President's Scholarship to undertake a PhD in Cosmology.



Three new postdoctoral fellowships were awarded during this period.

Name	Citizenship	Gender	Start date to end date	Research Field	Supervisor/Host
Adabor, Emmanuel Sarkodie	Ghana	M	20 March 2016 – 28 February 2018	Applied mathematics	Dr W Ndifon
Agarwal, Shankar	India	M	1 April 2016 – 31 March 2018	Cosmology	Prof. B Bassett
Cazzaniga, Alberto	Italy	M	1 January 2017 – 31 December 2018	Algebraic Geometry, pure mathematics	Prof. B Green
Chule, Siyabonga	South Africa	M	1 October 2015 – 30 September 2017	Mathematical foundations and pure mathematics	Prof. B Green
Daverio, David	Switzerland	M	19 February – 1 September 2016	Cosmology and astrophysics	Prof. B Bassett
Gavhi-Molefe, Mpfareleni Rejoyce	South Africa	F	15 June 2013 – 31 December 2016	Optimal C3 interpolatory subdivision scheme with fractal curves	Prof. J de Villiers
Lablanche, Pierre-Yves	France	M	15 September 2015 – 30 October 2016	Cosmology and astrophysics	Prof. B Bassett
Mialebama Bouesso, Andre Saint Eudes	Benin	M	15 January 2015 – 31 December 2017	Mathematical Foundations and pure mathematics	Prof. B Green
Mutombo, Frank Kalala	Democratic Republic of Congo	M	1 February 2015 – 31 December 2018	Foundations of mathematics, pure mathematics	Dr A Tambue
Ramarihamanana, Nantsoina Cynthia	Madagascar	F	1 January 2017 – 31 December 2018	Coupling ecological and evolutionary dynamics	Prof. B Green
Vos, Etienne Eben	South Africa	M	1 September 2016 – 31 August 2019	Cosmology	Prof. B Bassett

The number of students hosted by the AIMS Research Centre and supervised by AIMS resident researchers totalled 49 during the period under review. The ten students who graduated are highlighted in the table below.

Name	Citizenship	Gender	Study duration	Supervisor	Based at
Attipoe, David	Ghana	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
Bahizi, Antoine	Rwanda	M	1 February 2013 (ongoing)	Prof. C Hui	SU
Bolton, Larisse	South Africa	F	1 February 2015 (ongoing)	Prof. C Hui	Free State
Degoot, Abdo Elnaser Mahmmod	Sudan	M	10 March 2015 (ongoing)	Dr F Chirove & Dr W Ndifon	UKZN
Dufourq, Emmanuel	South Africa	M	31 May 2015 (ongoing)	Prof. B Bassett	AIMS
Gershom, Buri	Uganda	M	6 September 2016 (ongoing)	Dr W Ndifon	AIMS/SU
Geza, Ephifania	Zimbabwe	F	24 August 2015 (ongoing)	Dr G Mazandu	AIMS/SU
Gill, Zoe	South Africa	F	17 May 2016 (ongoing)	Dr W Ndifon & Prof. Martin Nieuwoudt	SU
Jones, Samantha	South Africa	F	1 January 2015 (ongoing)	Prof. R Becker	UCT
Kassai, Eli	Namibia	M	1 March 2016 (ongoing)	Prof. B Bassett	AIMS/UCT
Koffi, Rock Stephane	Ivory Coast	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
Kamkuemah, Martha	South Africa	F	1 July 2016 (ongoing)	Prof. J Sanders	AIMS/SU
Masakuna, Jordan	Democratic Republic of Congo	M	7 February 2016 (ongoing)	Dr S Utete & Dr S Kroon	AIMS/SU
Mayekiso, Luthando	South Africa	M	23 May 2017 (ongoing)	Prof. C Hui	SU
Nnyakeni, Chinenye Assumpta	Nigeria	F	1 January 2017 (ongoing)	Prof. C Hui	SU
Nuwagaba, Savannah	Uganda	F	1 February 2013 (ongoing)	Prof. C Hui	SU
Rajaona, Fortunat	Madagascar	M	1 March 2013 - December 2016	Prof. J Sanders	AIMS/SU
Ramiharimanana, Cynthia Nantsoina	Madagascar	F	1 January 2014 - December 2016	Prof. M Jarden & Prof. B Green	AIMS/SU
Ranirina, Dinna	Madagascar	F	1 January 2015 (ongoing)	Prof. J de Villiers	AIMS/SU
Watson, Neil	South Africa	M	1 January 2016 (ongoing)	Prof. I Durbach	UCT

Name	Citizenship	Gender	Study duration	Supervisor	Based at
Amar, Gilad	South Africa	M	1 July 2014 – June 2017	Prof. B Bassett	AIMS/UCT
Amima, Innocenter	Kenya	F	15 January 2017 (ongoing)	Dr G Mazandu	AIMS
Atuhaire, Fatumah	Uganda	F	1 October 2015 (ongoing)	Prof. C Hui	AIMS
Cygu, Steve Bicko	Kenya	M	1 January 2016 (ongoing)	Prof. C Hui	SU
Djenabou, Karimatou	Cameroon	F	1 January 2017 (ongoing)	Prof. C Hui	SU
Dlamini, Gciniwe	South Africa	F	1 January 2015 (ongoing)	Prof. I Durbach	UCT
Dube, Qobo	Zimbabwe	M	1 January 2015 (ongoing)	Prof. I Durbach	UCT
Eteko, Kossi	Togo	M	1 March 2015 – July 2016	Dr A Tambue	AIMS
Geldenhuis, Frieda	South Africa	F	1 January 2016 (ongoing)	Prof. C Hui	SU
Hosenie, Zafirah Benon	Mauritius	F	1 February 2016 (ongoing)	Dr N Oozeer & Prof. B Bassett	NASSP/UCT
Kyomugisha, Irene	Uganda	F	1 February 2015 – March 2017	Prof. C Hui	SU
Lagat, Vitalis	Kenya	M	1 December 2015 – March 2017	Prof. C Hui	SU
Langat, Gilbert	Kenya	M	1 January 2017 (ongoing)	Prof. C Hui	SU
Mamba, Wanele Gcinumuzi	Swaziland	M	1 February 2015	Prof. J Sanders & Prof. R Becker	AIMS
Mgudla, Africa	South Africa	M	February 2015 (ongoing)	Prof. I Durbach	AIMS
Mohammed, Mozzamil	Sudan	M	21 September 2016 (ongoing)	Prof. C Hui	SU
Mootoovaloo, Arrykrishna	Mauritius	M	1 June 2015 – July 2017	Prof. B Bassett	AIMS/UCT
Namundjebo, Elia Nghilifavali	Namibia	M	1 January 2015 – December 2016	Prof. J Sanders & Prof. R Becker	AIMS/SU
Nnyakeni, Chinenye Assumpta	Nigeria	F	1 July 2015 – December 2016	Prof. C Hui	SU
Mvubu, Mhlasakululeka	South Africa	M	1 February 2017 (ongoing)	Prof. R Becker	AIMS
Nyanzi, Alice	Uganda	F	15 January 2017 (ongoing)	DR F Kalala-Mutombo & Dr S Utete	AIMS
Olaleye, Kayode	Nigeria	M	15 January 2017 (ongoing)	Dr Y Fantaye	AIMS
Phaweni, Thembani	South Africa	M	1 February 2015 – July 2017	Prof. I Durbach	AIMS/UCT
Qokoqa, Nolubabalo	South Africa	F	15 January (ongoing)	Dr G Mazandu	AIMS
Ramolotia, Kagiso	South Africa	M	1 May 2016 (ongoing)	Prof. C Hui	SU
Ramuada, Vhahangwele Cedrick	South Africa	M	1 February 2017 (ongoing)	Prof. R Becker	AIMS
Roberts, Ethan	South Africa	M	1 July 2016 (ongoing)	Dr N Oozeer & Prof. B Bassett	AIMS/UCT
Tetteh, Josephine	Ghana	F	15 January 2017 (ongoing)	Prof. C Hui	SU
Van Schalkwyk, Helene	South Africa	F	1 February 2015 – December 2016	Prof. C Hui	SU

## PRESENTATIONS AT WORKSHOPS AND CONFERENCES

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

- Dr Mialebama Bouesso attended the **School and Workshop in Homological methods in Algebra and Geometry**, hosted by AIMS Ghana and done in collaboration with the Abdus Salam International Centre for Theoretical Physics (ICTP) from 1 to 12 August.
- The Operations Research Society of South Africa hosted a conference from 11 to 14 September in Stellenbosch. Prof. Durbach gave a talk titled: 'Fast-and-frugal heuristics for portfolio decision analysis.' Two AIMS alumni currently doing PhDs at SU were also present, namely Mr Noe Fouotsa Manfouo (AIMS Cameroon) and Ms Georgina Rakotonirainy (AIMS South Africa).
- Prof. Bassett, Prof. Davé, Dr Oozeer and Dr Lochner were all in attendance at the **SKA SA postgraduate bursary conference** to support their students and leverage the opportunity to reconnect with colleagues from all around the world. Mr Mootoovaloo gave an excellent presentation on his work in 'Bayesian Methods in Radio Astronomy' and Ms Hosenie's poster on 'Source Classification and Cluster Detection using Machine Learning' was very well received.
- **The Southern Africa Mathematical Sciences Association Annual Conference**, hosted by the University of Pretoria was held from 21 to 24 November. Dr Bah gave a plenary talk and Mr Gershom and Mr Masakuna both attended.
- Dr Kalala, Dr Mialebama Bouesso, Ms Ranirina, Dr Chule and Dr Adabor all attended and gave talks at the **SAMS Conference** held at Ratanga Junction from 2 to 4 November 2016. Dr Mutombo chaired one of the sessions.
- Prof. Bassett was a panellist on the 'Strengthening Africa's Innovation Ecosystem' discussion at the 2016 **South African Science Forum**. Mr Mootoovaloo was also in attendance at the meeting.

- On 1 December, Dr Utete, 12 Master's students (August intake) and two IT interns attended the **Open Evening Expo 2016** (hosted by the Department of Computer Science at UCT).
- Dr Mialebama Bouesso gave a talk at the 2<sup>nd</sup> Colloquium on the **Practice of Modelling and Numerical Simulation** held at Marien Nguabi University in Brazzaville on 22 March.
- Prof. Bassett and Dr Lablanche attended the **Big Data Africa Summer School**, organised by the SKA and SAMRC and held in Cape Town from 2 to 12 April. Prof. Bassett was an invited lecturer and Dr Lablanche was a facilitator. Dr Bah and Ms Amima also attended the workshop.
- On 11 May, Prof. Bassett gave a talk titled: 'The limits of artificial intelligence' at a colloquium hosted by the Department of Mathematics and Applied Mathematics, UCT.

## 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. Over 30 talks on a range of subjects took place during the period. Below are some highlights from members of the Research Centre:

- Mr Gershom spoke on 'Differential expression analysis of count data: a bottom-up approach'.
- Ms Geza spoke on 'The evolution of ancestry deconvolution'.
- Dr Ramiharimanana spoke on her research on 'Embedding problems and minimal ramification'.
- Dr Cazzaniga, a Claude Leon Postdoctoral Fellow, gave a talk titled: 'The ADE classification and related invariants'.
- Dr Bah described his research on 'Bounds of restricted isometry constants for Gaussian matrices'.

Visitors also spoke in the series:

- Prof. Elissa Schwartz (Washington State University) gave two Journal Club talks on: 'Modelling immune system evasion by HIV and similar retroviruses', and 'Free-virus and cell-to-cell transmission in models of equine infectious anemia virus infection'.
- Prof. Jane Hutton (University of Warwick) spoke on 'Missing data and how to see biased results'.
- Dr Ali Zahabi (University of the Witwatersrand and Queen Mary University of London) gave a talk titled: 'Universality in integrable combinatorics/probability: the curious case of generalized XXO spin chain'.

The Journal Club has welcomed back AIMS alumni as speakers on a number of occasions. In June, Mr Audace Amen Vioutou Dossou-Olory, an AIMS South Africa alumnus, now at SU, returned to AIMS to talk about his PhD research on extremal graph theory and combinatorics.



Prof. Schwartz

Highlights from this year's Cosmology Group Seminars:

- On 12 September, Dr Pierre Fleury (University of Geneva, Switzerland) gave a seminar titled: 'Stochastic gravitational lensing'.
- On 8 February, Dr Benjamin Racine (University of Oslo, Norway) gave a seminar titled: 'B modes: component separation using Gibbs sampling in the context of the SPIDER experiment'.
- On 6 March, Dr Simone Aiola (Princeton University, US) gave a talk titled: 'Cosmological Results From Two-Season ACTPol Data.'

Other seminars for the year included:

- 'Science and our future,' by Prof. Neil Turok, Chairman of the AIMS Board (Perimeter Institute for Theoretical Physics) on 24 August. A video of the talk can be viewed at <https://youtu.be/qBmWMGRGbyE>. On 28 February, he also gave a talk to the students on the 'Seven New Planets'.
- 'How do children learn to read? Using statistics to understand how biology and experience shape cognitive development,' Dr Kaja Jasinska (Yale University, US), 28 September.
- On 16 February, Prof. Theis Lange (University of Copenhagen, Denmark) gave a seminar in which he discussed parametric volatility models (GARCH) and how one can use these models to feed into the pricing of options (European call options using the famous Black-Scholes formula).
- On 23 February, Prof. Balazs Szendroi, AIMS South Africa Council member (University of Oxford) gave a lecture titled: 'Algebraic Curves: Geometry, Algebra and Number Theory.'



Prof. Turok



Dr Zahabi

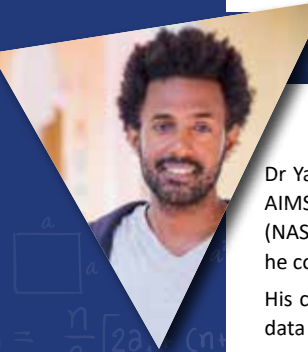


## DR BUBACARR BAH

Dr Bubacarr Bah is the German Research Chair of Mathematics, with specialisation in Data Science, at AIMS South Africa. He is an applied and computational mathematician and his research interest is at the intersection of Applied Mathematics and Computer Science. He has worked in the general area of signal and data processing and machine learning, with particular focus on the design and analysis of sampling strategies and algorithms for compressed sensing and learning linear embeddings of high-dimensional data sets. Some of his work relates to random matrix theory and numerical linear algebra, while some relates to scientific computing and the use of high performance computing (HPC) resources. He obtained a PhD in applied and computational mathematics at the University of Edinburgh, Scotland, under the supervision of Prof. Jared Tanner. His PhD research was on compressed sensing, in particular, on random matrix theory questions arising from compressed sensing and signal processing in general.

His first postdoctoral fellowship was at the Laboratory for Information and Inference Systems (LIONS) in Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland. His second was at the Department of Mathematics and the Institute of Computational and Engineering Sciences (ICES) at the University of Texas at Austin.

As the German Research Chair at AIMS, his research now focuses on data science. He plans to develop a vibrant research group on data science: conducting research in foundational mathematical and computational methods and techniques (modelling, sampling, algorithms, etc.) for data science problems from biomedical sciences, engineering, social sciences, etc. There is a wide range of data science problems in Africa from (e.g. finance, biomedical sciences, manufacturing, power systems, transportation) that are in need of data science research and technologies to improve efficiency and effectiveness of systems. It is envisaged that the research output from this Chair will have a significant impact on industries in South Africa, Africa in general and Germany via the collaboration with German researchers. Furthermore, the Chair gives Dr Bah the opportunity to engage in other academic activities that will contribute to the development of mathematics research and education in Africa.



## DR YABEBAL FANTAYE

Dr Yabebal Fantaye holds the ARETÉ Junior Research Chair in Applied Statistical Methods, Cosmology and Big Data and is based at AIMS South Africa. Dr Fantaye completed his Master's degree at UCT through the National Astrophysics and Space Science Programme (NASSP) and his PhD at the School for Advanced Studies (SISSA) in Trieste, Italy. Before taking up the ARETÉ Chair position in June 2016, he completed postdoctoral research fellowships at the University of Oslo, Norway, and at the University of Rome Tor Vergata, Italy.

His current work is in the investigation of the statistical properties of the Universe using the Cosmic Microwave Background (CMB) data from the Planck satellite. He also works on big data analysis and has contributed to the creation of computer software for public use. As the ARETÉ Chair, he will train young African scientists on big data techniques, which are indispensable tools to efficiently manipulate and mine cutting-edge astronomical data from large African radio experiments for e.g. MeerKat, SKA. His other main interest is leveraging astronomy data skills to help extract key insights from complex African social data.

Dr Fantaye sees the AIMS ARETÉ Research Chair position as an ambitious, unique, forward-looking and generous position, which he says he is delighted to hold: "This provides a unique platform for me to be part of Africa's transformation and an opportunity to make a real difference through research within the mathematical sciences." He will also be collaborating with institutions in his home country, Ethiopia, while building and fostering global research collaborations: "With Africa hosting world-leading initiatives like the SKA, Africa is positively transforming itself in all dimensions."



## DR MICHELLE LOCHNER

Dr Michelle Lochner is a Resident Researcher at AIMS South Africa. This is a joint position that was made possible through a collaboration between the SKA and AIMS South Africa.

Born in South Africa, Dr Lochner loved the stars from an early age and was driven by a need to understand the world around her. She obtained her undergraduate degree in Physics and Electronics from Rhodes University, where she first heard about the SKA, the biggest radio telescope in the world, currently being built in South Africa and Australia. Inspired by the SKA, she pursued her dream of becoming an astronomer by continuing her studies at UCT. She obtained her PhD under the guidance of Prof. Bruce Bassett, focusing on developing new statistical techniques in Cosmology and Radio Astronomy. Afterwards, she moved to the UK to take up a postdoctoral fellowship at University College London, where she worked on using machine learning for automatic classification of supernovae, the explosive deaths of massive stars.

As a Resident Researcher, Dr Lochner is focusing on using machine learning for the next generation of telescopes, especially the SKA and the Large Synoptic Survey Telescope, as well as applying statistical algorithms to leverage the massive datasets of these two telescopes. "I enjoy being part of the lively research group at AIMS, as well as being involved in the exciting development of the SKA."

In addition to her scientific research, she also runs a mentoring programme called the Supernova Foundation, designed to address the gender gap in physics by pairing undergraduate women, particularly those from developing countries, with senior women researchers from around the world. With the support and guidance of mentors, these students are more likely to pursue careers in physics and succeed in this traditionally male-dominated environment.

In 2016/17 the Research Centre hosted 36 visiting researchers. Seventeen of these researchers were affiliated to African institutions and six 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
Abiodun, Babatunde	Nigeria	M	University of Cape Town	Atmospheric Modelling	16 – 30 November 2016
Adewumi, Aderem	South Africa	M	University of Kwazulu-Natal	Computer Science	26 – 29 August 2016
Amara, Adam	Switzerland	M	ETH Zurich	Cosmology and Astrophysics	1 – 3 September 2016
Babindamana, Regis Freguin	Republic of Congo	M	University of Marien Ngouabi	Algebra and Cryptography	19 November – 15 December 2016
Banda, Mapundi Kondwani	Malawi	M	University of Pretoria	Numerical Analysis and Scientific Computing	9 July – 18 August 2017
Beardon, Alan	United Kingdom	M	Cambridge University	Pure Mathematics	14 June – 21 July 2016
Belobo, Didier	Cameroon	M	University of Yaoundé 1	Nonlinear Physics	1 September – 31 October 2016
Chere, Nega Arega	Ethiopia	M	Addis Ababa University	Algebra	3 April – 2 May 2017
Cole-Rhodes, Arlene	United States	F	Morgan State University	Electrical and Computer Engineering	8 – 12 May 2017
Fabris-Rotelli, Inger	Italy	M	University of Pretoria	Machine learning, statistics	22 – 23 August 2016
George, Blesson	India	M	St. Thomas College, Kerala	Cosmology, Machine Learning	13 – 28 November 2016
Hawkins, Rhoda	United Kingdom	F	University of Sheffield	Theoretical Physics	24 October – 4 November 2016
Houedanou, Koffi Wilfrid	Benin	M	Institut de Mathematiques et de Sciences Physique (IMSP)	Functional Analysis (Foundations of Mathematics)	28 January – 26 March 2017
Ihl, Matthias	Germany	M	University of Porto	Physics	1 July – 31 December 2017
Johnston, Simon	United Kingdom	M	University of Sheffield	Biochemistry	24 October – 4 November 2016
Jonvik, Sara	Norway	F	University of Oslo	Astrophysics/Observational Cosmology	20 May – 2 June 2017
Kara, Abdul Hamid	South Africa	M	University of Witwatersrand	Differential Equations	30 September – 7 October 2016
Kenfack Sadem, Christian	Cameroon	M	University of Dschang	Condensed Matter Physics	3 February – 30 March 2017
Koblitz, Neal	United States	M	Washington State University	Number Theory	26 – 29 November 2016
Kouemo Djoukoue, Derille	Gabon	M	University of Franceville	Pure Mathematics (Foundations of Mathematics)	10 February – 31 March 2017
Lochowski, Rafal Marcin	Poland	M	Warsaw School of Economics	Stochastic processes and their application in Mathematical finance	24 August – 14 September 2016 23 March – 23 April 2017
Mabula, Mokhwetha	South Africa	M	University of Pretoria	Functional Analysis	4 June – 5 July 2017
Mathibela, Bonolo	South Africa	F	IBM Research South Africa	Engineering Science (Data Science and Information Systems)	14 – 17 February 2017
Nandi, Diptatup	India	M	Indian Institute of Science	Biology and Statistics	9 February – 7 May 2017
Nang, Philibert	Gabon	M	University of Franceville	Algebraic Analysis: D-modules, perverse sheaves (Foundations of Mathematics)	10 February – 31 March 2017
Philip, Ninan Sajeeth	India	M	St. Thomas College, Kerala	Cosmology, Machine Learning	13 – 28 November 2016
Photopoulou, Theoni	South Africa	F	University of Cape Town	Biology and Statistics	30 September – 31 October 2016
Refregier, Alexandre	Switzerland	M	ETH Zurich	Astronomy, Dark Energy	1 – 3 September 2016
Salako, Godonou Ines	Benin	M	University of Abomey-Calavi	Cosmology	7 September – 31 October 2016
Sango, Mamadou	South Africa	M	University of Pretoria	Partial Differential Equations, and Differential Geometry	25 June – 16 July 2017
Schwartz, Elissa	United States	F	Washington State University	Biomedical Sciences	18 November – 31 May 2017
Smith, Robert	United States	M	University of Ottawa	Mathematics and Epidemiology	22 - 26 May 2017
Vafaei Sadr, Alireza (PhD student)	Iran	M	University of Tehran	Physics, Cosmology	18 May – 31 August 2017
Zambou, Serges	Cameroon	M	AIMS alumnus	Physics	1 December 2016 – 21 January 2017
Zahabi, Seyedali	Iran	M	Wits University	Theoretical and Mathematical Physics	5 – 10 June 2017
Zintl, Joerg	Germany	M	University of Kaiserslautern	Algebraic Geometry	21 April – 2 June 2017

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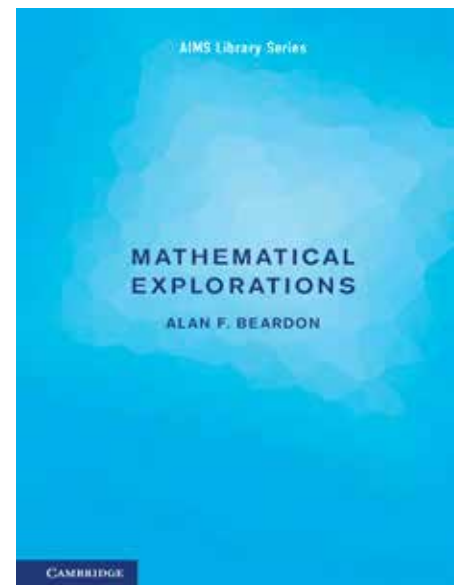
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## AIMS LIBRARY SERIES

The eighth book in the AIMS Library Series titled, *Mathematical Explorations* by Alan F Beardon was published in 2016.

Prof. Beardon continues as the editor of the AIMS Library Series. The texts are published by Cambridge University Press, and are intended to cover as diverse a range of mathematics and its applications as possible, roughly at a level of the AIMS lecture courses.



**D**uring the period under review, AIMS researchers hosted 17 workshops and conferences with 13 of these being held at AIMS South Africa. Many of these were held in collaboration with other organisations, including the University of the Witwatersrand, the University of Illinois at Urbana Champaign, SACEMA, SU, UCT and the Square Kilometre Array (SKA).



#SciComm@AIMS

### Science Communication and Engagement Workshop - #SciComm@AIMS

This workshop, sponsored by the British Council Newton Fund and Organization for Women in Science for the Developing World through the Academy of Science South Africa, was hosted by AIMS South Africa on 26 August. It was aimed at equipping the 50 participants, who were made up of 25% researchers, 35% PhD and 40% Master's students, with communication and engagement skills allowing them to communicate with different stakeholders at all stages of research.

"Participants, who came from all over South Africa (and one was from as far afield as the University of California), had very diverse research backgrounds. This made the workshop an excellent opportunity and platform for collaboration and networking with peers. As we are celebrating women's month, we were thrilled to see that 46% of participants were women," said Dr Gavhi-Molefe, one of the workshop organisers.



Computing in the Financial World

### Workshop on Computing in the Financial World

This workshop for senior undergraduates (3<sup>rd</sup> year) and honours students in mathematics, computing or statistics was held at AIMS South Africa from 28 November to 2 December 2016. It was attended by 29 participants from the universities of: Venda; Zululand; Cape Town; Stellenbosch; South Africa; Limpopo; Johannesburg; Witwatersrand; Pretoria and AIMS South Africa. It was organised by Prof. Ronnie Becker and Prof. Jeff Sanders.



JEDI.mz workshop

### JEDI.mz workshop

Funded by the IAU, the Office of Astronomy for Development and SKA, this workshop, based on the Joint Exchange Development Initiative (JEDI), was held in Mozambique from 26 to 30 September. It was aimed at exposing the 13 participants (young Mozambican university lecturers and students) to research in Astronomy and Astrophysics. It provided hands-on projects where the students learnt about radio astronomy, astrophysics, cosmology and data analyses, encouraging some of the students and university lecturers to go into research careers in the field. The JEDI Project Leader was Mr Claudio Paulo, and the team was made up of Prof. Bruce Bassett, head of the Cosmology Group at AIMS South Africa, Mr Arrykrishna Mootoovaloo, a Master's student in the Research Centre and Dr José Carlos S Fonseca, a postdoctoral fellow at UWC.



Prof. Koblitz

### Number Theory Talks

On 28 November, AIMS South Africa organised talks on Number Theory. Prof. Neil Koblitz (University of Washington) gave a talk titled: 'Introduction to some computer-science aspects of cryptography' and Dr Gareth Boxall's (SU) talk was titled: 'Rational Points on graphs of analytic functions.'



Dr Boxall





Prof. Nagel



Dr Runesha



Prof. Kim

## The University of Chicago Faculty Workshop

Faculty from The University of Chicago visited AIMS South Africa from 7 to 8 December to present a series of lectures to AIMS students and lecturers from local universities:

- Prof. Sidney Nagel, Stein-Freiler Distinguished Service Professor in Physics, James Franck Institute, Enrico Fermi Institute, and the College, gave two talks titled: 'Memories in Matter: How and What Can A Material Learn?' and 'Exploiting Disorder'.
- Dr Hakizumwami Birali Runesha, the Assistant Vice-President for Research Computing and founding Director of the Research Computing Center (RCC), gave a talk titled 'Scaling Algorithms on Supercomputers: Myth or Reality?'
- Prof. Young-Kee Kim, Louis Block Professor in Physics, Enrico Fermi Institute and the College gave a talk titled: 'The Invisible Universe'.



Indo - SA Bilateral JEDI

## Indo - SA Bilateral JEDI

Prof. Bruce Bassett was the organiser of this JEDI that focused on new developments in machine learning and artificial intelligence and their application to astronomy. The JEDI was held from 1 to 19 December and participants included members of the Cosmology Group in the AIMS South Africa Research Centre and Prof. Ninan Sajeeth Philip and Mr Blesson George, both affiliated to the Department of Physics at St Thomas College, Kerala, India.



Workshop on Estimating Animal Abundance and Density using Acoustic Data

## Workshop on Estimating Animal Abundance and Density using Acoustic Data

This workshop, organised by Prof. Ian Durbach, a resident researcher in the AIMS South Africa Research Centre, was held from 15 to 18 January 2017. It was funded by the NRF UK/South Africa Researcher Links Grant awarded to Prof. Durbach in 2016. The aim of the workshop was to explore open questions on the use of acoustic data to estimate animal density and abundance.

## Model Theory Workshop

Twenty participants, including local and international academics and students, attended a general Model Theory conference at SU. As part of this conference, a day of talks was presented at AIMS South Africa on 10 January.



Mathematics in Industry Study Group

## The Mathematics in Industry Study Group 2017

The Mathematics in Industry Study Group is a five-day workshop in which academic researchers and graduate students work collaboratively with representatives from industry on research problems submitted by local industry. Study Groups have been organised for over forty years in many countries around the world. The first Study Group in South Africa was held in 2004 at WITS. This year, the workshop took place at AIMS South Africa. The graduate workshop was held from 11 to 14 January, and the study group from 16-20 January 2017. In total there were 73 attendees. The problems covered in this year's workshop were related to the sugar industry, manufacturing, mining and the economic cost of landfill pollution. Guest speakers included: Prof. Graeme Hocking (Murdoch University, Perth, Australia); Prof. Neville Fowkes (University of Western Australia, Perth, Australia); Dr Sarah Mitchell (University of Limerick, Ireland); Prof. Tim Myers (Centre de Recerca, Matematica, Barcelona, Spain); Prof. Colin Please (University of Oxford, United Kingdom); and Prof. Alfred Owoloko (Covenant University, Nigeria).



Implications of Artificial Intelligence for Society workshop

## Implications of Artificial Intelligence for Society workshop

The Cosmology Group at AIMS organised this workshop on 10 February. Under the premise that artificial intelligence (AI) has replaced 50% of jobs, participants debated the implications for society with experts in a broad range of areas from law and art to organisational psychology and politics. The workshop was used to set the agenda for a future, bigger meeting on the same topic.



AIMS-IWR Summer School

## AIMS-IWR Summer School

The summer school 'Mathematical Modelling and Scientific Computing', jointly organised by the Interdisciplinary Centre for Scientific Computing (IWR), Heidelberg University, Germany and AIMS South Africa, was held from 13 to 17 February. The school brought together experts from Germany and Africa to lecture on various topics of Scientific Computing. The 24 attendees included postgraduate students, young researchers and seven AIMS students.



Data Science Workshop

## Data Science Workshop

This workshop, organised by Dr Bubacarr Bah, was hosted at AIMS South Africa from 22 to 27 May 2017. It introduced participants to some theory and methods, computational tools and applications of Data Science. The theory and methods lectures mainly covered mathematical underpinnings of Data Science algorithms, while the computation focused on the implementation of a selection of Machine Learning and Dynamical Network algorithms using the Python programming language. The application talks gave participants the opportunity to mathematically conceptualise problems and use Data Science computing tools to solve these problems. The 46 participants included AIMS students and Master's and PhD students from South African universities. The speakers were Prof. Maria Fasli (University of Essex); Dr Franck Kalala Mutombo (University of Lubumbashi/AIMS); Prof. Peter Grindrod (University of Oxford); Dr Yabebal Fantaye (AIMS); Dr Hans Georg Zimmerman (Siemens); Prof. Bruce Bassett (AIMS/UCT/SAAO); Dr Vukosi Marivate (CSIR) and Dr Jasper Horrell (SKA/Deep Data).



Summer School in Mathematical Finance

## Summer School in Mathematical Finance 2017

The 10th annual Summer School in Mathematical Finance was held at AIMS South Africa from 20 to 24 February. It brought several leading academic exponents of the fast-growing field of Mathematical Finance to South Africa. International speakers included Prof. Erik Schlögl (UTS, Australia); Dr Joerg Kienitz (UCT and Quaternion, Germany) and Prof. Tom Hurd (McMaster University, Canada). The school gave local practitioners, academics and students the opportunity to interact with international leaders in Mathematical Finance on topics and modelling techniques current in the South African and international financial markets. The school was attended by 71 participants (including 11 AIMS students).

## Cosmology Deep Learning JEDI

This workshop for nine members of the Cosmology Group was held in Malmesbury from 26 February to 1 March.

## Mini-Workshop in Pure Mathematics

This was an internally organised workshop held on 29 March for those working in the field. Speakers were visiting researcher Dr Philibert Nang, and postdoctoral fellows Dr Alberto Cazzinaga and Dr Nantsoina Cynthia Ramiharimanana.



MMED

## Clinic on the Meaningful Modeling of Epidemiological Data

The 8th annual **Clinic on the Meaningful Modeling of Epidemiological Data (MMED)** was held from 29 May to 9 June at AIMS South Africa. This was a two-week modelling clinic that emphasised the use of data in understanding infectious disease dynamics. Participants conducted modelling projects, informed by epidemiological data, that address practical questions in a meaningful way. There were 65 participants, including ten AIMS students.

## SETI Skills Development Workshop

This workshop, funded by the SKA and the Berkeley Research Centre and organised by Dr Ruby van Rooyen (SKA) and Dr Yabebal Fantaye, was hosted at AIMS South Africa from 3 to 7 July 2017. The workshop introduced participants to the challenges affecting all new astronomy projects, such as the incredible challenges in weak signal detection, data and image processing, as well as big data online processing. The workshop was attended by 38 participants, eight of whom were from AIMS South Africa.



SETI Skills Development Workshop

# AIMS SCHOOLS ENRICHMENT CENTRE



## MATHEMATICAL THINKING COURSE

From 3 to 13 April, AIMSSEC presented the 27<sup>th</sup> Mathematical Thinking (MT27) residential course at the Cape Academy of Mathematics, Science and Technology in Constantia, Cape Town. Sixty-seven teachers from across South Africa spent ten days consolidating their mathematical content knowledge and practising learner-centred methods of teaching. In addition to the AIMSSEC team, the course was facilitated by staff from both South Africa and the UK, who generously gave up their time to inspire the teachers and engage them in mathematical thinking. Five of the staff were AIMSSEC alumni.



Group photo of the MT27 Teachers

AIMSSEC is always especially happy to have alumni return — one objective of AIMSSEC is to create a professional development pathway for our teachers, and having teachers progress from MT participants to teaching assistants to lecturers is an important way of making this a reality.



Ms Sagree Pillay, alumna and MT lecturer



Ms Dungile Maponyane, alumna and teaching assistant

## TRAINING THE TRAINERS IN CAMEROON

From 15 to 28 October, AIMSSEC lecturers were invited to train 46 secondary school mathematics inspectors for the Mastercard Foundation Teacher Training Pilot (TTP) programme in Yaoundé, Cameroon. Expertise was provided in mathematical thinking and problem solving; the use of Information and Communication Technologies (ICT) in the teaching and learning of mathematics; and specific content areas such as calculus and permutations.



Mr Chapwanya demonstrating Geogebra

## REPRESENTATION ON THE AMESA WESTERN CAPE COUNCIL

AIMSSEC is proud to be part of the AMESA Western Cape Regional Council. Benefits of being on the Council include collaborations with the Western Cape Department of Education, local universities and corporates. All these different stakeholders in mathematics education get the opportunity to share ideas on teacher training, mathematics education and the promotion of events related to teacher training.

## ICTMA 18

The 18<sup>th</sup> conference of the International Community of Teachers of Mathematical Modelling and Applications (ICTMA 18) was hosted by SU and held at the Sanlam Training Centre Corporate Office in Bellville, Cape Town, from 23 to 28 July. It was followed by a Teachers' day on 29 July. AIMSSEC was represented by Ms Lindiwe Tshuma, Ms Sinobia Kenny and Dr Barrie Barnard.

ICTMA is one of the five affiliated study groups of the International Commission on Mathematics Instruction (ICMI). ICTMA conferences aim to foster research and exchange of information, experiences and ideas relating to the teaching, learning and assessment of mathematical modelling, mathematical models and applications of mathematics in genuine real world problems in primary, secondary and tertiary educational environments, including teacher education, together with professional and workplace environments.

“I will spread the word and recommend this exciting programme – Mathematical Thinking – so that we see more educators coming to get this A-class information in order to uplift the level of maths pass rate in our school and South Africa at large.” - Zamokwakhe D Zulu (KwaZulu-Natal)

On 24 July, Ms Tshuma co-presented a paper with Prof. Michael le Cordeur on language and mathematics instruction. On 29 July, Ms Kenny and Dr Barnard attended the Teacher's Day presented by Prof. Werner Blum of Germany and, as a follow-up to the conference, they also attended a mathematical modelling session on 1 August held at SU.



AIMSSEC alumnus Mr Jonathan Fischer with Ms Kenny, Prof. Blum and Dr Barnard

## POSITIVE REVIEWS FOR MATHEMATICAL THINKING BOOK

In February, the first book in AIMSSEC'S book series, *Mathematical Thinking in the Lower Secondary Classroom*, was published by Cambridge University Press. Since then, teachers, lecturers and education professionals from countries such as Kenya, UK and the USA as well as South Africa, have been writing reviews about the book and reacting positively to it. To access these reviews, please visit: <http://aimssec.ac.za/our-work/mt-book-series/>. Each chapter in the book is linked to the CAPS document. If you are interested, you can also order the book either from Amazon or the CUP website.



Teachers working together to practise teaching a lesson using the *Mathematical Thinking* book

## COMMUNITIES OF PRACTICE

The unbelievable pace at which technology has evolved and affected the lives of teachers and students of the 21<sup>st</sup> century is staggering. To remain relevant and keep pace with these developments, AIMSSEC participated in several local, national and regional educational technology communities of practice conferences, workshops and exhibitions.

On 25 July, AIMSSEC participated in the **EdTech Summit Africa 2016** held at Leap High School in Cape Town. This is an innovative technology conference for educators across Africa, which focuses on teacher training and programme development to address education equity and social justice issues, by working to implement creative and cutting-edge technologies in schools and communities. This was an excellent opportunity for AIMSSEC to tap into and share diverse, global perspectives on teaching strategies and educational technologies with like-minded organisations and individuals.

The Wordpress Cape Town community is a network of developers, designers and website builders who believe in the power and effectiveness of Wordpress as a platform to build online presence. In July 2016, AIMSSEC took part in the **do\_action WordPressCharity Hackathon** at the Bandwidth Barn in Woodstock. During this event, participants spent the whole day building new websites for a selection of local charities and NGOs. AIMSSEC's website was built and launched at the event.

AIMSSEC, represented by Mr Chapwanya, attended the first ever **EdTech Open Innovation Cluster** in Africa, launched by the Cape Innovation and Technology Initiative (CiTi), on 15 March at the Bandwidth Barn in Woodstock. The event brought together Education and Technology enthusiasts and experts from across the country, including government representatives, corporates and NGOs. The aim of the cluster is to collect as many of the best EdTech startups and companies in one location to work on education problems. This event was the first of many such monthly events to be held across Cape Town. AIMSSEC hopes to remain an active partner of this huge network that will transform education in South Africa.

From 24 to 25 March AIMSSEC attended the **Classroom of the Future Indaba** at the Cape Town Science Centre (CTSC). Leader in educational technology, Microsoft, showcased, along with other organisations, their latest technologies through workshops, presentations and demonstrations. During this event, the CTSC officially launched their Classroom of the Future — a futuristic view of the classroom that allows for creation and collaboration; enables exploration; and assists with the accommodation of any learning style while focusing on student-based learning outcomes.

From 19 to 21 July, Mr Chapwanya attended the annual **National Association of Distance Education and Open Learning in South Africa (NADEOSA) Conference** at the University of the Free State. The theme of the conference was 'Transforming the South African post-school education and training system.' This conference brought together regional and global leaders in higher education and saw local universities, training institutions, and technical and vocational education colleges taking part. The highlight of the conference was the pre-conference workshop, Assessment in open and distance learning presented by Tony Mays (University of Pretoria/South African Institute for Distance Education) and the keynote address titled: 'Talking about a Revolution: (Re)claiming distance education as revolutionary, humanising praxis' presented by Dr Paul Prinsloo from UNISA. AIMSSEC was privileged to take part in these workshops that involved activity-based and hands-on approaches to exploring principles, practices and possibilities for assessment and quality in an Open, Distance and e-Learning context.

The resources, expertise and exposure from the various communities of practice proved to be helpful for AIMSSEC as we seek to establish solid frameworks and world-class standards in all our courses and programmes.

It is very difficult for teachers to change their teaching strategies, even if they want to. In my professional development experiences, teachers frequently express an openness toward improving their instructional practices. They say such things as, "I'll do it, show me what it looks like." *Mathematical Thinking* does just that, in a teacher-friendly way." - Vicki Vierra (Mathematics Professional Development Consultant, Ventura County Office of Education, California, USA).

## FASMEd

On 25 November, AIMSSEC gave a talk titled 'A South African take on an EU project: Formative assessment in mathematics classrooms' to academic and research staff at AIMS South Africa's Journal Club.

The 'Formative Assessment in Science and Mathematics Education' (FaSMEd) project involved eight partners in Europe and one in Africa, AIMSSEC. The 'big idea' behind the project was the use of technology to help teachers use formative assessment effectively. The research findings were reported in two principal areas: firstly, the responses of the teachers to the process of taking part in the research; and secondly, what happened in the classrooms. The research was qualitative social science research broadly aimed at improving teaching and learning in mathematics and relevant to researchers with an interest in understanding how mathematics teaching could be improved.

The contribution that AIMSSEC made towards the international FaSMEd project can be found at <http://aimssec.ac.za/our-work/research/>. The FaSMEd project ended in December 2016.



Dr Marie Joubert presenting at the Journal Club

AIMSSEC presented a research paper on relationships between language competency and mathematics instruction. In line with SAARMSTE's focus of advancing research in mathematics, science and technology education in Southern Africa, the conference provided opportunities to discuss language issues in primary science and mathematics with experienced researchers in the field. The presentation was followed by a SAARMSTE post conference writing clinic from 20 to 21 January for emerging researchers conducted by Fred Lubben, emeritus professor (York University) and Editor-in-Chief of the African Journal of Science, Mathematics and Technology Education.

### SAARMSTE Post Conference Writing Clinic

As a follow-up to the SAARMSTE post conference writing clinic, Prof. Lubben conducted a writing clinic for Cape Town based researchers at the AIMSSEC offices in Muizenberg on 10 February. This clinic allowed Prof. Lubben to provide individualised attention and feedback to journal manuscripts being developed by local researchers.



Ms Kenny, Prof. Lubben and Miss Tshuma

## CONFERENCES

### ADEA Triennale

The Association for Development of Education in Africa (ADEA) Triennale was held at Abdou Diouf International Conference Centre in Dakar, Senegal, from 14 to 17 March 2017. The theme was 'Revitalising Education towards the 2030 Global Agenda and Africa's Agenda 2063'. The Triennale brought together and promoted dialogue among policy makers and education ministries in African countries, academics, stakeholders from the private sector and development cooperation partners in education. These included the Mastercard Foundation, the African Development Bank Group and UNICEF. At the event, AIMSSEC presented a paper on how the language of instruction plays an important role in enhancing understanding and performance in mathematics. The paper was presented by Miss Lindiwe Tshuma.

### SAARMSTE Conference 2017

The 25<sup>th</sup> annual conference of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) was hosted by the Central University of Technology from 17 to 20 January in Bloemfontein.



Dr Audrey Msimanga (SAARMSTE Executive Committee Member & Snr Lecturer, University of the Witwatersrand) and Dr Paul Denley, (Research Fellow, University of Bath) with Miss Tshuma

### STEM Education Conference

From 29 to 30 May, the STEM Education Conference 2017 for Southern African countries was held in Sandton, Johannesburg. The Department of Basic Education, Southern African Universities, NGOs and the private sector — all of whom contribute towards the teaching and learning of STEM education — were represented at the conference. Speakers shared ideas on empowering STEM teaching professionals and learners; fostering international, national and regional collaborations in STEM; and sharing innovative school projects. AIMSSEC showcased its model of professional learning and research in mathematics education in a talk titled, 'Research and Teaching Mathematics in Southern Africa'. The talk was delivered by Ms Sinobia Kenny.



Participants at the STEM Education Conference

# PUBLIC ENGAGEMENT

## EVENTS AND EXHIBITIONS

### Public Engagement Workshop

AIMS South Africa hosted its first Public Engagement Workshop on 30 November. The workshop was attended by members of the Research Centre and staff from AIMS South Africa, AIMSSEC and AIMS-NEI. The workshop provided an opportunity to discuss the importance of public engagement; to review past public engagement activities and to design a strategic framework for future activities.



Public Engagement Workshop

### National Science Week Launch 2016

AIMS South Africa and AIMSSEC hosted an exhibition at the launch of National Science Week (NSW), which was held on 5 and 6 August. The exhibition was attended by 1625 scholars from 65 schools and 1000 members of the general public. Postdoctoral Fellow Dr Franck Kalala Mutombo; AIMS Research Centre students Ms Dinna Ranirina and Ms Fatumah Atuhaire; and Mr Dakalo Ramufhi, Ms Lindiwe Tshuma and Ms Loveness Mahwire of AIMSSEC attended.



NSW launch 2016

### NRF PhD Project Regional Conferences

The National Research Foundation (NRF) hosted the SA PhD Regional Conferences focusing on Higher Education Institutions in KwaZulu-Natal on 17 August and in Cape Town on 13 September. Dr Rejoyce Gavhi-Molefe was asked to speak on 'Understanding your discipline – STEM'. This included what to expect during a PhD in STEM disciplines, what skills are needed and acquired, good practices, and getting ready for the road ahead. The exhibition table was hosted by Dr Mutombo at the first event, and by two PhD students in the AIMS South Africa Research Centre, Ms Martha Kamkuemah and Mr Rock Stephane Koffi, at the second event.

The South African PhD Project aims to significantly increase the number and diversity of South Africans with research doctorate degrees. The audience included about 300 current and potential PhD students, mentors, and representatives from funding agencies, higher education institutions offering doctoral training programmes, public and private research institutions and government departments.

Dr Mutombo noted, "Exhibiting at this event as a postdoc was a great opportunity to promote the AIMS Research Centre, to highlight the different fields of research and the opportunities available for PhD and Master's students."

### UWC Women in Mathematics

On 24 August 2016, UWC Science Learning Centre for Africa hosted their annual Women in Science Mini-Convention which was held as part of the University's celebration of women in the month of August. Dr Gavhi-Molefe was one of five successful female role model speakers who addressed 125 girls from disadvantaged schools across the broader Cape Flats on the role that mathematics plays in their lives.



AIMS Women in STEM mentoring session

### The 2<sup>nd</sup> International Day for Women & Girls in Science

AIMS recognises that the involvement of women and girls in mathematical sciences is a critical factor that will contribute to shaping Africa's growth and development. It is important to attract and retain more women in the STEM workforce as this will maximize innovation, creativity and competitiveness.

As part of network-wide activities to celebrate the day, AIMS South Africa hosted a public lecture by Dr Bonolo Mathibela on 15 February (see page 31). There was also a mentoring session for female students, which included motivational talks on scientific careers by invited role models. A group discussion on the 'Leaky pipeline for women in STEM' also took place. The guest speakers and facilitators were: Prof. Elissa Schwartz, Dr Bonolo Mathibela, Ms Samar Elsheikh, Ms Martha Kamkuemah, Ms Noluvuyo Hobana, Dr Rosita Yocgo, and AIMS alumni Ms Siphokazi Gatyeni, Ms Juliet Nagawa, Dr Cynthia Ramiharimanana, Omowunmi Isafiade, Ms Fatumah Atuhaire and Ms Dinna Ranirina.

"Progressing on the path towards successful STEM careers is not easy and many young women get lost along the way. Organising events such as these give women an excellent platform to network with peers and empower each other in a safe environment to achieve their full potential," said Dr Gavhi-Molefe, event organiser.

#### International Women's Day Events

As part of the AIMS Women in Stem initiative, AIMS South Africa hosted a variety of events from 6 to 11 March to celebrate International Women's Day. Events included visits to local high schools by eight female role models from AIMS South Africa, three from AIMSSEC and two from local companies. They provided learners with the opportunity to listen to female role models whose career journeys/paths can inspire and stimulate an interest in girls to continue to study STEM subjects at college and university. AIMS South Africa also hosted a public lecture by Prof. NP Makunga (see page 31) and a social media campaign was run in which photos of AIMS staff, lecturers and students appeared with their message on what they would say to inspire young girls to study STEM. A follow-up Women in STEM mentoring session was held on 11 March. The week of activities was organised by Dr Gavhi-Molefe, with the assistance of staff from AIMS South Africa and AIMSSEC, researchers and AIMS alumni.



Role models visit Muizenberg High School



AIMS Women in STEM mentoring lunch

#### AIMS Women in STEM Mentoring Lunches

On 9 May, as part of the 2017 women mentoring programme, the AIMS Women in STEM initiative hosted a lunch for female students to interact with female AIMS researchers and a visiting researcher, Prof. Arlene Cole-Rhodes (Morgan State University). A second lunch was held on 23 May, giving female students the opportunity to network with inspirational female scientists and AIMS alumni who were visiting AIMS South Africa as part of the Data Science Workshop.

"The mentoring lunches were a great opportunity to meet successful women in science and also to strengthen relationships with women met at previous mentoring events. The lunch succeeded in opening a communication channel between students and mentors that will be valuable in future," said AIMS student, Ms Shané van Graan.

#### Maths Olympiad Pre-camp

AIMS South Africa, in partnership with the South African Mathematics Foundation (SAMF), hosted this year's Olympiad pre-camp for 12 learners and four coaches from 26 to 30 June 2017. During this camp, the learners participated in a series of mathematical tests requiring insight, ingenuity and rigorous logical proof. The learners were coached by four coaches from SU and UCT. The SAMF selected six of these learners to participate in the International Mathematics Olympiad that took place from 16 to 23 July in Brazil and six learners to participate in the Pan-African Mathematics Olympiad that took place from 1 to 6 July in Morocco.



Maths Olympiad Pre-camp

## REGIONAL SCHOOL VISITS

#### Mthatha District School Visits

From 12 to 17 September 2016, lecturers of AIMSSEC visited four primary and two secondary schools and facilitated five workshops for teachers in and around Mthatha, Eastern Cape.

The visit highlighted the importance and value of keeping in touch with teachers who have attended the MT courses. The value of these visits and meetings was evident for both the lecturers and the teachers. Teachers felt inspired to once again apply the strategies and approaches they had learnt on the course and lecturers were able to fully appreciate the realities faced by the teachers in rural and deep rural schools.

#### East London District School Visits

Dr Barrie Barnard and Mr MacDonald Chapwanya made a short trip to East London at the start of March 2017. The purpose of this visit was to meet with the Eastern Cape Department of Education and visit local schools in order to discuss future areas of cooperation. One of the schools visited was Byletts High School, which is a rural boarding school. Dr Barnard and Mr Chapwanya appreciated the chance to meet both educators and district officials, and AIMSSEC is hopeful that this trip will lead to greater collaboration in the future.



Mr Chapwanya (2<sup>nd</sup> from right) and Dr Barnard (4<sup>th</sup> from right) at Byletts High School



## NATIONAL SCIENCE WEEK (NSW) 2017

This annual week-long event, coordinated by the South African Agency for Science and Technology Advancement on behalf of the DST, is now in its 18<sup>th</sup> year and ran from 5 to 12 August 2017. AIMS South Africa hosted one of the Western Cape events at the Oliver Tambo Community Hall in Khayelitsha, Cape Town, from 7 to 10 August. NSW is a countrywide celebration of science, technology, engineering, mathematics and innovation (STEMI), which exposes the public and learners to the wonders of science. Each year, a different theme is chosen and the activities are offered around the theme. The 2017 theme was 'Advancing Science Tourism' and it was aligned with the United Nation's International Year of Sustainable Tourism for Development.

Project Leader of the AIMS South Africa event, Dr Gavhi-Molefe, noted that over 1 350 learners from Khayelitsha and surrounding municipalities were treated to a science feast. The event started by stimulating the appetites of the learners with a rich menu of role model speakers in Science, Technology, Engineering, Mathematics and Innovation (STEMI) who shared their journeys, career paths and provided the students with career guidance.

The main course, served in buffet style, was the practical hands-on activities: an exhibition and maths show by AIMS South Africa; a SKA workshop; arts and geometry activities; ethnomathematics (mathematics of basket weaving, pottery and street wire to mention but a few); practical probability, robotics and computer programming; and the engineering of transportation.

Finally, learners interacted with STEMI exhibitors from Bright Future Youth IT Centre, Cape Citizen Science, City of Cape Town Water Conservation, Crypto Giants - University of Pretoria, the Department of Correctional Services RSA, Design Afrika, EduOne, Fundza, Iziko Museums of South Africa, Khayelitsha Youth Clinic, Little Professor, Map Blitz, Potter's Workshop, South African National Biodiversity Institute, SAPS, Science Stars, Square Kilometre Array Africa, Streetwires, Thope

Foundation, TutorX, Two Oceans Aquarium, United States General Cape Town, University of Cape Town Maths Department, University of Stellenbosch Faculty of AgriSciences, University of Western Cape Astrophysics, and Young Engineers.

A special Women's Day treat, which included a panel discussion on 'Women in STEMI' and speed-dating scientists (where learners, particularly girls, had a one-to-one interaction with professional role models), was also held.



## ACHIEVEMENT

Dr Gavhi-Molefe recently joined co-convenors Prof. Caradee Wright and Ms Dorothy Ngila to launch a documented account of inspirational and real stories about female academics who challenged the odds to realise their dreams. Titled *Because Science is Fun – Stories of Emerging Female Scientists in South Africa*, the inspiring compilation of stories was launched by the National Minister of Science & Technology, Honourable Naledi Pandor, as part of the National Science Week Launch at Nelson Mandela University in Port Elizabeth on 5 August. The dynamic book presents the stories of 25 emerging South African female scientists with the aim to inspire the next generation of young female mathematicians, researchers and scientists to pursue their professional dreams. It tells stories of how young female scientists have overcome a wide spectrum of obstacles to obtain their PhD degrees and embark on successful science-based careers, and who are engaged in science for society work.





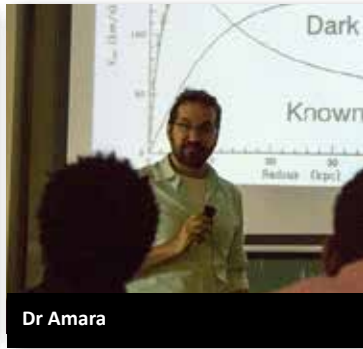
PUBLIC LECTURE SERIES

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

- On 1 September, **Prof. Alexandre Refregier** and **Dr Adam Amara** (both from the Institute for Astronomy, ETH, Zurich) gave a public lecture titled: 'The Emergence of the Dark Universe.'
- On 15 November, a talk titled: 'Big Data and related Machine Learning Challenges' was given by **Prof. Ninan Sajeeth Philip** (Department of Physics, St. Thomas College, Kozhencheri-Kerala). He talked about big data paradigm and tools, mostly at an introductory level, and pointed out why we require machine learning in this new paradigm. He also gave an example of where the method to filter glitches hidden in signals collected from the LIGO Gravity Wave Detector was used.
- On 7 December 2016, **Prof. Sidney Nagel** (University of Chicago) gave a talk titled: 'The Life and Death of a Drop'. In the talk he gave the history of a liquid drop – from its birth to its eventual demise as it fades into memory – illustrating the passage of its existence with the scientific surprises that determine its fate. This video can be viewed at <https://youtu.be/SqtUcO66zDc>
- On 18 January 2017, **Prof. Tim Myers**, (Universitat Politècnica de Catalunya and Centre de Recerca Matemàtica (CRM), Barcelona, Spain) gave a talk titled: 'Mathematics in Nanotechnology'. In the talk Prof. Myers provided an insight into modelling efforts in nanotechnology being carried out at the CRM.
- On 15 February, **Dr Bonolo Mathibela** (IBM Research South Africa Lab) gave a talk titled: 'Shaping society as women in technology.'
- On 7 March, as part of the International Women's Day activities, **Prof. NP Makunga** (SU) presented: 'Plants for human health: venturing into traditions of old with a biotechnological toolkit'. In her talk, she encouraged the audience to share their research with a general public: "If you want to be part of the knowledge economy, it is crucial to keep the science message going, and to be able to use all the different communication platforms."
- On 9 May **Dr Arlene Cole-Rhodes** (Morgan State University), gave a talk titled: 'Excursions into Signal Processing Research and its Applications.' In the talk Prof. Cole-Rhodes presented her areas of research with a focus on mathematics.
- On 6 June **Prof. Brian Williams** (SACEMA) gave a talk titled: 'Scientific certainty and public health action: Where does the balance lie?' He discussed how debate is needed in order to develop new guidelines to supplement those already in place in order to inform those who practice public health and those who are engaged in developing guidelines that inform public health practice.
- 'The Exoplanet Revolution: NASA's Kepler Mission and the Search for Earth-like Planets,' by **Mr Howard Isaacson** (University of California, Berkeley, & Breakthrough Listen) and 'Fast Radio Bursts: Mysterious Cosmic Whistles,' by **Dr Griffin Foster** (University of Oxford and the University of California at Berkeley) were co-hosted with SKA on 4 July.
- As part of our NSW activities, **Ms Nozuko Poni**, Marketing & Project Coordinator, Silicon Cape, gave a talk titled: 'Tech is the future' on 8 August.



Prof. Refregier



Dr Amara



Prof. Philip



Prof. Nagel



Prof. Myers



Dr Mathibela



Prof. Makunga



Prof. Cole-Rhodes



Prof. Williams



Mr Isaacson



Dr Foster



Ms Poni



German delegation visit



University of Southampton visit

## MEETINGS ATTENDED

On 18 July, Ms Lynne Teixeira gave a presentation about AIMS South Africa at the Pan African University Roadshow held at the Cape Peninsula University of Technology.

Prof. Barry Green attended a meeting of the South African Basic Sciences Platform in Pretoria on 26 July. AIMS South Africa is a member of this platform whose main thrust is to provide a structural mechanism for reviewing the adequacy of support to the basic science disciplines; identifying bottle-necks and inefficiencies across and between sectors in this respect; and finding ways of stimulating system-level coordination across the different learning societies, institutes and associated role players.

## VISITORS

On 19 August, 20 DST interns, led by Ms Palesa Motsoeneng (Assistant Director: Multilateral Cooperation and Africa) visited AIMS South Africa to learn about the opportunities and successes of AIMS. Prof. Barry Green, Director, welcomed the group. They were given presentations on AIMS South Africa, AIMSSEC and the AIMS Network. AIMS alumnus, Mr David Attipoe, and current AIMS student, Mr Zuko Mthwesi, also presented talks.

Ms Motsoeneng said, "We gained a lot of insight into the role that AIMS plays in Africa's education system, specifically in Science, Technology, Engineering and Mathematics. The AIMS Women in Stem Initiative (AIMSWIS) is crucial and beneficial to Africa's innovative capacity and global competitiveness, since social and economic inclusion of women plays a huge role in economic growth. What was also notable, was the pan-African approach in the work that AIMS does. Additionally, we would like to commend you on the gradual expansion of the centres of excellence and wish you the best of success in your latest centre of excellence due to be opened in Kigali, Rwanda." Another group visited on 18 July 2017.

On 8 September, Prof. Wim de Villiers, Rector and Vice-Chancellor of SU, visited AIMS South Africa. After being welcomed by Prof. Green, two AIMS students, Mr Morris Musyoka and Ms Rita Sianga, gave talks on their experiences. In his talk, Prof. de Villiers noted that he was very impressed by the motivation and spirit displayed in the student's stories and he told the students about his own academic journey.

On 14 September, 15 Stanford University students and staff visited AIMS South Africa to run a workshop with the students on the future of Africa. The group was led by Dr Tina Seelig of the Department of Management Science and Engineering at Stanford University who is Faculty Director of the Stanford Technology Ventures Program. The visit was organised by Prof. Bassett.

On 22 September, 30 students from the University of Limpopo visited AIMS South Africa to find out more about the programmes on offer.

Prof. Green welcomed the students; Prof. Sanders gave an overview of the programmes; and Mr Mhlasakululeka Mvubu, a current student, gave a talk about his experience at AIMS.

On 24 October 2016, Prof. Jill Adler, FRF Chair of Mathematics Education (University of the Witwatersrand) South Africa and winner of the 2015 Hans Freudenthal Medal, met with Prof. Green. This was followed by a meeting, with Ms Sinobia Kenny and Ms Lindiwe Tshuma who represented AIMSSEC. During the meeting they exchanged ideas about teacher education in South Africa.

On 25 October, Mr Nelson Wanambi and Ms Doreen Matovu Lwanga, representatives from the Ministry of Education and Sports in Uganda, visited AIMS South Africa to gain an insight into how the institute is run. The Ministry, who is in the process of establishing an institute of science and technology, to be named John Kale Institute of Science and Technology (JKIST), was undertaking visits around the world to gain insights into best practice.

On 13 December, Mr Stefan Müller, Parliamentary State Secretary from Germany, together with a delegation that included Mr Siedal, the Deputy German Consul in Cape Town and representatives from the German Federal Ministry of Education and Research (BMBF), visited AIMS South Africa. They were taken on a tour of the facilities and met with Prof. Barry Green and Dr Bubucarr Bah, the German Research Chair based at AIMS South Africa.

On 6 March, Prof. Colin Grant, Vice-President (International, University of Southampton) and Prof. Green signed a partnership agreement between AIMS and the University of Southampton. The next day, Prof. James Vickers (Director, Southampton Doctoral College and Professor of Mathematics), Mr Keith Johnstone (Director of International Relations & Development) and Ms Melissa Gibson (Regional Director, International Office) visited AIMS South Africa. They were taken on a tour of the facilities and had a meeting with Prof. Green. Prof. Vickers gave a talk to AIMS students and researchers titled: 'Is time travel possible?', after which the visitors had tea with students, researchers and staff. The visit continued with talks by students and alumni and a presentation on the University.

Dr Josef Teichmann, an Austrian mathematician and professor at ETH Zürich working on mathematical finance, visited AIMS South Africa on 25 July 2017. He met with Prof. Green.



Visit by students from the University of Limpopo

# AIMS NETWORK



**AIMS**

African Institute for  
Mathematical Sciences  
NEXT EINSTEIN INITIATIVE

## GRADUATIONS

Across the network, 278 students graduated from their respective centres during the 2016–2017 academic year. This brings the total number of alumni from 43 countries to over 1 500, with 32% of them being women.



44 students from 10 African countries graduated from AIMS Rwanda



47 students from 19 African countries (including 18 women) graduated from AIMS Ghana



36 students from 14 African countries graduated from AIMS Senegal



46 students from 13 African countries (including 16 women) graduated from AIMS Cameroon



AIMS Tanzania held its 3<sup>rd</sup> graduation ceremony on 1 July. The 55 graduates from 18 African countries (with a third being women) brought the three-year total to 140 students.

## ACHIEVEMENTS

To date, 1 513 students from 43 countries (of whom 32% are women) graduated via the AIMS Network. AIMS alumni are working in academia, industry, shaping policy for the continent's growth. To date, 1 513 students from 43 countries (of whom 32% are women) graduated via the AIMS Network. AIMS alumni are working in academia, industry, shaping policy for the continent's growth and others have gone on to Research Master's and PhDs as outlined in the table below.

Status	Post AIMS Studies					
	PhD			Research Master's		
	Female	Male	Total	Female	Male	Total
Completed	50	182	232	124	274	398
In progress	70	151	221	42	102	144
Total	120	333	453	166	376	542



AIMS Rwanda launch



QLA workshop participants

## AIMS IN RWANDA

In partnership with the Government of Rwanda, AIMS launched its Rwanda centre on 3 April 2017. The official launch took place at the Kigali Convention Centre with H.E. President Paul Kagame as the guest of honour. "We are collaborating with AIMS to develop an ecosystem of pan-African institutions with a transformation agenda. We all recognise that AIMS' educational model is an important tool for development and progress on our continent," he said. Mr Thierry Zomahoun, President and CEO of AIMS noted: "We are thrilled to have partnered with the government of Rwanda to continue to nurture Africa's most talented scientific minds in mathematical sciences, creating opportunities to allow them to contribute to the continent by tangibly developing solutions to Africa's problems, and fostering collaboration that will reverse the brain drain of our thinkers, problem-solvers and innovators."

## QUANTUM LEAP AFRICA WORKSHOP

AIMS South Africa's Prof. Bruce Bassett, Head of the Cosmology Group, and Dr Yabebal Fantaye, ARETÉ Junior Research Chair, were part of the scientific organising committee (chaired by Prof. Neil Turok) of the inaugural Quantum Leap Africa (QLA) data science workshop. The three-day event, which brought together around 30 leading data science researchers from around the world, was held in Kigali and explored possible themes, topics and ideas that might help ensure that QLA is both world-class and highly relevant to Africa's needs in the 21<sup>st</sup> Century. The researchers and practitioners spanned industry, academia, as well as the NGO-world of development, ensuring a diverse set of perspectives about the future of data science, big data and artificial intelligence and determining how these perspectives will lead the transformation of Africa. Dr Bubacarr Bah, the German Research Chair, also attended the workshop.



Dr Parmen



Prof. Mophou

## RESEARCH CHAIRS

In October 2016, AIMS welcomed Dr Olivier Menoukeu Pamen to its Research Centre at AIMS Ghana. He is the second German Research Chair appointed in the Network. Dr Pamen commented that he felt privileged to be among the African scientists who will contribute towards the capacity building of the next generation of mathematical scientists on the continent.

In April 2017, Prof. Gisele Mophou joined AIMS Cameroon as a German Research Chair with specialisation in Control Theory and Calculus of Variations.

## NETWORK MEETINGS

Members of the AIMS-NEI Academic and Scientific Advisory Council met at the Secretariat Office in Kigali on 20 to 21 April 2017. This meeting was attended by academic representatives from each of the AIMS centres and provided an opportunity to review and advise on the training, research and public engagement activities of the network. There was enthusiastic support for the growth and establishment of AIMS in Rwanda. Key to the work of AIMS is strong involvement with the local education and STEM environment and a fruitful roundtable discussion was held with local and international representatives in Kigali.

Ms Lynne Teixeira attended the IDRC/DFID Final Evaluation Inception meeting, held from 24 to 25 May, and the Learning Workshop, held from 2 to 3 August, at the AIMS Secretariat in Rwanda. The meetings were held to plan and review the evaluation of the AIMS Academic Programme, the AIMS Industry Initiative, and the contribution of AIMS Alumni to Africa's development challenges.



Members of the AIMS-NEI Academic and Scientific Committee

# GOVERNANCE AND ADMINISTRATION

## TRUST

The AIMS South Africa Trust meeting took place on 24 February 2017. 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).

## COUNCIL

AIMS South Africa Council members met on 24 February 2017. Council members during this reporting period were Prof. Daya Reddy (Chair, UCT), Prof. Ramesh Bharuthrum (UWC), Prof. Cheryl de la Rey (Pretoria), Prof. Hendrik Geyer (SU), Prof. Grae Worster (Cambridge), Prof. Stéphane Ouvry (Paris-Sud), Prof. Daya Reddy (UCT), Prof. Graham Richards (Oxford), Prof. Balazs Szendroi (Oxford) and Prof. Neil Turok (Perimeter Institute).



## ADVISORY BOARD

The AIMS South Africa Advisory Board advises on strategic and academic aspects of the AIMS programme, including its integration with existing courses and research projects in South African and other African universities. Its current members are Prof. Edward Lungu (University of Botswana), Ms Nasima Badsha (Cape Higher Education Consortium), Prof. Jacek Banasiak (UKZN), Prof. Eugene Cloete (SU), Prof. David Fisher (UWC), Prof. Barry Green (AIMS), Prof. Louis Labuschagne (South African Mathematical Society), Dr Sizwe Mabizela (Rhodes University), Dr Thandi Mgwebi (NRF), Dr Sibusiso Sibisi (Council for Scientific and Industrial Research), Prof. Danie Visser (UCT) and Dr Zebulon Vilakazi (Wits). The Board did not meet during this period.

## 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 included: Dr Karin Howell, Dr Hannes Kriel and Prof. Ingrid Rewitzky (SU); Prof. Henri Laurie, Prof. Nicola Mulder and Prof. Jessie Ratzkin (UCT), and Prof. Kailash Patidar and Dr Sylvain Halindintwali (UWC).



## LECTURERS AND TUTORS

Resident teaching faculty at AIMS South Africa include Prof. Jeff Sanders (Academic Director), Ms Noluvuyo Hobana (Language and Communication) and Mr Jan Groenewald (Computing). Visiting lecturers are invited to teach courses on the AIMS Master's and Honours programme (see page 3).

The following tutors assisted visiting lecturers during the period under review: Mr Georg Anegg (head tutor), Mr Alberto Cazzaniga, Ms Maye Yassin Ahmed Elmardi, Mr Eyaya Birara Eneyew, Mr Yae Gaba, Mr Nirina Maurice Hasina Tahiridimbisoa, Ms Myriam Mahaman, Mr Romeo Mandanirina, Mr Andry Rabenantoandro and Ms Carine Umulisa. Mr Ben Walker and Ms Loveness Mahwire assisted on the AIMSSEC programmes.

## 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, Ms Naomi Fekema was appointed as the Academic Programme Officer, Mr Mark Heerden was appointed as the Student Development Officer and Mr Morgan Steyn as the Project Accountant from December 2016 to March 2017. Ms Tamsyn Seramie joined AIMS South Africa as an intern to assist with the administration of the Research Centre, workshops and events.

At AIMMSEC, the FaSMEd project ended on 31 December 2016, as such Dr Marie Joubert's and Ms Ingrid Mostert's contracts came to an end.



## INFORMATION TECHNOLOGY

In the period under review, the AIMS South Africa IT Department's focus was on work leading up to the AIMS' launch of Desktop 2017.1 (based on Debian 9); migration of the campus desktops and visiting laptops to this new version; and adding support for the new software to SystemImager. Importantly, AIMS desktop now supports both Python 2 and Python 3 for scientific computing, and the academic programme's default is now Python 3.

Support was given to AIMS Rwanda's establishment and operations, and to AIMS Tanzania during the SystemImager upgrade. AIMS desktop has been distributed to the IT teams of the AIMS network at the new website [desktop.aims.ac.za](http://desktop.aims.ac.za). An AIMS desktop installation course was taught at AIMS South Africa in June 2017. The aims-tech mailing list continues to support AIMS alumni with AIMS desktop or science software questions.

During 2016–2017 two new staff desktops and two staff laptops were purchased. Cabling maintenance in the Villa and Hall was completed, as well as wireless maintenance on the links to AIMSSEC and the accommodation for tutors and visiting researchers. Further wireless access point upgrades are underway at this accommodation. Four new data projectors were installed on campus via funding from the ESMT-AIMS Industry Immersion Programme. AIMS and AIMSSEC web servers switched to free, auto-renewed certificates from Let's Encrypt. The 130 campus desktops and two file servers are due for replacement.

AIMS IT tutor, Dr Yaé Gaba, departed from AIMS in March and Mr Mhlasakululeka Mvubu has taken on IT duties while doing his research Master's at AIMS. Mr Kyle Robbertze, a UCT computer science student, completed an internship of six weeks over December and January. Mr Jonathan Carter continues as Systems Architect and Mr Macdonald Chapwanya runs IT operations at AIMSSEC.

## COMMUNICATIONS REPORT

Our archive of professional photographs continues to expand. Public lectures, journal club talks, research visits, workshops, seminars, roadshows and the recognition of achievement ceremony are some of the events which have been documented. Furthermore, staff portraits and portraits of students (graduation and corporate-style) were completed for use online and at the graduation ceremony.

Photographs were linked to the following campaigns:

- The International Women's Day campaign, which made use of the slogan "My message to young African girls is...?" Thirty-nine statements were posted on social media, with most reaching more than 1000 people on Facebook alone. One post reached 4100 Facebook users.
- The graduation campaign, which used the message "My next step is...", was exhibited at the graduation ceremony to showcase the career objectives of the graduates.

The continuous documentation of people, activities and events at AIMS South Africa is 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.

FINANCIAL REPORT 2016-2017

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

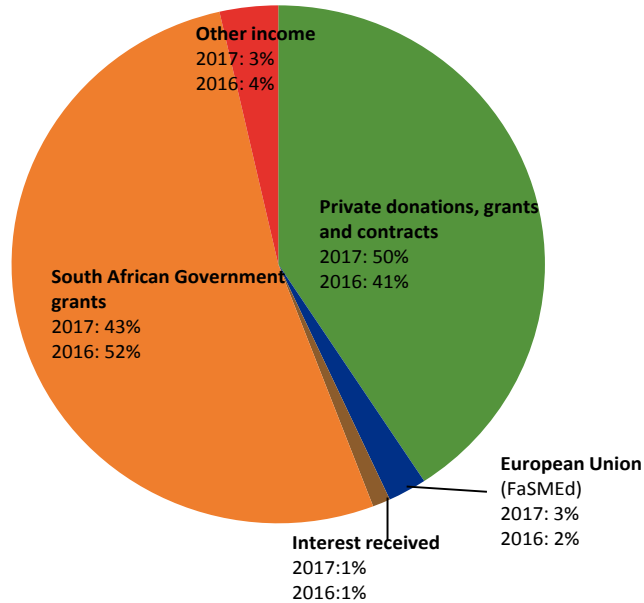


Figure 1: shows the comparison of AIMS South Africa's income per main component as well as the relative ratio to total income

Total income decreased by 3% to R36,411 million from R37,684 million. Variance is as a result of the grant from the Department of Higher Education and Training: National Skills Fund ending in September 2016.

South African Government grants for the 2017 and 2016 years are as follows:

Department	Programme	2017	2016
Department of Higher Education and Training	Academic Programme	R 5 265 000	R 5 000 000
Department of Science and Technology	Academic Programme, Research Programme and Post AIMS Bursaries	R 3 350 000	R 3 350 000
National Research Foundation	Research Programme	R 5 298 844	R 5 275 000
National Skills Fund	Teacher Training Academic Programme, South African Taught Masters and Teacher Training bursaries	R 1 805 937	R 6 064 487
<b>Total South African Government Grants</b>		<b>R 15 719 781</b>	<b>R 19 689 487</b>

Private donations, grants and contracts, is comprised mainly of funding from The IDRC Main Grants and MasterCard Foundation towards the Structured Masters' Programme and IDRC Joint Career Development Research Chairs, The Robert Bosch Foundation towards the first and second ARETE Junior Chairs and grant from The Alexander Von Humboldt Foundation towards the German Research Chair.

Private donations, grants and contract income for the 2017 and 2016 years are as follows:

Department	Programme	2017	2016
IDRC Main Grant	Taught Masters Programme	R 4 452 675	R 4 596 206
IDRC Research Grant	Research Programme	R 2 180 781	R 1 566 031
MasterCard Foundation	Taught Masters Programme and Teacher Training Bursaries	R 3 423 414	R 2 704 907
The Alexander Von Humboldt Foundation	German Research Chair	R 1 334 343	R -
The Robert Bosch Foundation	Research Programme	R 3 186 887	R 1 663 150
The Oppenheimer Memorial Trust	Teacher Training Programme	R 900 000	R -
DAAD	Bursaries/Scholarships	R 1 711 499	R 2 116 500
Other private donations	Taught Masters Programme and Teacher Training	R 861 276	R 2 721 997
<b>Total Private donations, grants and contract income</b>		<b>R 18 050 875</b>	<b>R 15 368 791</b>

**Figure 2: Total expense per main component**

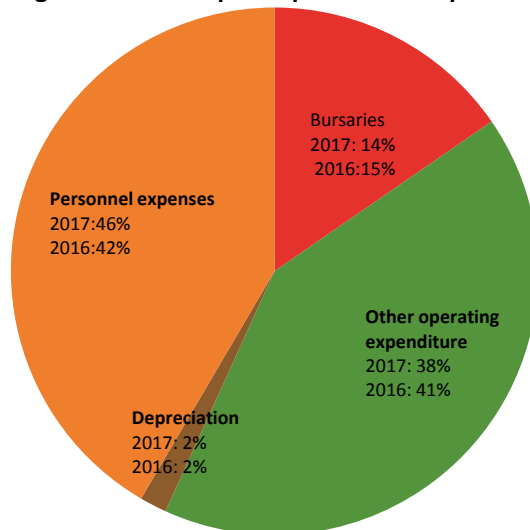


Figure 2: shows the comparison of AIMS South Africa's expenditure per main component as well as the relative ratio to total expenditure .

Total expenditure for 2017 increased by 4% from R39,666 million to R38,084 million, as a result of expenses for the research activities for the 2nd ARETE Junior Chair and The Alexander Von Humboldt German Chair. Expenditure is monitored carefully, within prescribed limits.

The increase in personnel costs of 16% can be attributed to the approved annual cost of employment adjustment of 7% for all qualifying staff and the appointment of the 2nd ARETE Junior Chair and the Alexander Von Humboldt German Chair.

Our full consolidated financial statements, audited by PwC, are available on our website [www.aims.ac.za](http://www.aims.ac.za)

Deborah Wilsnagh  
Finance and HR Manager



## AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

## CONSOLIDATED STATEMENT OF FINANCIAL POSITION AT 30 JUNE 2017

	2017 R	2016 Restated R	2015 Restated R
<b>ASSETS</b>			
<b>NON-CURRENT ASSETS</b>	34 351 480	34 557 401	34 673 045
Property, plant and equipment	29 869 232	30 040 471	30 637 576
Available-for-sale financial assets	4 482 248	4 516 930	4 035 469
<b>CURRENT ASSETS</b>	15 986 450	10 874 474	11 245 593
Cash and cash equivalents	1 960 284	2 401 947	3 885 023
Trade and other receivables	9 318 081	7 170 173	2 343 553
Stellenbosch University receivable	4 708 085	1 302 354	5 017 016
<b>TOTAL ASSETS</b>	<b>50 337 930</b>	<b>45 431 875</b>	<b>45 918 638</b>
<b>FUNDS AND LIABILITIES</b>			
<b>FUNDS AND RESERVES</b>	42 776 958	44 128 670	44 105 015
Accumulated funds	37 711 591	39 076 187	36 261 641
Restricted reserve: endowment fund	1 799 863	1 775 483	1 716 272
Restricted reserve: other	583 119	535 553	3 807 904
Fair value reserve	2 682 385	2 741 447	2 319 197
<b>CURRENT LIABILITIES</b>	7 560 972	1 303 205	1 813 623
Trade and other payables	7 560 972	1 303 205	1 813 623
<b>TOTAL FUNDS AND LIABILITIES</b>	<b>50 337 930</b>	<b>45 431 875</b>	<b>45 918 638</b>

## AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

## CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2017

	2017	2016
	R	R
Income	36 064 942	37 224 539
Operating expenses	(39 666 154)	(38 083 853)
	<hr/>	<hr/>
Operating surplus	(3 601 212)	(859 314)
Profit on sale of assets	-	53 846
Finance income	346 062	406 873
	<hr/>	<hr/>
Surplus for the year	(3 255 150)	(398 595)
Other comprehensive income:		
<i>Item that may be subsequently reclassified to profit or loss</i>		
Change in value of available-for-sale financial assets	(59 062)	422 250
	<hr/>	<hr/>
<b>Total comprehensive income for the year</b>	<b>(3 314 212)</b>	<b>23 655</b>
	<hr/> <hr/>	<hr/> <hr/>

## 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

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

European School of Management and Technology (ESMT Berlin)

German Federal Ministry of Economic Cooperation and Development

German Federal Ministry of Education and Research (BMBF)

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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)

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University of Oxford

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:

Prof. Grae Worster

Prof. Wilson Lamb

Dr Paolo Zuliani

Prof. R de Mello Koch

Dr Michael Grinfeld

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:**

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Department of Education: Eastern Cape

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

European Commission FP7 FASMED

Give and Gain

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/](http://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



$a^{-n} = 1a^n [a_0]$   
 $\operatorname{arccsch}(z) = \ln(1 + \sqrt{1 - z^2})$   
 $(axb)^n = a^n \times b^n \quad a_n = \frac{1}{a_1 + (n-1)d}$   
 $a^{-n} = 1a^n [a_0] = -i \tan(iz)$   
 $\square_a \text{ Square} = a^2$   
 $\sum_{i=1}^N (x_i - \bar{x})^2 \quad S_n = \frac{n}{2} [2a_1 + (n+1)d]$   
 $\operatorname{arccsch}(z) = \ln(1 + \sqrt{1 + z^2})/z \quad S_n = \frac{a_1}{1}$   
 $(axb)^n = a^n \times b^n \quad \log_n m = \frac{\log m}{\log n} \quad S = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N}} \quad \log_n m = \frac{\log m}{\log n}$   
 $\operatorname{sch}(z) = -i \tan(iz)$   
 $\frac{n!}{(n-r)!} \quad \square_{ABCD} \quad a^{-n} = 1a^n [a_0] \quad a^0 = 1 [a_0] \quad a^{-n} = 1a^n [a_0]$   
 $\operatorname{csch}(z) = \cos(iz)$   
 $a^{-n} = 1a^n [a_0]$   
 $a^{-n} = 1a^n [a_0]$   
 $F(-2, 4) \quad V(-2, 0) \quad \text{arc} \quad \operatorname{coth}(x) = \frac{1}{y_0} \quad = \operatorname{sec} \quad a^{-n} = 1a^n [a_0]$



**AIMS** | African Institute for Mathematical Sciences SOUTH AFRICA

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