AIMS | African Institute for Mathematical Sciences SOUTH AFRICA

ANNUAL REPORT

2016

ABOUT US

The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for postgraduate education, research and public engagement in mathematical sciences. Its mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of driving Africa's future scientific, educational and economic self-sufficiency. AIMS was founded in Cape Town, South Africa, in 2003. Since then AIMS centres have opened in Senegal (2011), Ghana (2012), Cameroon (2013), Tanzania (2014) and Rwanda (August 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 2015 to 31 July 2016. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2015 calendar year.

Since AIMS South Africa opened in 2003, 645 students from 37 different African countries have graduated from its core academic programme. The alumni include 216 women.

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

AIMS South Africa offers:

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

CONTENTS

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

FOREWORD

BY THE DIRECTOR

This year the AIMS network graduated its 1000th student with the AIMS Master's degree in Mathematical Sciences – a proud achievement which began in 2003 with the opening of this centre in Muizenberg.

Each year, over 3 000 students apply to follow this degree at one of our centres and more than 250 are selected for full scholarship support. AIMS South Africa has now graduated 645 students and South Africa is in third spot for the highest number of graduates per country by this centre. Altogether, our network of five centres has graduated 1 210 students. Alongside an exciting academic programme, we are very proud of the growth of our Research Centre and the impact it is having. Our teacher training work and community engagement activities have also grown. In this annual report we present these and other highlights of the past year.

Each year outstanding international and local experts from a variety of fields teach at AIMS, making it the richest programme of its kind in the mathematical sciences. In February this year, it was a pleasure to have Fields Medallist, Prof. Vaughan Jones visiting for a month. He presented a review course on Knot Theory and gave special talks at our centre, as well as enjoying kite surfing in Muizenberg's beautiful natural environment. Dr Madeline Cule, who was an AIMS tutor in 2010 and is now a Quantitative Analyst at Verily Life Sciences (formerly Google Life Sciences) in San Francisco, presented a skills course and Prof. Jonathan Marks, of the Gordon Institute of Business Sciences, offered an entrepreneurship skills course.

The AIMS Research Centre is now well established and contributes significantly to South Africa's research output in the mathematical sciences. There are 12 researchers based at AIMS South Africa, including two SARChI joint appointments with our partner universities, two Canadian IDRC Junior Chairs, and a Bosch Foundation ARETÉ Junior Chair. It is a pleasure to mention the contribution Prof. Bruce Basset has made in building our Cosmology Group and establishing an outstanding research environment at AIMS. A second ARETÉ Junior Chair and an SKA Researcher will be joining this group. In the 2015-16 year AIMS researchers supervised over 50 postgraduate research students – 22 PhDs and 31 Research Master's; 12 postdoctoral fellows were hosted and over 100 publications were produced. Many interesting workshops were held, including the 'Global Change Impact on Diseases and Alien Species Expansion workshop', which was supported by a number of leading scientific unions and organisations and organised by Prof. Christiane Rousseau, former Vice President of the International Mathematical Union, and Prof. Jacek Banasiak, an AIMS South Africa Advisory Board member. An excellent new contribution was made by the German Federal Ministry of Education and Research (BMBF) in association with the Alexander von Humboldt Foundation, which awarded AIMS South Africa a Research Chair in Mathematics with specialisation in data science. Our colleagues from Germany visited in June 2016 for the selection process and an appointment has subsequently been made jointly with Stellenbosch University.

In August 2015 we hosted the Department of Science and Techology's (DST) National Science Week – a week-long programme which attracted more than 1 500 school learners to our centre. This was a special outreach activity organised by Dr Mpfareleni Rejoice Gavi, which we plan to host as a participating institution biennially. As part of the AIMS Women in STEM Initiative, AIMS South Africa celebrated International Women's Day (8 March 2016) by hosting a number of special events encouraging more young women to enter the exciting world of science: women role models visited local schools and there were panel discussions, a public lecture, and a mentoring session for women students currently at the centre.

For those closely involved with, or interested in, AIMS South Africa, it is important to view our work through the bigger lens of the pan-African AIMS network, which we are part of. A special event, which took place in Dakar in March this year, was the Next Einstein Forum's (NEF) Global Gathering, an inspiring gathering, which is reported on. The AIMS-NEI Secretariat has relocated to Kigali, Rwanda, in the heart of Africa, with extensive support from the Rwandan Government, and our 6th AIMS centre was opened there in August 2016, in a beautifully redesigned hotel facility. These are exciting and important new developments for the AIMS network this year.

After serving as chair of the AIMS South Africa Council for 13 years, Prof. Neil Turok (the founder of AIMS) retired from this position in February. We are most grateful to him for his enormous efforts in establishing AIMS and working with others to lead the AIMS South Africa Council. Prof. Daya Reddy, also a founding member of the AIMS South Africa project, has kindly agreed to serve as our new chair. It is a pleasure to note that Prof. Turok will continue to serve on the AIMS South Africa Council and Board, and is also chair of our larger AIMS-NEI Board. Thank you Neil and Daya.

The staff of AIMS South Africa, its Council, our partner universities, AIMS-NEI and our many supporters all contribute to the success of this institute and it is a pleasure to acknowledge and thank them here.

Barry Green, Director

ACADEMIC PROGRAMMES

This year AIMS has again been able to offer exciting and innovative courses. This is thanks to the enthusiasm and interest of visiting international and South African lecturers, combined with the support of a strong team of tutors led by Academic Director, Prof. Jeff Sanders.

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

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2015 INTAKE)

AIMS attracted 13 students to its structured Master's in Mathematical Sciences, which commenced in January 2015. Most of these students were South Africans from the Universities of Limpopo, Venda, Zululand and KwaZulu-Natal. Their year conforms to the AIMS model (as per the August intake), with a slight change in emphasis of subjects to reflect local student interest. Their elective (review) courses included many of those offered to the August intake, and extra topics such as an Investment Economics course lectured by Prof. Weber of the University of Western Australia. A feature of the programme was the participation of all students in the workshop 'Computing the Quantified Self' co-organised by Dr Simukai Utete from the Research Centre.

All students graduated, with five students completing research projects in financial mathematics, three in biomathematics, three in statistics, one in pure mathematics, and one in computer science.

RESEARCH PROJECTS OF THE JANUARY 2015 INTAKE

	Name	Gender	Origin	Research Project Title	Supervisors
1	Khuthadzo Eshily Hlongwane	F	South Africa	Modelling the age-vaccination structure-based Tuberculosis transmission dynamics without hazard function restriction	G Mazandu, AIMS
2	Hangwelani Mamuthubi	F	South Africa	Market Risk Modelling	R Becker, AIMS
3	Hulisani Constance Maremahae	F	South Africa	Optimal portfolio choice for an investor of two stocks	S Mataramvura, Cape Town
4	Mokgapi London Mashabela	M	South Africa	Time in Distributed Systems	JW Sanders, AIMS
5	Banele Phumlani Mdakane	M	South Africa	Bayesian Hierarchical Models for Ordinal Data Applied to Women Malnutrition Data	T Achia, Witwatersrand
6	Robert Ramapulana Motala	M	South Africa	Hedging a European call option written on a Langevin type stock	S Mataramvura, Cape Town
7	Modupi Peter	M	South Africa	Diagnosis of Zero Inflation	P Hewson, Plymouth
8	Zinhle Emily Mthombothi	F	South Africa	Modelling the control of trypanosoma brucei rhodesiense through mass chemoprophylaxis and insecticide-treated cattle in a two-host population	R Ouifki, SACEMA
9	Juliet Nagawa	F	Uganda	Extracting Features in Big Data	JW Sanders, AIMS
10	Evans Otieno Omondi	M	Kenya	Modelling the infection dynamics of Onchocerciasis and its treatment	F Nyabadza, Stellenbosch
11	Lilies Mokganyetsi Phadime	F	South Africa	Trinomial tree model for energy derivatives	R Becker, AIMS
12	Anas Yusuf	M	Nigeria	Riesz Spaces and Operators on Banach Lattices	M Mabula, Pretoria
13	Simphiwe Nhlanhla Zitha	M	South Africa	A two-factor model for modelling commodity futures pricings	R Becker, AIMS

MASTER'S IN MATHEMATICAL SCIENCES (AUGUST 2015 INTAKE)

The August 2015 intake of the Master's in Mathematical Sciences attracted about 20 applications per place, however many applications were judged to be incomplete and consequently discarded by the recently introduced online application system. The result was a class of 54 students originating from 24 different African countries. Lecturers and tutors also reflected a spread: 70% of the lecturers were international, and the tutors (eight at any time) came from Italy, Benin, Namibia, Austria, Venda, Rwanda, Ethiopia, Switzerland, Zimbabwe, Madagascar, Democratic Republic of Congo, Poland, Sudan and Egypt.

The Master's is accredited by Cape Town's three participating universities, between which students are divided for registration. It consists of three phases. Firstly, the compulsory (skills) courses introduce the highly interactive and problem-based style of learning and focus on upgrading students' skills in problem solving and computation. Courses in computer programming, scientific writing and discussion in English, statistics and business and entrepreneurial skills are also included. We were very pleased to have Dr Jonathan Marks offer the first part of our course in Entrepreneurship, which featured team entrepreneurial projects evaluated by a panel of experts. Prof. Graham Richards again contributed case studies in this field. As usual, a special subject – The Scientific Environment – addressed important extra issues: anti-plagiarism presented by Dr Corina Du Toit (SU); a session on gender issues led by Prof. Amanda Gouws (SU); and a lively discussion on management of research by Prof. Bruce Bassett (AIMS,SAAO,UCT).

Secondly, the elective (review) courses introduce students to cutting-edge topics in mathematical science and are lectured by international and local experts. Students choose about two-thirds of the courses offered. The AIMS model incorporates continuing assessment to allow students to focus on the acquisition of research skills. As in previous years, the programme included specialised guest lecturers and the 'Mathematics in Industry Study Group' workshop, which provides students with the opportunity for group study of industry-related problems. Two-thirds of the courses were offered by international lecturers on a range of topics that enabled us to support the usual themes of: computing, statistics, applied mathematics, pure mathematics, physics, biomathematics, mathematical finance and industrial mathematics. Of special interest was the course in Knot Theory by Fields Medallist Prof. Vaughan Jones, who also presented a seminar in which he described the development of his research career.

In the third component of the programme students undertake three-month research projects. Supervision again worked well, with solid support from the three Cape Town universities (54%) and the AIMS Research Centre (18%) and international and other South African supervisors providing the balance. To help students appreciate what is involved in research in various areas and to support their selection of a research project from amongst those proposed online by supervisors, half a dozen sessions called `An Evening with the Prof.' were offered to students. These comprised a 1-2 hour presentation on problems in a particular research area, and were usually scheduled after dinner and early in the week. These events proved to be popular, and were well attended and helpful.

> "The August 2015 intake consisted of 54 students from 24 African countries."

The examiners awarded distinctions to 35% of the research projects, though after moderation with coursework marks the number of distinctions overall for the year dropped to 22%. Of the remaining students, 48% achieved grade 'Good' for the year and 30% 'Pass'. The external examiners this year were Prof. David Holgate (UWC); Prof. Herbert Weigel (SU); Dr Alan Cornell (Wits); Prof. Amartya Goswami (Limpopo); Prof. Francesca LIttle (UCT); Prof. Winston Garira (Venda); Prof. Philip Mashele (North-West); Prof. Ronnie Becker (AIMS); Prof. Wilfred Ndifon (AIMS); Dr Linke Potgieter (SU); and Prof. Mapundi Banda (Pretoria).

For the first time, students were offered the opportunity of providing weekly support teaching at local secondary schools during the final stage of the year: this programme was expertly coordinated by AIMSSEC.

Study breaks allow students the opportunity to consolidate their studies and to benefit from attending specialised workshops. This year a variety of topics were covered, including: quadratic differentials, financial mathematics, mathematics of industrial problems, neural networks, and epidemiology and climate change (see workshops section for the full list). As usual, the year began with one night each week being devoted to mathematical videos and inspiring presentations by our students to visiting groups of politicians and potential funders. As in previous years, the students enjoyed various outings, hikes, trips to Cape Town sights and scientific visits, among others.

Fields Medallist, Prof. Vaughan Jones

Entrepreneurial skills project evaluations with Dr Jonathan Marks

AIMS student, Ahmed Jama, supporting a learner with ICT skills

MS ZINHLE MTHOMBOTHI
AIMS South Africa 2015

Ms Zinhle Mthombothi is from Mpumalanga Province in South Africa. She holds a BSc degree in Mathematics and Chemistry (2013) and a BSc Honours in Mathematics (2014) completed at Rhodes University. In 2015 she joined AIMS South Africa for the structured Master's degree. She was awarded the prestigious Ben and Mary Turok Scholarship for excellent achievement at the end of the academic year.

"During my undergraduate studies I did not study any computational or programming courses, which made it difficult for me to apply for jobs that required the application of these skills. Fortunately for me, a classmate told me about AIMS. I am so glad that I went to AIMS, as now I am doing a Research Master's in Mathematical Modelling."

"In just 10 months AIMS taught me a lot about academia and life in general. Having to live and study amongst people from all over Africa not only gave me an opportunity to interact with this diverse group but also helped me to learn about and appreciate their different cultures, faiths, beliefs and practices. The most exciting part was having world-renowned lecturers and Professors offer classes to us. It was very rewarding having the chance to meet and interact with them at leisure, given the comfortable interactive atmosphere that AIMS always strives to provide. AIMS taught me that I can apply my mathematical skills in very many areas and it proved that, indeed, the sky is the limit and I have the power to make a difference. My dream is to inspire and motivate more youth to study science and make a difference in their lives and their respective communities. "

Zinhle is currently pursuing a research Master's degree in Mathematical Sciences at the South African Centre of Excellence for Epidemiological Modelling and Analysis (SACEMA) at SU.

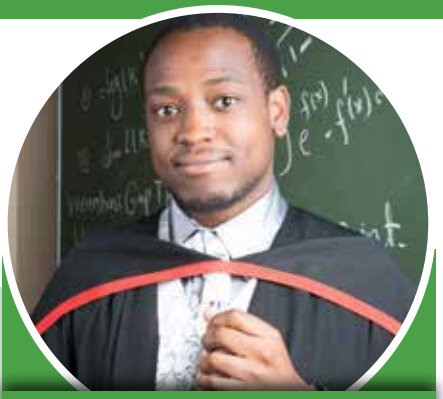
MS VESTER POYAMBA GUNSARU
AIMS South Africa 2016

Ms Vester Poyamba Gunsaru grew up in Malawi, where attending school meant travelling long distances each day. Her interest in mathematics was sparked at a young age by her father, a mathematician and author of math textbooks. Although he never pushed her to follow a career in mathematics, his work and passion for the subject inspired her. Her devotion to her studies led to Vester being awarded a MasterCard Foundation Scholarship to attend AIMS South Africa.

Vester recalls the 'math connection' that brought all students of AIMS South Africa together. Regardless of which discipline they had studied – computer science, physics, or statistics – and regardless of where they had come from in Africa, "once we talked mathematics, it was like we were all from the same region".

Whilst at AIMS, she was given the opportunity to attend the Clinton Global Initiative University 2016 meeting held in Berkeley, California. There she met with MasterCard Scholars from around the world to discuss commitments to bring positive change to developing communities and create global networks of young upcoming leaders. She learned a great deal from the other scholars with whom she was able to connect "through the passion we all had for being leaders".

As she moves forward in her career, Vester hopes to apply her mathematical skills to the health sector. "I want to be a part of the team creating a healthier Africa each and every day, as I believe good health is the basic stepping stone to any nation's development."



MR ROBIN MSISKA
AIMS South Africa 2016

Mr Robin Msiska completed his undergraduate degree in Physics at the University of Zambia in 2014. He heard of AIMS from a Zambian alumnus, and its promise to produce formidable African scientists to help tackle some of the most difficult problems facing Africa today was what attracted him to apply. He also believed that the wide range of courses would expose him to many mathematical and scientific disciplines.

"The first thing that struck me about AIMS was how multicultural the place was. I was unsure of how I was going to relate to so many people from such diverse backgrounds with varying ideals. As time went by, I realised that we were not so different – we were all driven by a passion for mathematics and how it could be used to make Africa a better place. AIMS' unique structure and approach to learning further fueled my passion to bring about change. During my stay I couldn't help but feel a sense of community. This 'AIMS spirit' was also shared by the excellent guest lecturers that came to teach."

At AIMS he was exposed to many invaluable tools for mathematical and scientific research and the range of different fields of study helped him to make a more informed decision about his future. He plans to continue with condensed matter physics research.

"I also met several world-class researchers at AIMS who inspired me to achieve more. Being a part of the AIMS family has really changed my life. I am undoubtedly a better scientist today because of AIMS. I am deeply indebted to AIMS for all it has done for me. AIMS has taught me that the only way I can ever hope to repay that debt is to go out and better Africa, touch as many lives as I can, and inspire the next generation of African scientists and mathematicians."

COMBINED COURSES TABLE

Period	Lecturer	Course	MSc Jan 2015	MSc Aug 2015	MSc Jan 2016	Hons Biomaths 2016
2015						
24 Aug - 27 Nov	Noluvuyo Hobana, AIMS	English and Communication Skills		x		
24 Aug - 27 Nov	Jan Groenewald, AIMS	Computing and LaTeX		x		
24 Aug - 27 Nov	AIMS Staff	The Scientific Environment		x		
31 Aug - 11 Sept	Matt Gidden, Wisconsin	Python		x		
31 Aug - 11 Sept	David Aschman, Cape Town	Concepts and Problem Solving in Physics	x	x		
14 Sep - 18 Sep	Jeff Sanders and Yae Gaba, AIMS	Programming in Python		x		
21 Sep - 9 Oct	Karl-Dieter Crisman, Gordon College	Experimental Mathematics with Sage		x		
22 Sep - 9 Oct	Madeleine Cule, Google	Statistics and Probability		x		
12 - 23 Oct	Jonathan Marks, GIBS	Entrepreneurial Skills	x	x		
12 - 30 Oct	Stephan Wagner and Dimbinaina Ralaivaosaona, Stellenbosch	Mathematical Problem Solving		x		
9 - 27 Nov	Karin-Therese Howell, Stellenbosch	Algebra		x		
9 - 27 Nov	Sicelo Goqo and Joseph Malinzi, KwaZulu-Natal	Differential Equations		x		
30 Nov - 18 Dec	Gareth Boxall, Stellenbosch	Model Theory		x		
30 Nov - 18 Dec	Des Johnston, Heriot-Watt	Finite-Dimensional Quantum Mechanics and Quantum Computing		x		
30 Nov - 18 Dec	Gabriel Lord and Lyonell Boulton, Heriot-Watt	The Numerical Solution of Differential Equations		x		
2016						
4 - 22 Jan	Jayadev Athreya and Steve Bradlow, Illinois at Urbana Champaign	Flat and Hyperbolic Geometry of Surfaces		x		
4 - 22 Jan	Rafael Nepomechie, Miami	Quantum Mechanics and Quantum Spin Chains		x		
4 - 22 Jan	Jan Groenewald and tutors, AIMS	Introduction to LaTeX and computing			x	x
4 - 22 Jan	Sigrid Boege, Heidelberg	Mathematical Problem Solving			x	
4 - 22 Jan	Jeff Sanders and Yae Gaba, AIMS	Python			x	x
6 - 15 Jan	Witwatersrand University	Mathematics in Industry Study Group		x		
4 - 22 Jan	Florian Rupp, German University of Technology in Oman	Financial Mathematics		x		
25 Jan - 12 Feb	Neville Fowkes, Western Australia	Industrial Mathematics		x	x	
25 Jan - 12 Feb	Wilson Lamb, Strathclyde	Analytical Techniques in Mathematical Biology		x	x	x
25 Jan - 12 Feb	Grae Worster, Cambridge	Fluid Dynamics		x	x	
25 Jan - 12 Feb	Stéphane Ouvry, Paris Sud XI	Introduction to Random Systems, Information Theory, and related topics		x	x	
25 Jan - 12 Feb	Ross Darnell, CSIRO	Statistics			x	
22 - 26 Feb	Graham Richards, Oxford	Entrepreneurship		x	x	
22 Feb -11 Mar	Paolo Zuliani, Newcastle	Bioinformatics		x	x	x
22 Feb -11 Mar	Gerhard Pfister and Wolfram Decker, Kaiserslautern	Computational Algebra		x	x	
22 Feb -11 Mar	Vaughan Jones, California, Berkeley	Knot theory		x	x	
22 Feb – 11 Mar	Eric Ould Dadah Andriantiana, Rhodes	Experimental Mathematics			x	
14 Mar - 1 Apr	Robert de Mello Koch, Witwatersrand	Introduction to Quantum Field Theory		x	x	
14 Mar - 1 Apr	Cang Hui (and A Ramanantoanina and P Landi) AIMS/Stellenbosch	Biomathematics		x	x	x
14 Mar - 1 Apr	Walter van Assche, KU Leuven	Approximation Theory		x	x	
4-8 April	Hans Georg Zimmerman	System Identification and Forecasting with Neural Networks			x	
11 - 29 April	Fernando Pestana da Costa, Aberta	Differential Equations in Population Dynamics			x	
11 - 29 April	Juerg Weber, Western Australia	Insurance Economics			x	
2-6 May	Jacek Banasiak, Pretoria and Christian Rousseau, Montreal	Global Change Impact on Diseases and Alien Species Expansion.			x	x
9 - 20 May	Kinvi Kangni, Félix Houphouet Boigny	Harmonic Analysis			x	
23 May - 10 June	Steve Bellan, Austin	Mathematical Modelling in Medicine			x	x
15 June - 1 July	Jeff Sanders, AIMS	Designing Algorithms			x	

RESEARCH PROJECTS OF THE AUGUST 2015 INTAKE

	Name	Gender	Origin	Research Project Title	Supervisors
1	Derhham Abdelfattah Ibrahim Abdelfattah	M	Egypt	General Relativity and Penrose Process	P Dunsby, Cape Town
2	Solomon Addai	M	Ghana	Financial Forecasting Using Machine Learning	R Becker, AIMS
3	Samah Mohamed Ahmed	F	Sudan	Perturbation field theory methods for calculating expectation values	WA Horowitz, Cape Town
4	Masoandro Andrianina*	F	Madagascar	Schröder Numbers	H Prodinger, Stellenbosch
5	Ravelomanantsoa Heritiana Andriantsilavo	M	Madagascar	Surfaces in 3-dimensional projective space	B Szendröi, Oxford & A Cazzinga, AIMS
6	Oluwatosin Leke Babasola	M	Nigeria	The behaviour of the zeros of the Hermite Polynomials and some applications	A Jooste, Pretoria
7	Isidore Bivugire	M	Burundi	Partially defined completely positive trace preserving maps	Y Hardy, South Africa
8	Lelise Geleta Boneya	F	Ethiopia	An Eco-Epidemiological Model with Selective Predation	F Nyabadza, Stellenbosch
9	Elliott Degbe	M	Ghana	Numerical Computation of Indefinite Integrals	N Hale, Stellenbosch
10	Karimatou Djenabou*	F	Camaroon	Predator-prey Models with Different Functional Response Forms	C Hui, AIMS/Stellenbosch
11	Zamokwakhe Mvuyandlela Dlamini	M	Swaziland	Bivariate spectral local linearisation method for solving unsteady three dimensional magneto-hydrodynamic flow and mass transfer on a porous media	S Motsa & V Magagula, KwaZulu-Natal
12	Emanuel Muema Dominic*	M	Kenya	Estimating Age Mixing Patterns in the Presence of Missing Data: A Comparison of Imputation Methods	W Delva, SACEMA
13	Audace Amen Vioutou Dossou-Olory	M	Benin	Wiener Index and Quadratic Assignment	S Wagner, Stellenbosch
14	Bonaventure Dusabe	M	Burundi	Conversion Efficiency of Solar Energy into Electrical Energy	D Joubert & G Moïse, Witwatersrand
15	Arzag Noureldein Korany Ebrahim*	F	Egypt	An Introduction to Fluid Structure Interaction: Application to the Piston Problem	M Banda, Pretoria
16	Hager Sayed Mohammed Elsayed Elboghdady *	F	Egypt	QED Quasi-Particle Scattering	A Peshier, Cape Town
17	Mohamed Elmokhtar Osman Adam Elnor	M	Sudan	Characterization of Ultrashort Laser Pulses	EG Rohwer & G Bosman, Stellenbosch
18	Michael Sonneyboy Gboneh*	M	Liberia	An Optimal Control Approach to the Cash Balance Problem and the Optimal Equity Financing of a Firm	JM Ngnotchouye, KwaZulu-Natal
19	Gebretsadkan Teklu Gebreyohannes	M	Ethiopia	Prey switching in Predator Prey model	C Hui, AIMS/Stellenbosch
20	Vester Poyamba Gunsaru*	F	Malawi	Incidence of cancer in South Africa from Pathology-based cancer surveillance	C Babb, National Cancer Registry
21	Mamoiloa Pascalina Hlongoane*	F	Lesotho	Species Distribution Modelling of Aloe Dichotoma (quiver tree)	I Durbach, AIMS
22	Ratsimandresy Holinirina Dina Miora*	F	Madagascar	Image processing and imaging analysis for fluorescence microscopy	EG Rohwer & G Bosman, Stellenbosch
23	Enas Haider ElSheikh Idris*	F	Sudan	Thermal Radiation of an Expanding Black Body	T Dietel, Cape Town
24	Ahmed Mohamoud Jama	M	Somali	The Deep Learning Revolution	B Bassett & M Lochner, AIMS
25	Lamin Juwara	M	Gambia	Reverse-engineering T-cell proliferation dynamics	W Ndifon, AIMS
26	Stephen Kadedesya*	M	Uganda	On the finite subgroups of SO(3) and SU(2)	B Szendröi, Oxford & A Cazzinga, AIMS
27	Mukeba Benjamin Kanyinda	M	DRC	Robot Planning Strategies	S Utete, AIMS
28	Frether Getachew Kebede	F	Ethiopia	Ring Theoretic Properties of Leavitt path algebras	J Sanchez-Ortega, Cape Town
29	Oluwakemi Imole Kolawole*	F	Nigeria	Pricing European Put Option in a Geometric Brownian Motion Stochastic Volatility Model	S Mataramvura, Cape Town
30	Linda Kumah*	F	Ghana	The Value of Ordinal Weight Constraints for Decision-Making	I Durbach, AIMS
31	Nelson Kyakutwika	M	Uganda	Stable Distributions and their Application to Modelling Asset Returns	R Becker, AIMS
32	Gilbert Kiprotich Langat	M	Kenya	Adaptive Interaction Switching in Multispecies Competitive Communities	C Hui, AIMS/Stellenbosch
33	Thabe Peter Malapela	M	South Africa	Pricing Zero Coupon Bonds In a Two Factor Mixed Model	S Mataramvura, Cape Town
34	Akindele Adebayo Mebawondu	M	Nigeria	Multipliers and Bounded Approximate Identities in Banach Algebras	OT Mewomo, KwaZulu-Natal
35	Nothando Precious Mhlongo*	F	Swaziland	On Multi-domain Spectral Relaxation Method for solving systems of differential equations that model chaotic systems	SS Motsa & M Magagula, KwaZulu-Natal
36	Mary Yalenga Mkandawire*	F	Malawi	Mathematical Modelling of HIV Prevalence trends in Kenya	R Ouifkir, Stellenbosch
37	Ahmed Ibrahim Elgali Mohamed*	M	Sudan	Computing electronic transitions of Isoindigo based copolymers for organic solar cell application	H Schwoerer & O Olaoye & N Tegegne, Stellenbosch
38	Robin Msiska	M	Zambia	Low Dimensional Electron Transport in a Dilution Refrigerator	M Blumenthal, Cape Town
39	Oluwaseun Franklin Musa	M	Nigeria	Pricing a European Call Option with Stein-Stein Model	S Mataramvura, Cape Town
40	Nancy Mumbua Musili*	F	Kenya	Do age-disparities in sexual relationships predict HIV incidence?	W Delva, SACEMA
41	Alice Nanyanzi*	F	Uganda	Laplacian Matrix of a Network and Applications	FK Mutombo, AIMS/Cape Town/ Lubumbashi
42	Arnaud Pastel Nono Tchiomo	M	Cameroon	Shape effect modelling & enhancement thermal conductivity in nanofluids	M Maaza, iThemba Labs
43	Rosemary Jasson Nzobo	F	Tanzania	Category of Groups with at most Ten Elements	T Janelidze-Gray, Cape Town
44	Salma Dafa Allah Ahmed Omer	F	Sudan	Optimization in Big Data	M Ali, Witwatersrand
45	Maxwell Paganga*	M	Zimbabwe	The association between cumulative viral load and the development of viral treatment resistance mutations in HIV infected people on antiretroviral therapy	M Nieuwoudt, SACEMA
46	Avulundiah Edwin Phiri	M	Zambia	Arithmetic of polynomials over a finite field	F Breuer, Stellenbosch
47	Mampionona Ralaimiaramanana Rajaoferason	M	Madagascar	Higgs decay to two photons	AS Cornell, Witwatersrand
48	Jean Bernoulli Ravelomanana	M	Madagascar	Tree enumeration	S Wagner, Stellenbosch
49	Sogo Pierre Sanon	M	Burkina Faso	An introduction to Nearrings	K Howell, Stellenbosch
50	Lesego Setlhake	M	Botswana	Superhedging, Model-free approach to mathematical finance and stochastic integration	R Łochowski, Warsaw School of Economics
51	Adewale Olusegun Shofolabo	M	Nigeria	Modelling and design of a Fractional-Order DC-DC Power Converter using Fractional Calculus	A Raji, Cape Peninsula
52	Mianda Laeticia Shoma*	F	DRC	Network spectra and applications	FK Mutombo, AIMS/Cape Town/ Lubumbashi
53	Josephine Naa Ayeley Tetteh	F	Ghana	A critique of a research article on a mathematical model for Onchocerciasis dynamics	F Nyabadza, Stellenbosch
54	Abu Bakr Elbukhari Mohamed Mohamed Tom	M	Sudan	The ultraspherical spectral method	N Hale, Stellenbosch

**AIMS-MasterCard Foundation Scholar*

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2016 INTAKE)

12 students registered for the Master's in Mathematical Sciences which commenced in January 2016.
They are expected to graduate in December 2016.

Students – January 2016 intake	Gender	Country	Previous Institution
Mxolisi Mlondolozi Nelson Bhengu	M	South Africa	Cape Town
Waleed Khaled Khalaf Hassaan	M	Egypt	Sohag University, Egypt
Maropeng Ronny Makgatho	M	South Africa	Venda
Sthabiso Siphamandla Mbongwa	M	South Africa	Zululand
Sibonelo Saselihle Mlambo	M	South Africa	Zululand
Cebisile Innocentia Mthabela	F	South Africa	Zululand
Zuko Mthwesi	M	South Africa	Fort Hare
Ndivhuwo Millicent Mudzudzanyi	F	South Africa	Johannesburg
Mhlasakululeka Mvubu	M	South Africa	Cape Town
Siboniso Confrence Nkosi	M	South Africa	Limpopo
Vhahangwele Cedrick Ramuada	F	South Africa	Venda
Josline Adhiambo Otieno*	F	Kenya	Massai Mara University, Kenya

** AIMS-MasterCard Foundation Scholar*

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

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

Five students graduated at the end of 2015, with final defences of particularly high standard.

Six students enrolled in the 2016 programme: Siboniso Nqubeko Goba, Tsebo Kibe, Lebogang Ogodiseng, Khotso Precious Matlou, Mandisi Moya and Brandon Mark Ristow. Features of this programme were the workshops on the Meaningful Modelling of Epidemiological Data (as usual) and the Global Change Impact on Diseases and Alien Species Expansion workshop.

"Six students enrolled in the BSc Honours in Mathematics with a focus in Biomathematics programme."

Mrs Mary Turok hands the award to Ms Mthombothi

13 students successfully completed the Master's programme in November 2015.

JANUARY 2015 INTAKE

A special Recognition of Achievement Ceremony was held at AIMS South Africa in Muizenberg on 26 November 2015, to honour the 13 students of the January 2015 intake who had successfully completed their Master's programme.

The main speaker was Prof. Thandi Mgwebi, currently the Director for Research at UWC and member of the AIMS South Africa Advisory Board. Bursaries for South African students at AIMS are provided by the National Skills Fund, whose Director of Strategic Projects, Mr Eubert Mashabane, also gave a talk at the ceremony.

Ms Zinhle Emily Mthombothi, a South African student from Kabokweni in Mpumalanga, was awarded the Ben and Mary Turok Scholarship Award for Excellent Achievement. This award was created through a donation by Prof. Neil Turok, the founder of AIMS and Director of the Perimeter Institute for Theoretical Physics in Canada. The award honours the role Prof. Ben and Mary Turok played in establishing the first AIMS centre in South Africa, and their continued interest and support of this pan-African project. Students subsequently graduated at their universities of registration.

Recognition of Achievement Ceremony November 2015

AUGUST 2015 INTAKE

The AIMS South Africa graduation ceremony took place at the Muizenberg Pavilion on 21 June 2016. Fifty-four students (including 21 women) from 24 African countries were awarded a Master's in Mathematical Sciences.

"Africa has an exciting journey ahead of it and so do you," said Dr Solomon Assefa, Director IBM Research – Africa, the guest speaker at the event. "We are determined to transform the African continent by hiring the best talent to tackle the challenges of our time. But our success depends on you and talented, motivated graduates like yourself. You have the power to change the world, so go out and change the world, change the African continent and make a difference."

The ceremony was officiated by Prof. Eugene Cloete, Vice-Rector Research, Innovation and Postgraduate Studies, SU; Prof. Danie Visser, Deputy Vice-Chancellor, Research and Internationalisation, UCT; and Prof. Vivienne Lawack, Deputy Vice-Chancellor, Academic, UWC.

Front row: Dr Stroebel (NRF), Mr Ravelomanana, Ms Kebede, Prof. Mgwebi, Mr Sanon. Back row: Prof. Sanders, Mr Msiska, Mr Juwara, Prof. Green

AIMS ENDOWED SCHOLARSHIPS

During the ceremony AIMS Endowed Scholarships were awarded to a number of top achievers by Prof. Thandi Mgwebi, Director of Research at the University of the Western Cape and an AIMS Advisory Board member. The recipients were: Mr Robin Msiska, from Zambia, who received the Stephen Hawking Scholarship; Mr Lamin Juwara, from Gambia, who received the Martin Rees Scholarship; Ms Frether Getachew Kebede, from Ethiopia, who received the Paul G Allen Scholarship; and Mr Jean Bernoulli Ravelomanana, from Madagascar and Mr Sogo Pierre Sanon, from Burkina Faso, who each received a Victor Rothschild Scholarship.

AIMS Choir

54

students (including 21 women) were awarded a Master's in Mathematical Sciences in June 2016

Graduation Ceremony June 2016

AIMS BURSARIES FOR STUDY AT SOUTH AFRICAN UNIVERSITIES

Through the generous support of the South African Department of Science and Technology (DST) and the ForExcellence partners, AIMS South Africa is able to offer matching half bursaries to its students who are accepted for Master's or PhD study at South African universities. This year AIMS South Africa awarded 12 such bursaries for Master's study and two for doctoral studies. Recipients of these bursaries are asterisked in the table below. A further three students who will be supported in the AIMS Research Centre, are also noted.

PROGRESS OF RECENT STUDENTS

Student	Gender	Country of Origin	Institution	Programme
Graduates from January 2015 intake				
Khuthadzo Eshily Hlongwane	F	South Africa	Wits Health Consortium (PHRU)	Statistics intern
Hangwelani Mamuthubi	F	South Africa	Still exploring opportunities	
Hulisani Constance Maremahae	F	South Africa	SAP Skills for Africa	Student programme
Mokgapi London Mashabela	M	South Africa	South African Sugarcane Research Institute	Scientific programmer
Banele Phumlani Mdakane	M	South Africa	Zululand	Research Master's/Lecturer
Robert Ramapulana Motala	M	South Africa	Standard Bank	Backend developer
Modupi Peter Mphekgwana	M	South Africa	Limpopo/McCain	Research Master's/ Graduate programme
Zinhle Emily Mthombothi	F	South Africa	SACEMA, Stellenbosch	Research Master's
Juliet Nagawa	F	Ugandan	Still exploring opportunities	
Evans Otieno Omondi	M	Kenya	Stellenbosch	Research Master's
Lilies Mokganyetsi Phadime	F	South Africa	Still exploring opportunities	
Anas Yusuf	M	Nigeria	UDUS, Nigeria	PhD
Simphiwe Nhlanhla Zitha	M	South Africa	Rhodes/Square Kilometre Array	Research Master's/ Junior Telescope Operator
Graduates from August 2015 intake				
Derhham Abdelfattah Ibrahim Abdelfattah	M	Egypt	Still exploring opportunities	
Solomon Addai	M	Ghana	Ball State University, US	Master's
Samah Mohamed Ahmed	F	Sudan	Still exploring opportunities	
Masoandro Andrianina	F	Madagascar	Still exploring opportunities	
Ravelomanantsoa Heritiana Andriantsilavo	M	Madagascar	Still exploring opportunities	
Oluwatosin Leke Babasola	M	Nigeria	KwaZulu-Natal	PhD
Isidore Bivugire*	M	Burundi	KwaZulu-Natal	Research Master's
Lelise Geleta Boneya	F	Ethiopia	Still exploring job opportunities	
Elliott Degbe	M	Ghana	Northern Arizona University, USA	Research Master's
Karimatou Djenabou*	F	Cameroon	Stellenbosch	Research Master's
Zamokwakhe Mvuyandlela Dlamini*	M	Swaziland	KwaZulu-Natal	Research Master's
Emanuel Muema Dominic	M	Kenya	Stellenbosch	Research Master's
Audace Amen Vioutou Dossou-Olory*	M	Benin	Stellenbosch	PhD
Bonaventure Dusabe	M	Burundi	Still exploring opportunities	
Arzag Noureldein Korany Ebrahim	F	Egypt	Still exploring opportunities	
Hager Sayed Mohammed Elsayed Elboghdady*	F	Egypt	Cape Town	Research Master's
Mohamed Elmokhtar Osman Adam Elnor	M	Sudan	Still exploring opportunities	
Michael Sonneyboy Gboneh	M	Liberia	University of Liberia	Lecturer
Gebretsadkan Teklu Gebreyohannes	M	Ethiopia	Still exploring opportunities	
Vester Poyamba Gunsaru	F	Malawi	KFW Office Lilongwe	Intern
Mamoiloa Pascalina Hlongoane	F	Lesotho	Still exploring opportunities	
Ratsimandresy Holinirina Dina Miora*	F	Madagascar	Stellenbosch	Research Master's
Enas Haider ElSheikh Idris*	F	Sudan	Cape Town	Research Master's
Ahmed Mohamoud Jama	M	Somali	Still exploring research opportunities	
Lamin Juwara	M	Gambia	McGill University, Canada	Research Master's
Stephen Kadedesya	M	Uganda	Still exploring opportunities	
Mukeba Benjamin Kanyinda	M	DRC	IMA World Health, DRC	IT Technician
Frether Getachew Kebede	F	Ethiopia	Still exploring opportunities	
Oluwakemi Imole Kolawole	F	Nigeria	Still exploring opportunities	
Linda Kumah	F	Ghana	AIMS Research Centre/Cape Town	Research Master's
Nelson Kyakutwika	M	Uganda	Still exploring opportunities	
Gilbert Kiprotich Langat	F	Kenya	AIMS Research Centre/Stellenbosch	Research Master's
Thabe Peter Malapela	M	South Africa	Still exploring opportunities	
Akindele Adebayo Mebawondu*	M	Nigeria	KwaZulu-Natal	Research Master's
Nothando Precious Mhlongo	F	Swaziland	Cape Town	Research Master's
Mary Yalenga Mkandawire	F	Malawi	University of Livingstone, Zambia	Lecturer
Ahmed Ibrahim Elgali Mohamed	M	Sudan	Still exploring research opportunities	
Robin Msiska*	M	Zambia	Cape Town	Research Master's
Oluwaseun Franklin Musa	M	Nigeria	Univeristy of Lagos, Nigeria	Master's
Nancy Mumbua Musili	F	Kenya	Still exploring opportunities	
Alice Nanyanzi	F	Uganda	AIMS Research Centre/Stellenbosch	Research Master's

PROGRESS OF RECENT STUDENTS (CONT.)

Student	Gender	Country of Origin	Institution	Programme
Arnaud Pastel Nono Tchiomo*	M	Cameroon	Johannesburg	PhD
Rosemary Jasson Nzobo*	F	Tanzania	PAUST, Nairobi, Kenya	Research Master's
Salma Dafa Allah Ahmed Omer	F	Sudan	Still exploring opportunities	Teaching assistant
Maxwell Paganga	M	Zimbabwe	Still exploring opportunities	
Avulundiah Edwin Phiri	M	Zambia	Still exploring opportunities	
Mampionona Ralaimiaramanana Rajaoferason	M	Madagascar	Still exploring opportunities	
Jean Bernoulli Ravelomanana*	M	Madagascar	Stellenbosch	Research Master's
Sogo Pierre Sanon*	M	Burkina Faso	Stellenbosch	Research Master's
Lesego Setlhake	M	Botswana	Still exploring opportunities	
Adewale Olusegun Shofolabo	M	Nigeria	Still exploring opportunities	
Mianda Laeticia Shoma	F	DRC	Still exploring opportunities	
Josephine Naa Ayeley Tetteh*	F	Ghana	Stellenbosch	Research Master's
Abu Bakr Elbukhari Mohamed Mohamed Tom	M	Sudan	University of Khartoum	Teaching assistant

DAAD BURSARIES FOR DOCTORAL STUDY

This year, the German Academic Exchange Service (DAAD) generously awarded seven scholarships within its DAAD/AIMS agreement which was signed in 2008. According to the agreement, in-region scholarships are awarded annually, based on recommendations by AIMS, to students from sub-Saharan Africa (excluding South Africa) for PhD studies in the Mathematical Sciences.

NEW AWARDS FOR 2016 WERE MADE TO:

Students	Gender	Country of Origin	University
Mirriam Chepkoech	F	Kenya	Witwatersrand
Kenneth Dadedzi	M	Ghana	Stellenbosch
Oluwaseun Francis Egbelowo	M	Nigeria	Witwatersrand
Yishak Abraham Lailulo	M	Sudan	Western Cape
Jaquiline Wangui Mugo	F	Kenya	Cape Town
Rosephine Georgina Rakotonirainy	F	Madagascar	Stellenbosch
Elimboto Mwiki Yohana	M	Tanzania	KwaZulu-Natal

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

A number of DAAD scholarships holders from previous years graduated.

AIMS ALUMNI UPDATES

Ms Edna Manda, a 2014 AIMS South Africa alumnus, has graduated cum laude from the University of KwaZulu-Natal with her Research Master's in Applied Mathematics. Her research comprises an investigation of how within-host HIV infection dynamics affect the dynamics of the epidemiology of HIV infection and vice-versa. She is currently registered for a PhD.

Dr Joseph Malinzi, a 2012 AIMS South Africa alumnus was awarded his PhD in Applied Mathematics for work done on the mathematical modelling of cancer treatments and the role of the immune system's response to tumour invasion.

Dr Sidiki Zongo (2011) and **Dr Prosper Ngabonziza** (2010), attended the First African Light Source Conference and Workshop that was convened at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, during November 2015.

Dr Zongo also attended the 66th Lindau Nobel Laureate Meeting which took place from 26 June to 1 July 2016, in Lindau, Germany.

Ms Savannah Nuwagaba, an AIMS South Africa alumnus who is currently doing her PhD at Stellenbosch University, was one of 10 finalists in the FameLab competition in South Africa, held on 4 May 2016. Her talk can be viewed at https://youtu.be/wMOs4nn6-7M.

AIMS alumnus, **Ms Chinenye Assumpta Nnakenyi,** and AIMS Master's Research student, **Ms Nolubabalo Qokoqa,** were part of the Libertas Choir, run by Prof. Johan de Villiers, which presented 15 performances in Germany during a four-week tour from 14 April to 9 May 2016. A video from one of their performances can be viewed at http://youtu.be/mEi5rlh7Qfw.

MS ANNE AKOTH MISERE
AIMS South Africa 2013

As a business analyst and management consultant, Ms Anne Akoth Misere's job is to put Africa's talented youth to work growing African organisations. After receiving a Bachelor's in Education Science for physics and mathematics from Moi University, Kenya, Anne spent a few years teaching at Maseno School in Kenya, where she won the award for top teacher out of the faculty of sixty at the school. Despite her success as a teacher, she wanted to further her own education and so, in 2012, applied to AIMS South Africa. At AIMS, Anne found students who shared a love of solving problems, whether those were related to physics, computer science, engineering or pure mathematics. As opposed to the harsh methods enforcing rote learning used by her past teachers, "the teaching style at AIMS was very interactive and the success of my fellow students at AIMS made me believe that anyone who puts their heart into it can be a mathematician".

From AIMS South Africa, Anne joined Infinite Potentials Consulting (IPC), which from its inception has shared a close relationship with AIMS. Since joining IPC, Anne has continued to make valuable contributions to AIMS, notably as one of the visionaries and driving forces behind the hugely successful Next Einstein Forum which brought together leading scientists from across Africa in Dakar, Senegal in 2016.

Her work with IPC is driven by the group's vision of pairing the most brilliant and focused African youth with African organisations, whether corporate, governmental or NGO. "We believe organisations are not fully benefiting from Africa's rapidly growing body of highly skilled young people. By helping to link employers with regional talent, I am convinced that African firms will have exponential gains in productivity, while simultaneously tackling youth unemployment." She has created corporate growth plans for private education institutions in Ghana and South Africa, software development firms in Ghana and Rwanda, and has provided investment strategy for firms in Europe and North America looking to expand into burgeoning African markets. Anne also helps IPC run its social outreach initiatives, which provide students with scholarship support and internships to grow the pipeline of indigenous skilled workers to African firms.

DR BEWKETU TESHALE BEKELE
AIMS South Africa 2008

Dr Bewketu Teshale Bekele grew up in Agew Gimijabet, in the Awi zone in north-west Ethiopia. He first became interested in mathematics at the elementary level, when he discovered he loved working on problems with geometrical figures. His good marks in elementary school maths exams, and strength in high school maths, and physics motivated him to continue towards a university degree. At Haramaya University he joined the maths department of the Education Faculty. There, on top of his studies, he served as a graduate assistant.

At AIMS South Africa, Bewketu's options for where to take his mathematics suddenly widened but, it was modelling infectious diseases that most interested him. Bewketu was drawn to understand the dynamics of disease using mathematics, as he realised modelling was crucial for informing public policy and preparing intervention mechanisms. "Biomathematics research is at the heart of efforts to eradicate diseases such as HIV and tuberculosis." In addition to studying disease dynamics, Bewketu explains that mathematics can be used to determine the most cost-effective prevention strategies – a vital consideration for African countries with limited public resources.

Bewketu's own research has included developing HIV and malaria co-infection models as the group leader of a team of researchers from South Africa, Botswana, Zimbabwe, Kenya and the United States. The paper they produced was published in 2015 by the peer-reviewed journal *BioMed Research International*. Concurrently, Bewketu pursued doctoral studies at SACEMA, in Stellenbosch. Having finished his PhD, Bewketu says, "My first priority is to work on the African continent as a health researcher contributing to disease control. I also hope to strengthen ties between African and international universities with collaborative research to build the capacity of African educational institutions. With mathematicians working together with biologists, pharmacists and other health professionals, I envision a future free of AIDS."

MS SOPHIE TSINAMPOIZINA
AIMS South Africa 2011

Ms Sophie Tsinampoizina, from Madagascar, graduated from AIMS South Africa in 2011. During her time at AIMS she discovered a passion for climate modelling. Her final project, on the relationship between the climate variability over the Indian Ocean with rainfall over northern Madagascar, began a pursuit to become an expert on Madagascan climate.

Upon graduating from AIMS South Africa, Sophie went on to complete a Master's degree in Ocean and Climate Dynamics at UCT, developing a more comprehensive rainfall variability model for south-western Madagascar. In 2016, she reworked her dissertation into a scholarly article, 'Interannual variability of rainfall characteristics over south-western Madgascar' which was published in the scientific journal *Theoretical and Applied Climatology*. The research gained the attention of the Regional Initiative in Science and Technology (RISE) based at the Institute for Advanced Study in Princeton, New Jersey. With the WIO-RISE Western Indian Ocean Regional Initiative, Sophie became part of a network of scientists working to grow local STEM expertise in Southern African universities to stimulate economic development.

In 2016, Sophie's work in climate modelling led to her being awarded a Climate Protection Fellowship from the Alexander von Humboldt Foundation. The initiative gives research grants to bring prospective leaders in fields related to climate change and biodiversity conservation from developing countries to host institutions in Germany. Together with Prof. Dr Andreas Hense of the University of Bonn, she has been working to create more accurate climate models using climate reanalysis for Madagascar and its surrounding Indian Ocean. The project contributes to regional climate services for the western Indian Ocean, helping to predict the rainfall critical to agriculture, which remains the main source of livelihood in Madagascar.

Though her work has taken her out of the continent for now, Sophie proudly describes herself as an ambassador for Madagascar: "I have a vision of leading a change in thinking on how best to tackle climate and other development challenges. Mathematics can be used to create solutions that are both efficient and reliably correct in everyday life."

RESEARCH

With support from the NRF, the DST, the Canadian government through IDRC and the Bosch Foundation, the AIMS South Africa Research Centre has expanded significantly over the last year, with an additional eight postdoctoral fellowships awarded and over 50 students being supervised by AIMS researchers. The visitors' programme continues to attract researchers from Africa and further afield. AIMS is a popular venue for workshops and conferences and, as in previous years, a number of interesting scientific events took place in the AIMS South Africa facilities.

RESIDENT RESEARCHERS

AIMS currently hosts 12 resident researchers, including two NRF South African Research Chairs and three Junior Research Chairs. Although no new appointments were made during this period, a number of researchers have been appointed to commence in the next academic year.

50+ students have been supervised by AIMS researchers.

The following researchers accepted an invitation to be associated with AIMS during the period under review:

Dr Sehun Chun
Prof. Kerstin Jordaan
Prof. Abdul Kara
Prof. Rafal Lochowski
Prof. Amanda Weltman
Dr Diane Wilcox

Researchers

RESIDENT RESEARCHERS

Name	Current Position	Gender	Area of research
Prof. Bruce Bassett	Senior Resident Researcher	M	Cosmology and astrophysics
Prof. Ronnie Becker	Senior Resident Researcher	M	Mathematical finance
Prof. Romeel Davé	South African Research Chair in Cosmology with Multi-Wavelength Data (UWC-SAAO-AIMS)	M	Cosmology and astrophysics
Prof. Johan De Villiers	Senior Resident Researcher	M	Analysis and approximation theory
Prof. Ian Durbach	Resident Researcher	M	Multi-criteria optimisation
Prof. Barry Green	Senior Resident Researcher	M	Algebra and number theory
Prof. Cang Hui	South African Research Chair Mathematical and Theoretical Biosciences (SU-AIMS)	M	Mathematical and theoretical physical biosciences
Dr Gaston Kuzamunu Mazandu	IDRC Junior Research Chair	M	Biomathematics
Dr Wilfred Ndifon	IDRC Junior Research Chair	M	Biomathematics
Dr Antoine Tambue	AIMS ARETÉ Junior Chair	M	Modelling with partial differential equations
Prof. Jeff Sanders	Senior Resident Researcher	M	Theoretical computer science
Dr Simukai Utete	Senior Resident Researcher	F	Robotics

POSTDOCTORAL FELLOWS

AIMS awarded eight new postdoctoral fellowships during this period bringing the total number of fellows hosted to twelve.

Name of student	Citizenship	Gender	Start date to end date	Research Field	Supervisor/Host
Adabor, Emmanuel Sarkodie	Ghana	M	20 March 2016 – 28 February 2017	Applied mathematics	Dr W Ndifon
Agarwal, Shankar	India	M	1 April 2016 – 31 March 2018	Cosmology	Prof. B Bassett
Chule, Siyabonga	South Africa	M	1 October 2015 – 30 September 2016	Mathematical foundations and pure mathematics	Prof. B Green
Daverio, David	Switzerland	M	19 February – 15 September 2016	Cosmology and astrophysics	Prof. B Bassett
Gavhi-Molefe, Mpfareleni Rejoyce	South Africa	F	15 June 2013 – 30 June 2016	Optimal C3 interpolatory subdivision scheme with fractal curves	Prof. J de Villiers
Lablanche, Pierre-Yves	France	M	15 September 2015 – 15 October 2016	Cosmology and astrophysics	Prof. B Bassett
Levick, Jeremy	Canada	M	23 February – 1 August 2016	Physics	Prof. B Green
Mialebama Bouesso, Andre Saint Eudes	Republic of Congo	F	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 January 2017	Numerical analysis, complex networks, dynamical systems	Dr A Tambue
Njagarah, John Boscoh Hatson	Uganda	M	1 September 2015 – 30 August 2016	Biomathematics	Prof. C Hui
Owerre, Solomon Aka	Nigeria	F	1 October 2015 – 31 March 2016	Mathematical foundations and pure mathematics	Prof. B Green
Ramanantoanina, Andriamihaja	Madagascar	M	1 March 2014 – 28 February 2016	Coupling ecological and evolutionary dynamics	Prof. C Hui

PHD STUDENTS

Name of student	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 and Dr W Ndifon	UKZN
Dufourq, Emmanuel	South Africa	M	31 May 2015 (ongoing)	Prof. B Bassett	AIMS
Galane, Lesiba Charles	South Africa	M	1 January 2016 (ongoing)	Dr F Mhlanga and Dr R Lochowski	LU
Geza, Ephifania	Zimbabwe	F	24 August 2015 (ongoing)	Dr G Mazandu	AIMS
Gill, Zoe	South Africa	F	17 May 2016 (ongoing)	Dr W Ndifon and Prof. Martin Nieuwoudt	SU
Ikpe, Dennis Chinemerem	Nigeria	M	1 October 2012 – June 2016	Prof. R Becker	UCT
Jones, Samantha	South Africa	F	1 February 2015 (ongoing)	Prof. R Becker	UCT
Kantu, Dieudonne Kabongo	Democratic Republic of Congo	M	1 November 2015 (ongoing)	Prof. I Durbach	UCT
Kassai, Eli	Namibia	M	1 April 2016 (ongoing)	Prof. B Bassett	AIMS/UCT
Koffi, Rock Stephane	Ivory Coast	M	1 April 2016 (ongoing)	Dr A Tambue	AIMS/UCT
Masakuna, Jordan	Democratic Republic of Congo	M	1 February 2016 (ongoing)	Dr S Utete	AIMS
Minoarivelo, Henintsoa Onivola	Madagascar	F	1 May 2012 – March 2016	Prof. C Hui	SU
Nuwagaba, Savannah	Uganda	F	1 February 2013 (ongoing)	Prof. C Hui	SU
Rajaona, Fortunat	Madagascar	M	1 March 2013 (ongoing)	Prof. J Sanders	AIMS
Ramiharimanana, Cynthia Nantsoina	Madagascar	F	1 January 2014 (ongoing)	Prof. M Jarden and Prof. B Green	SU
Ranirina, Dinna	Madagascar	F	1 January 2015 (ongoing)	Prof. J de Villiers	AIMS
Razafindramahatsiaro, Christalin	Madagascar	M	1 January 2013 – December 2015	Prof. B Green	AIMS
Watson, Neil	South Africa	M	1 January 2016 (ongoing)	Prof. I Durbach	UCT

MASTER'S STUDENTS

Name of student	Citizenship	Gender	Study duration	Supervisor	Based at
Amar, Gilad	South Africa	M	1 July 2014 (ongoing)	Prof. B Bassett	AIMS/UCT
Assan, Belthasara	Ghana	M	1 July 2014 – December 2015	Dr F Nyabadza and Prof. C Hui	SU
Attipoe, David	Ghana	M	1 February 2015 – April 2016	Dr A Tambue	AIMS/UCT
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
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
Etekpo, Kossi	Togo	M	1 March 2015 (ongoing)	Dr A Tambue	AIMS
Gatyeni, Princess	South Africa	F	1 February 2014 – December 2015	Prof. C Hui	SU
Gebremariam, Zoe Zerihun	Ethiopia	F	11 November 2014 (ongoing)	G Mazandu	AIMS
Geldenhuys, Freda	South Africa	F	1 February 2016 (ongoing)	Prof. C Hui	SU
Hosenie, Zafiirah Benon	Mauritius	M	1 February 2016 (ongoing)	Dr N Oozer and Prof. B Bassett	NASSP/UCT
Koffi, Rock Stephane	Ivory Coast	M	1 February 2015 – April 2016	Dr A Tambue	AIMS/UCT
Kyomugisha, Irene	Uganda	F	1 February 2015 (ongoing)	Prof. C Hui	AIMS/UCT
Lagat, Vitalis	Kenya	M	1 December 2015 (ongoing)	Prof. C Hui	AIMS
Mamba, Wanele Gcinumuzi	Swaziland	M	1 February 2015 (ongoing)	Dr R Becker	AIMS
Mgudla, Africa	South Africa	M	1 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 (ongoing)	Prof. B Bassett	AIMS
Namundjebo, Elia	Namibia	M	1 January 2015 (ongoing)	Prof. R Becker	AIMS
Netshabumu, Phathutshedzo	South Africa	M	1 February 2014 – December 2015	Prof. C Hui	SU
Nnyakeni, Chinenye Assumpta	Nigeria	F	1 July 2015 (ongoing)	Prof. C Hui	SU
Ochiaga, Evans Otieno	Kenya	M	1 October 2014 – December 2015	Prof. C Hui	AIMS
Phaweni, Thembani	South Africa	M	1 February 2015 (ongoing)	Prof. I Durbach	AIMS/UCT
Roberts, Ethan	South Africa	M	1 July 2016 (ongoing)	Dr N Oozeer and Prof. B Bassett	NASSP/UCT
Rakotonirainy, Rosephine Georgina	Madagascar	F	1 October 2014 – June 2016	Prof. I Durbach	AIMS
Ramolotja, Kagiso	South Africa	M	1 May 2016 (ongoing)	Dr G Mazandu	SU
Sall, Mamadou	Senegal	M	21 October 2013 – March 2016	Dr S Chun	SU
Staats, Kai	United States	M	1 March 2014 (ongoing)	Prof. B Bassett	AIMS
Van Schalkwyk, Helene	South Africa	F	1 February 2015 (ongoing)	Prof. C Hui	SU

The student's programme was upgraded to PhD during the period under review.

The student graduated during the period under review.

Mr David Sena Attipoe

Mr Solofomampionona Rajaona

Ms Samantha Jones

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:

- Prof. Durbach presented his work at the MCDM conference on multi-criteria decision making in Hamburg, Germany, 2-7 August.
- Dr Razafindramahatsiaro gave a talk titled: 'Deuring's constant reductions theory and lifting problems' at the Lifting Problems and Galois Theory Workshop held in Banff, Canada, 16-21 August.
- Dr Mialebama Bouesso presented at the 1st Nairobi Workshop on Algebraic Geometry on 20 August.
- The Next Einstein Forum Global Gathering was held from 8-10 March in Dakar, Senegal. IDRC/AIMS Junior Research Chair Dr Ndifon was selected as a Next Einstein Fellow and gave a presentation. Prof. Bassett was part of the NEF Scientific Committee and sat on the panel of judges for the innovation competition and Prof. Green facilitated a discussion in the Ministerial Session.
- Dr Tambue was an invited speaker at the Workshop on Simulation of Complex Processes in Porous Media, Brazil, 25-26 September.
- PhD student, Mr Kasai, presented the talk titled 'SALT Spectroscopy of 5 DES Type Ia Supernovae' at the International Conference on Light Science and Applications held in Namibia, 26-28 October.
- Two PhD students, Ms Ramiharimanana and Mr Rajaona and postdoctoral fellow Dr Mialebama Bouesso gave talks at the South African Mathematical Society's (SAMS) annual meeting at UNISA, 4-6 November.
- Dr Ndifon presented a paper at the EMBL - Stanford Conference on Personalised Health in Heidelberg, Germany, 15-20 November.
- Prof. Green represented AIMS on the steering committee of the DFG-AIMS-Workshop, 5-7 March in Dakar, Senegal. The workshop brought together mathematicians from Germany and various African countries to discuss potential topics of joint research in six different mathematical fields. Dr Ndifon gave a presentation.
- Prof. Bassett and Dr Tambue gave talks at the Symposium of Numerical and Applied Mathematics 2016 (SANUM 2016), 22-24 March.

ACHIEVEMENT

Dr Wilfred Ndifon wrote a paper published by the Royal Society which proposed a mathematical solution to the 70-year-old scientific mystery of original antigenic sin and its role in disease. The concept of original antigenic sin was first reported about 70 years ago by American epidemiologist Thomas Francis Jr, but its underlying biological mechanisms remain poorly understood. Dr Ndifon's study introduced and confirmed an original theory using mathematics and experimental data to explain why original antigenic sin occurs and how it can be alleviated by an adjuvant – substance that is added to a vaccine to better activate the immune system's white blood cells.

SEMINARS

Throughout the year, visitors, staff, researchers, tutors and postgraduate students presented talks at the AIMS Journal Club, coordinated by Dr Utete. The scope of work presented was broad, with topics ranging from epistemic logic to quasi-pseudometrics to internet security. A sample of talks is provided below:

- On 27 October, Mr David Sena Attipoe (AIMS research student) spoke on 'Numerical Techniques for Pricing American Put Options'.
- Ms Rosemary Aogo (Department of Mathematics, SU and AIMS alumna) gave a talk on 'Modelling the role of HIV and its treatment in non-Hodgkin lymphoma growth dynamics' on 3 November.
- Mr Solofomampionona Rajaona (AIMS and SU) gave a talk on his doctoral research on 15 December. The talk was entitled 'An algebraic proof of the muddy children puzzle'.
- On International Women's Day, 8 March, Ms Samantha Jones, a PhD student at UCT, gave a talk entitled 'An Overview of the Liquidity of the South African Vanilla Bond Market and the Impact on Credit Spreads'.
- Ms Grace Mwakyoma (AIMS tutor 2015-16) spoke on 24 May on 'A link between Hofer's geometry and Aubry-Mather theory'.
- On 26 May, Dr Ndifon, IDRC Joint Career Development Chair in Biomathematics at AIMS, gave a talk entitled 'Searching for principles in biological systems'.

Highlights from this year's seminars arranged by the Cosmology Group were:

- 'Weak Lensing analysis with Bayesian Hierarchical Modelling' by Prof. Andrew Jaffe (Imperial College) on 1 February.
- 'How to model the effect of small-scale structures on light propagation?' by Dr Pierre Fleury (UCT) on 18 April.

Python JEDI hack day events

These are organised by the Cosmology Group at AIMS South Africa and take place every two weeks at the AIMS South Africa Research Centre. The objectives of these days are to develop participant skills in data-related computer sciences; to facilitate skills transfer between participants; to create or reinforce collaboration and to create a strong core of Proficient data scientists able to tackle various problems. The hack days alternate with brainstorming sessions, intense coding times and short lectures. The range of topics covered include different types of problems (classification/regression problems, outliers detection and patterns recognition and similarity detection); preprocessing and dimensional reduction; real time vs. static analysis and front and back-end related issues. Participants range from postgraduate students to senior scientists from local institutions with an interest in data science and machine learning. The first of these hack days was held on 10 June.

PROF. IAN DURBACH
Resident Researcher

Prof. Ian Durbach has a joint appointment as resident researcher at AIMS South Africa and Associate Professor of Statistical Sciences at UCT. He works in multi-criteria decision analysis (MCDA), developing and testing approaches for assisting human decision-making. At the heart of MCDA is the view that better decisions are made when evaluations are decomposed over a number of relevant criteria (like cost and quality) and by explicitly quantifying trade-offs and value judgments between these, rather than leaving these as unarticulated assumptions. Current projects include developing models for choosing optimal subsets of items, applying MCDA to support the selection of a rugby team, and a review of 'simple models' that ignore many real-world complexities, apparently with little or no worsening in performance.

Prof. Durbach is also a core member of the Centre for Statistics in Ecology, the Environment and Conservation at UCT, where his work focusses on developing statistical and machine learning techniques for ecological applications. Current projects include developing models for classifying frog species from acoustic data, as well as identifying individual frogs from the same species using only their calls. These models can be used to provide abundance estimates, an important indicator for conservation management. A recent paper with colleagues at the Plant Conservation Unit at UCT uses statistical methods to reassess the status of Aloe dichotoma, the quiver tree, as an indicator species for climate change.

Highlights in 2015/16 included the graduation of Ms Georgina Rakotonirainy with a Research Master's (with distinction) for a thesis on the optimal scheduling of load shedding, and an award for best collaborative research paper from the *International Journal of Market Research*, for a paper with Gareth Lloyd of Ipsos Laboratories entitled 'Eliminating order effects in association tasks without using randomisation'. The award is given annually to a paper that celebrates collaboration between academic researchers and agency practitioners.

"AIMS is a unique experiment in mathematics education in Africa, and I feel very lucky to be a part of it. I have really enjoyed working with students and fellow researchers from diverse backgrounds and with diverse skill sets, and have learned a lot in the process. The growing interest in statistics and machine learning at AIMS, and especially the desire among students to work on applied problems is also very exciting to me."

DR ANDRE SAINT EUDES MIALEBAMA BOUESSO
Postdoctoral Fellow

Dr Andre Saint Eudes Mialebama Bouesso completed his Master's degree in Pure Mathematics at Marien Ngouabi University, Congo in 2007, after which he completed a Master 2 in Algebra and Applications at Cheikh Anta Diop University in Senegal in 2010 and did a PhD in Computer Algebra at the same university.

During his PhD, Andre was awarded the IMU Berlin Einstein Foundation Fellowship, which enabled him to spend nine months at the Freie Universität of Berlin, Germany. In 2014, he was appointed as a DAAD Postdoctoral Fellow at the Institute of Mathematics and Physical Sciences in Benin. Since January 2015 he has been a Postdoctoral Fellow in the AIMS South Africa Research Centre.

"My main area of research is computer algebra. I am mostly interested by anything related to the computation of commutative and non-commutative Groebner bases. But I have expanded my research into algebraic geometry, where I work on intersection theory and related topics."

"Having the opportunity to be a full-time postdoc researcher (without teaching duties) is very rare and precious, as it has provided the possibility to grow and strengthen my research activities, including expanding into a new area, algebraic geometry.

> "Thanks to AIMS I can collaborate with prestigious researchers such as Prof. Wolfram Decker and Prof. Gerhard Pfister, who are considered to be among the leading experts in computer algebra worldwide."

MS EPHIFANIA GEZA
PhD student

Ms Ephifania Geza was born in Gokwe, Zimbabwe. She completed a Mathematics Honours degree in 2009 and spent one year as a secondary mathematics teacher before joining the National University of Science and Technology as a teaching assistant. After finishing a Master's degree in Operations Research, her supervisor encouraged her to apply to AIMS. She graduated from AIMS South Africa in 2015 and is currently doing her PhD in Bioinformatics under the supervision of Dr Mazandu at the AIMS South Africa Research Centre.

Ephifania attended the Science and Communications Workshop, held in Sandton from 16 to 18 March, facilitated by Dialogue Matters and funded by the British Council and the Academy of Science South Africa. The workshop was aimed at equipping women in science with communication and engagement skills. She notes, "I learnt how to prepare engaging presentations for conferences and workshops, high-impact policy briefs, and press releases that get noticed. I believe this kind of training is of paramount importance." With this belief in mind she successfully applied for funding from the organisers to host a similar workshop at AIMS South Africa in August 2016.

"My experience at AIMS has taught me how to become a problem solver able to tackle a diverse range of problems. It gave me a lot of courage and built my confidence, enabling me to believe in myself as a person who can change society and hence Africa. Interacting with people of diverse cultures and academic backgrounds and first class international researchers and using cutting-edge technologies, has enhanced my communications, analytical and research skills. My interests lie in solving problems that directly affect the agriculture, food security, water and health sectors. AIMS has helped me to live my dream."

Visitors to the AIMS South Africa Research Centre included academics attending workshops and conferences, AIMS Distinguished and Associate Research Fellows and researchers collaborating with resident researchers.

Name	Nationality	University (Affiliation)	Research	Dates of visit
Athreya, Jayadev	United States	Illinois at Urbana Champaign	Quadratic differentials	1 – 19 January 2016
Attan, Sylvain	Benin	University of Benin	Computational algebra	1 – 9 August 2015 and 5 February – 3 April 2016
Beardon, Alan	United Kingdom	Cambridge University	Pure mathematics	15 – 18 January 2016
Bradlow, Steve	United States	Illinois at Urbana Champaign	Differential geometry	3 – 22 January 2016
Chirove, Faraimunashe	Zimbabwe	University of KwaZulu-Natal	Biomathematics	1 – 28 February 2016
Clarkson, Peter	United Kingdom	University of Kent	Integrable systems, special functions, and symmetry methods for differential equation	28 March – 8 April 2016
Decker, Wolfram	Germany	Kaiserslautern University	Computational algebra	22 February – 12 March 2016
Djoufack, Zacharie	Camaroon	Yaoundé	Physics	20 October – 17 November 2015
Dongho-Nguimdo, Guy	Camaroon	University of the Witwatersrand	Computational physics	4 – 30 April 2016
Gaensler, Bryan	Canada	University of Toronto	Magnetic fields	20 May 2016
Gumma, Elzain Ahmed	Sudan	International University of Africa	Derivative-free optimization	11 April – 10 May 2016
Guerrero Cardenas, Diego	United States	MIT	Cosmology	31 May – 15 August 2015
Ihl, Matthias	Germany	University of Porto	Physics	9 – 27 November 2015
Jaffe, Andrew	Britain	Imperial College	Astrophysics	21 January – 19 February 2016
Jones, Vaughan	New Zealand	Berkeley/ Vanderbilt	Knot Theory	15 February – 12 March 2016
Jordaan, Kerstin	South Africa	University of Pretoria	Special functions; orthogonal polynomials and approximation theory	29 March – 8 April 2016
Kometa, Bawfeh Kingsley	Camaroon	University of Bergen	Applied mathematics	8 March – 30 April 2016
Likibi Pellat, Rhoss Beauneur	Republic of Congo	Marien Ngouabi University	Novel numerical schemes for stochastic differential equations	11 July – 30 September 2015
Lochowski, Rafal Marcin	Poland	Warsaw School of Economics	Stochastic processes and their application in mathematical finance	5 – 19 April 2016
Mansfield, Elizabeth	United Kingdom	University of Kent	Computational mathematics	28 March – 2 April 2016
Mohammed, Mogtaba	Sudan	University of Pretoria	Homogenization of stochastic linear hyberbolic equations	15 June – 30 November 2015
Nang, Philibert	Gabon	University of Paris	Algebraic analysis	18 May – 11 June 2016
Pfister, Gerhard	Germany	Kaiserslautern University	Computational algebra	22 February – 12 March 2016
Sango, Mamadou	South Africa	University of Pretoria	Partial differential equations, stochastic processes and differential geometry	17 June – 17 July 2016
Shock, Jonathan	South Africa	University of Cape Town	Mathematics and applied mathematics	9 – 27 November 2015
Weltman, Amanda	South Africa	University of Cape Town	Cosmology and astrophysics	20 May 2016
Yanga, Serge	Yaoundé	Félix Houphouët-Boigny University, Abidjan	Modelling and numerical simulation of environmental fluid dynamics	15 October – 15 December 2015
Zekeng, Elsa (PhD student)	Germany	University of Liverpool	Biomathematics	27 October – 30 November 2015
Zimmerman, Hans Georg	Germany	Siemans, Germany	System identification and neural networks	1 – 9 April 2016

Dr Hans Georg Zimmerman

Prof. Bryan Gaensler

LIST OF PUBLICATIONS

The AIMS South Africa Research Centre continues to increase its publication outputs with 65 appearing in 2015 and 48 (to date) in 2016.

2016 (48)

RO Akinola, **GK Mazandu** and NJ Mulder. A quantitative approach to analyzing genome reductive evolution using protein-protein interaction networks: A case study of Mycobacterium leprae. *Frontiers in Genetics.* 7 (2016) 39.

A Alhamud, **PA Taylor**, AJ van der Kouwe, EM Meintjies. Real-time measurement and correction of both B0 changes and subject motion in diffusion tensor imaging using a double volumetric navigated (DvNav) sequence. *Neuroimage*. 126 (2016) 60-71.

G Ashebir, **S Zambou**, U Mannl, R Setshedi, M Harting, D Britton. Fully screen printed LRC resonant circuit. *Microelectronic Engineering*. 162 (2016) 6-11.

G Bernadi, T Venturi, R Cassano, D Dallacasa, G Brunetti, V Cuciti, M Johnston-Hollitt, **N Oozeer**, V Parekh & OM Smirnov. KAT-7 observations of an unbiased sample of mass-selected galaxy clusters. *Monthly Notices of the Royal Astronomical Society*. 456 (2) (2016) 1259-1268.

L Boyero, **C Hui**, et al. Biotic and abiotic variables influencing plant litter breakdown in streams: a global study. *Proceedings of the Royal Society B: Biological Sciences.* 283 (2016) 2015-2664.

TM Cantwell, AMM Scaife, **N Oozeer**, ZL Wen & JL Han. A newly discovered radio halo in merging cluster MACS J2243.3-0935. *Monthly Notices of the Royal Astronomical Society*. 458 (2) (2016) 1803-1814.

L Chen, ZB Li, **C Hui**, X Cheng, BL Li & PJ Shi. X. A general method for parameter estimation in light-response models. *Scientific Reports*. 6 (2016) 27905.

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S Colafrancesco, N Mhlahlo, T Jarrett, **N Oozeer** and P Marchegiani. Discovery of a suspected giant radio galaxy with the KAT-7 array. *Monthly Notices of the Royal Astronomical Society*. 456 (1) (2016) 512-517.

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J Fan, SW Jacobson, **PA Taylor**, CD Molteno, NC Dodge, ME Stanton, JL Jacobson, EM Meintjies. White matter deficits mediate effects of prenatal alcohol exposure on cognitive development in childhood. *Human Brain Mapping.* 37(8) (2016) 2943-2958.

K Finlator, BD Oppenheimer, **R Dave**, E Zackrisson, R Thompson, S Huang. The soft, fluctuating UVB at z ~ 6 as traced by C IV, Si IV and CII. *Monthly Notices of the Royal Astronomical Society.* 459 (3) (2016) 2299-2310.

AB Ford, JK Werk, **R Dave**, J Tumlinson, R Bordoloi, N Katz, JA Kollmeier, BD Oppenheimer, MS Peeples, JX Prochaska, DH Weinberg. Baryon cycling in the low-redshift circumgalactic medium: a comparison of simulations to the COS-Halos survey. *Monthly Notices of the Royal Astronomical Society.* 459 (2) (2016) 1745-1763.

XZ Han, BY Chen, & **C Hui**. Symmetry breaking in cyclic competition by niche construction. *Applied Mathematics and Computation.* 284 (2016) 66-78.

S Hassan, **R Dave**, K Finlator, MG Santos. Simulating the 21 cm signal from reionization including non-linear ionizations and inhomogeneous recombinations. *Monthly Notices of the Royal Astronomical Society.* 457 (2) (2016) 1550-1567.

C Hui, DM Richardson, P Landi, HO Minoarivelo, J Garnas, & HE Roy. Defining invasiveness and invasibility in ecological networks. *Biological Invasions.* 18 (2016) 971-983.

SL Jack, MT Hoffman, RF Rohde and **I Durbach**. Climate change sentinel or false prophet? The case of Aloe dichotoma. *Diversity and Distributions*. 22 (7) (2016) 745-757.

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L Liang, F Durier, A Babul, **R Davé**, BD Oppenheimer, N Katz, M Fardal, T Quinn. The growth and enrichment of intragroup gas. *Monthly Notices of the Royal Astronomical Society*. 456 (4) 4266-4290.

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A Ramanantoanina and **C Hui**. Formulating spread of species with habitat dependent growth and dispersal in heterogeneous landscapes. *Mathematical Biosciences.* 275 (2016) 51-56.

MP Robertson, V Visser, and **C Hui**. Biogeo: an R package for assessing and improving data quality of occurrence record datasets. *Ecography.* 39 (2016) 394-401.

A Rodgers, M Mokoena, **I Durbach**, et al. Do teas rich in antioxidants reduce the physicochemical and peroxidative risk factors for calcium oxalate nephrolithiasis in humans? Pilot studies with Rooibos herbal tea and Japanese green tea. *Urolithiasis.* 44 (2016) 299-310.

M Rouget, MP Robertson, JRU Wilson, **C Hui**, F Essl, JL Renteria & DM Richardson. Invasion debt–quantifying future biological invasions. *Diversity and Distributions.* 22 (2016) 445-456.

N Roura-Pascual, N Sanders, **C Hui**. The distribution and diversity of insular ants: Do exotic species play by different rules? *Global Ecology and Biogeography*. 25 (2016) 642-654.

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F Sembolini, **R Dave** et al. nIFTy galaxy cluster simulations - II. Radiative models. *Monthly Notices of the Royal Astronomical Society.* 459 (3) (2016) 2973-2991.

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TJ Stewart and **IN Durbach** (2016). Dealing with Uncertainties in MCDA. In *Multiple Criteria Decision Analysis: State of the Art Surveys*, edited by S Greco, M Ehrgott, JM Figuera. 467-496. Springer.

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Workshop on Quadratic Differentials

During the period under review AIMS researchers hosted 10 workshops and conferences, with seven of these being held at AIMS South Africa. Many of these were collaborations with other organisations, including the University of the Witwatersrand, the University of Illinois at Urbana Champaign, SACEMA, SU and UCT.

Organised by Prof. Romeel Davé, Research Chair at AIMS South Africa and UWC, the **Modelling gas in galaxies workshop** was a small workshop held in Gordon's Bay, Cape Town, from 16 to 20 November, and funded by a National Research Foundation-Germany bilateral grant obtained by Prof. Davé and Dr Thorsten Naab at the Max Planck Institute for Astrophysics. The 15 participant researchers came from Germany, South Africa and the United States. The aim of the workshop was to foster collaborations centred on simulations of neutral and molecular gas in galaxies, with an eye towards comparisons and predictions for the Atacama Large Millimeter/submillimeter Array (ALMA) and MeerKAT/Square Kilometer Array (SKA).

The **Mathematical and computer methods for understanding financial markets workshop** for financial maths students, undergraduates and honours students in mathematics, computing or statistics registered at South African universities, was held at AIMS South Africa from 18 to 21 November. The workshop was attended by 16 students including five AIMS students. The programme included the following: an introduction to R and its use in the analysis of financial data; pricing options on financial assets using the Binomial Model; stochastic asset models and their analysis using Monte Carlo methods and constructing efficient stock portfolios.

The **Workshop on Quadratic Differentials**, held in partnership with the Clay Mathematics Institute, was hosted at AIMS South Africa from 4 to 8 January. Holomorphic differentials on Riemann Surfaces have long held a distinguished place in several areas of low dimensional geometry, dynamics and representation theory. More recently they have emerged in intriguing ways in the study of billiards in polygons, special (so-called Hitchin) components of representation varieties, stability conditions on Fukaya-type categories, spectral networks, and asymptotic properties of Higgs bundle moduli spaces. This workshop brought together a small number of experts at the forefront of these diverse areas to explore common themes and in particular to investigate the use of techniques that could potentially cross disciplinary boundaries.

The Mathematics in Industry Study Group is a five-day workshop at 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. This year the **13th Mathematics in Industry Study Group** was held at the University of the Witwatersrand. The following AIMS students attended the workshop: Mr Zamokwakhe Mvuyandlela Dlamini, Ms Arzag Noureldein Korany Ebrahim, Ms Frether Getachew Kebede, Mr Africa Mgudlwa, Ms Nothondo Precious Mhlongo, Mr Elia Namundjebo, Ms Alice Nanyanzi, Ms Salma Dafa Allah Ahmed and Mr Thembani Phaweni.

Mathematical and computer methods for understanding financial markets workshop

9th Summer School in Mathematical Finance

3rd Machine Learning JEDI

A work group during the InSciDa Workshop of Statistics and Data Science in Industry

The **InSciDa Workshop of Statistics and Data Science in Industry** was co-hosted by AIMS South Africa and the Department of Statistical Sciences at UCT and held at AIMS South Africa from 18 to 23 January. It brought together a total of 44 participants, including industry experts, postgraduate students (including six AIMS South Africa students) and outstanding undergraduate students to work collaboratively on real-world problems in statistics, data science and analytics. The problems were submitted by industry partners and students worked under the joint supervision of experts in the field and the industry partners themselves. The goal of the event was to develop practical skills in the areas of statistical modelling, analytics and data science.

The **3rd Machine Learning JEDI** workshop funded by the Harry Oppenheimer Foundation, NRF and AIMS South Africa was held from 6 to 14 February. The workshop brought together 15 students, post-docs and researchers interested in machine learning and artificial intelligence. Drawn from a variety of fields with the goal of building new, interdisciplinary collaborations, the participants worked on a number of projects, including source extraction in radio astronomy, digital anthropology and deep learning.

> “The workshop brought together 15 students, postdocs and researchers interested in machine learning and artificial intelligence.”

The **9th Summer School in Mathematical Finance**, held at AIMS South Africa from 18 to 20 February, brought several leading academic exponents of the fast-growing field of Mathematical Finance to South Africa. The school presented a unique opportunity for local practitioners, academics and students to interact with international leaders in research on topics and modelling techniques current in the South African and international financial markets. The speakers were Prof. Erik Schlögl, Dr John Schoenmakers and Prof. Michael Sørensen. The school was attended by 45 participants, including ten AIMS Research Master’s and Master’s students.

Global Change Impact on Diseases and Alien Species Expansion Workshop

7th Annual Clinic on the Meaningful Modelling of Epidemiological Data

The **Workshop on System Identification and Forecasting with Neural Networks** was held from 4 to 8 April. This workshop was for researchers and practitioners working in optimisation, machine learning and designing complex systems. The main speaker was Dr Hans-Georg Zimmerman, from Siemens Corporate Technology, who has decades of experience in applying neural networks to industrial problems, for example energy demand and price forecasting, prediction of electricity output in renewable power systems and systems diagnosis. The 50 attendees, including students from AIMS South Africa, UCT, SU and UKZN, had the opportunity to learn about the theory and practice of neural network system design and use.

The **Global Change Impact on Diseases and Alien Species Expansion Workshop** took place at AIMS South Africa from 1 to 6 May and had 15 speakers and 52 attendees (including 22 AIMS South Africa students). This international, interdisciplinary, educational and capacity-building workshop brought together the subjects of infectious diseases and invasive species and the context of climate change, thus allowing the sharing of methods and building partnerships. The workshop addressed a whole range of topics, from field-work and collecting of data to the building and validating of models; the adjustment of models to take into account the changing environment and social characteristics; and the design and implementation of strategies to fight infectious diseases and invasive species. Special emphasis was put on African diseases and invasive species, as well as the characteristics of the changing environment in Africa. It was organised by the International Mathematical Union, the International Union of Biological Sciences, the International Union of Immunological Societies, the International Union of Microbiological Societies, the International Social Science Council, the International Council of Industrial and Applied Mathematics, the ICSU Regional Office for Africa, ecoHEALTH from Future Earth, the International Society for Biometeorology, AIMS South Africa, the South African Mathematical Society, the DST-NRF Centre of Excellence for Invasion Biology, UNESCO and Mathematics of Planet Earth, and supported by the ICSU.

SACEMA held its **7th Annual Clinic on the Meaningful Modelling of Epidemiological Data (MMED)** from 30 May to 10 June. This two-week modelling clinic was held in collaboration with the International Clinics on Infectious Disease Dynamics and Data (ICI3D) Programme and AIMS South Africa. It brought together graduate students, postdoctoral scholars and other researchers from North America and Africa with the goal of engaging the participants in epidemiological modelling projects that use real data to grapple with practical questions in a meaningful way. The Clinic consisted of a series of lectures, discussions and tutorials that guided participants through the process of developing data-based, dynamic models of disease spread and using models to answer public health questions. There were 63 participants, which included 20 AIMS South Africa Master's and Biomath Honours students, 27 North American and African participants and 16 faculty members and mentors.

Workshop on System Identification and Forecasting with Neural Networks

AIMS SCHOOLS ENRICHMENT CENTRE

AIMS | African Institute for Mathematical Sciences SCHOOLS ENRICHMENT CENTRE

UNDERSTANDING THE CONTEXT OF OUR SCHOOLS

AIMSSEC strives to better understand the context of teaching and learning of mathematics in primary and secondary schools to ensure that its courses continue to be useful and relevant. To this end, interacting with teachers and learners in the classroom has become an essential component of AIMSSEC's outreach to schools. From 16 to 19 May 2016, AIMSSEC staff visited five schools in the East London district of the Eastern Cape.

The school visits provided deeper insight into:

- how to improve the face-to-face residential component of AIMSSEC's courses;
- the engagement of learners with mathematically rich activities in schools that have little access to resources;
- the best practice for demonstrating model lessons to teachers in disadvantaged communities;
- the day-to-day challenges the teachers and learners experience in communities;
- government and non-government interventions working in schools and the surrounding communities.

At the five schools visited there were 12 AIMSSEC alumni who had attended an MT course – some of whom had started their journey with AIMSSEC as far back as 2003. These teachers spoke very highly of AIMSSEC and work tirelessly to improve the quality of teaching and learning not only in their schools, but also in their communities.

The school visits highlighted the significance of the role of senior and middle leadership in prioritising the teaching and learning of mathematics in schools and sustaining change.

MATHEMATICAL THINKING FLAGSHIP COURSE

The Mathematical Thinking (MT26) course was attended by 134 teachers from six provinces from 4 to 14 July 2016 at Stellenbosch High School. The MT course is a blended-learning course consisting of a ten-day residential component followed by three months of distance learning. Learner-centred, activity-based approaches using cheap resources are key to the success of this course, while consolidating the educators' content knowledge and building on their general teaching strategies. The course is endorsed by the South African Council of Educators (SACE) for 15 professional development points and is delivered by a strong local team with the support of an international team of experts. A tutor system, led by the AIMSSEC local team, provides further support to the educators.

With the birth of the 'digital age' and the consequent creation of a 'knowledge society,' teachers, curriculum designers, and governments all over the world are refocusing their positions, realigning their beliefs and rapidly embracing Information and Communication Technologies (ICT) in the 21st century classroom. AIMSSEC strives for excellence in education and as such prioritises the integration of various media, technologies and techniques in teaching and learning. To this end, AIMSSEC includes a hands-on IT course during the MT residential training.

The IT course covers basic skills and exposure to software packages and computer applications, including:

- effective Internet searches to source mathematics software and resources that match specific curriculum standards;
- using ICT to search for, manage, analyse, integrate and evaluate information that can be used to support professional teaching and learning;
- basic Microsoft Office and Excel skills that can be used for administrative purposes and to make interactive lessons, presentations, and assessment tools; and

Learners engaging with a hands-on activity

A working session during the MT course

MT26 group photo

- the AIMING HIGH Teacher Network (aiminghigh.aimsec.ac.za) which enables educators to develop a support network that can form the basis of a growing community of good practice. The network offers free resources to teach mathematics and a supportive space where educators can ask each other for advice.

Most importantly, ICT is used to inspire the teachers to communicate and collaborate with students, peers, parents, school faculties, and the larger community. To cultivate and sustain this culture, AIMSSEC introduces the teachers to various global Professional Learning Networks, giving them access to outside international experts and learning communities that can support their activities and their own professional learning.

RESEARCH AND WORKSHOPS

AIMSSEC presented their research and workshops nationally and internationally.

FaSMEd: An international research project at AIMSSEC

The Formative Assessment in Science and Mathematics Education (FaSMEd) project is a consortium of science and mathematics experts from eight countries: seven in Europe and one in South Africa (AIMSSEC). All partners work with teachers in two or more schools to develop classroom activities. The main focus of the work is on formative assessment – a deliberate process of gathering information about learners' current understanding of mathematics or science – and using this information to decide what to do next. A second focus of the work is the use of technology in the formative assessment process, for example in gathering and sharing student work, processing results or providing interactive environments.

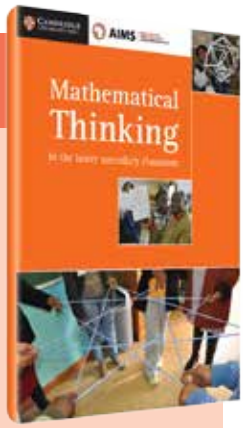
The work with the teachers informs the development of a toolkit to support teachers in the use of formative assessment in their mathematics and science classrooms. From time to time, the international team gathers to share results, discuss emerging findings and plan what to do next. AIMSSEC hosted one such meeting in February 2016.

International Congress on Mathematical Education (ICME), Hamburg, Germany

Dr Marie Joubert, Ms Ingrid Mostert and Ms Lindiwe Tshuma represented AIMSSEC at the 13th International Congress on Mathematics Education (ICME 13), which was held in Hamburg, Germany, from 25 to 29 July 2016.

At ICME Dr Joubert was part of a high-profile invited team who presented a survey of the literature related to mathematics teachers' learning through collaboration. She also took part in the topic study group on task design in mathematics classrooms, where she presented a paper on some of the research Ms Mostert and she have done since July 2014 for the EU-funded FaSMEd project. She spoke about the design decisions the research team and the teachers involved in the research had made in implementing a range of pre-designed lessons in the teachers' classrooms. Ms Mostert chose to join the study group focusing on professional development for secondary

AIMSSEC PUBLISHES FIRST BOOK IN THE MATHEMATICAL THINKING SERIES



In April 2016, Cambridge University Press (CUP) published the first book in AIMSSEC's Mathematical Thinking series and the book is now available in South Africa. Written for senior phase mathematics teachers, it is the culmination of years of collaborative work by many people.

The material in the book is based on activities used in AIMSSEC's courses and gives guidance for mathematics teachers to enable them to run professional development workshops without expert assistance.

The chapters were trialled by approximately 150 teachers who attended an MT24 course in July 2015. The book has 20 chapters covering topics in numbers, algebra, geometry and measures, and data handling and probability. Each chapter covers one mathematical concept and addresses one of six teaching strategies. The book also has chapters on formative assessment, teaching and learning mathematics with technology (with a glossary) and an appendix with more than ten photocopiable resources. Not only does the book cover important content and address useful teaching strategies, it also offers ideas for learning activities and low-cost resources designed to encourage learners to think for themselves and develop problem-solving and communication skills.

Books can be purchased online through CUP (free delivery in South Africa): www.cup.co.za/products/mathematical-thinking-in-the-lower-secondary- classroom, or from the AIMSSEC offices at 65 Main Road, Muizenberg, Cape Town.

teachers of mathematics and presented a paper on the learning of the teachers involved in the FaSMEd project in South Africa. Ms Tshuma joined the study group on mathematics education in a multilingual and multicultural environment and presented a paper on her early PhD research about the relationship between language competency and mathematics instruction in intermediate phase mathematics classrooms.

Association for Mathematics Education for South Africa (AMESA) National Conference, Nelspruit, South Africa

The AIMSSEC delegation at the AMESA National Conference held in Nelspruit from 27 June to 1 July 2016, was the largest group of presenters from one organisation. Presentations were made by Dr Joubert, Dr Barrie Barnard, Ms Christine Hopkins (international visiting lecturer), Ms Mostert, Ms Sinobia Kenny and Ms Tshuma.

Ms Tshuma also represented AIMSSEC at the Western Cape provincial conference as the keynote plenary speaker on 28 May 2016 delivering a talk about language and mathematics. Ms Mostert delivered a workshop on introducing fractions to intermediate phase learners.

AIMSSEC AND AIMS SOUTH AFRICA ALUMNI SUPPORT ON EDUCATIONAL PROGRAMMES

For the first time, AIMSSEC alumni and AIMS South Africa graduates joined the AIMSSEC local and international team at the Mathematical Thinking course held from 4 to 14 July 2016. Eight AIMSSEC alumni, four AIMS Master's students and one AIMS Honours student helped to make the course a success. It was a huge learning curve and thoroughly enjoyed by all.

AIMSSEC alumni	Gender	Roles
Sagree Pillay	F	Lecturer
Zikona Ntlonti	F	Associate lecturer
Stephen Basvi	M	Co-lecturer, FET Teaching Assistant
Elliot Dakada	M	SP Teaching Assistant
Andiswa Mphulu	F	IP Teaching Assistant
Luvoyo Mnqibisa	M	IP Teaching Assistant
Innocent Dlamini	M	SP Teaching Assistant
Maylene Williams	F	FET Teaching Assistant

AIMS South Africa alumni	Gender	Roles
Oluwatosin Babasola	M	IT Teaching Assistant
Mebawandu Akindele	M	Admin Teaching Assistant
Oluwakemi Kolawole	F	IT Teaching Assistant
Arzaq Ibrahim	F	Admin Teaching Assistant
Frieda Geldenhuys	F	IT co-lecturer

Back row: Mr Dakada, Ms Ntlonti, Mr Basvi, Mr Mphulu, Mr Mnqibisa, Mr Dlamini, Mr Babasola (AIMS student), Mr Mebawondu (AIMS student). Front row: Ms Williams, Ms Ibrahim (AIMS student), Ms Kolawole (AIMS student), and Ms Pillay (lecturer).

Dr Joubert and Ms Mostert also presented papers at the Southern African Research in Mathematics, Science and Technology Conference held in Pretoria in January 2016.

SATURDAY SCHOOL

AIMSSEC and AIMS South Africa collaborated with GrandWest Casino to run a Saturday School tutoring project at ID Mkhize Secondary School and Gugulethu Comprehensive School, from 6 February to 11 June 2016. This project was made possible by the dedication and commitment of Ms Celiwe Ngwenya, CSI Project Coordinator of GrandWest Casino.

The project saw over 20 AIMS South Africa students and alumni sacrificing their time on Saturdays to go into the township of Gugulethu and make a difference in the lives of nearly a hundred grade 11 and grade 12 learners. The project was led and coordinated by AIMSSEC lecturer Mr Macdonald Chapwanya. The aim of the project was to help reduce the achievement gap in disadvantaged township schools and to mentor and guide learners to be able to access higher education and opportunities in STEM fields. AIMSSEC prepared the resources for the sessions with the learners and delivered mentoring sessions for the AIMS students and alumni.

MONITORING AND EVALUATION

There has been good progress in creating a Monitoring and Evaluation Framework. The local AIMSSEC team met on 4 November 2015 to discuss the question 'How does AIMSSEC make the world a better place?'. At a workshop session on 11 March 2016, the team agreed to an AIMSSEC vision and theory of change which clarified AIMSSEC's role in building and improving the education pipeline. The team also discussed the newly created Teacher Training Delivery Framework, which will assist in monitoring AIMSSEC systems. The team also recognised the need to understand the context of the schools and; as a result, the visits to the Eastern Cape schools took place in May 2016.

Case studies of four alumni who have been tracked since 2013 and who have progressed to teaching assistants and lecturers on AIMSSEC courses have been compiled. Snapshots of the interviews can be found on the AIMSSEC YouTube channel (www.youtube.com/aimssec).

For individual courses, AIMSSEC's current indicators to measure progress include:

- achievement in content-based assessments;
- changes in the beliefs of teachers about the teaching and learning of mathematics;
- improvements in lesson planning during and at the end of the course.

> "It was such a privilege to be back at AIMSSEC. I was returning as a teaching assistant, but my learning didn't stop from the word go. I saw strategies this time that I didn't see before. I will definitely use them when I return to school."
>
> *Mr Innocent Dlamini, AIMSSEC alumnus*

PUBLIC ENGAGEMENT

JOINT INITIATIVES & MEETINGS

PUBLIC ENGAGEMENT EVENTS

In October 2016, the AIMS Academic Director, Prof. Jeff Sanders visited the Universities of Limpopo and Venda to give talks to students and staff about opportunities available to them at AIMS.

Prof. Sanders with students at the University of Venda

INTERNATIONAL WOMEN'S DAY EVENTS

As part of our efforts to encourage more young women to enter the exciting world of science, AIMS South Africa and AIMSSEC arranged and hosted a variety of events to celebrate International Women's Day (8 March). The events took place from 7 to 11 March and included visits to local high schools by staff members and women role models in STEM fields, a public lecture and a panel discussion by women scientists. These activities formed part of the AIMS Women in STEM Initiative (AWIS) – a programme dedicated to accelerating the progress for African women in STEM through evidence-based reporting and advocacy, leveraging increased investments, the adoption of best practices, and engaging men and collaboration across the African Women in STEM pipeline.

The public lecture titled 'Women in science and the science of women – studying microbiomes' by Prof. Nicola Mulder, UCT Computational Biology Group, was held on 8 March at AIMS South Africa. The lecture can be viewed at https://youtu.be/FYAZHbi3Wxk.

The panel discussion by women scientists, held on 10 March was titled 'Courageous Women with Careers in STEM.' The panelists discussed aspects of their work and gave advice to young people who are considering entering the world of science. Members of the panel were: Dr Rejoyce Gavhi-Molefe (mathematician, AIMS South Africa), Dr Tandeka Magcwebeba (biochemist, SU), Ms Amanda Namba (engineer, City of Cape Town), Ms Celiwe Ngwenya (educationalist, Sun International), Ms Desiree Timmet (statistician, STATSA) and Ms Mmabatho Mokiti (entrepreneur, founder of Mathemaniacs). A video of this panel discussion can be viewed at https://youtu.be/9zraptDPHLw.

AIMSSEC visited local schools during the week to promote women in mathematics. They presented learner-centred fun activities, including solving a murder mystery, investigating Euler's theorem, making three-dimensional objects and a quiz in mathematics language. Most importantly, learners benefitted from motivational talks by successful guest women speakers from a range of STEM careers.

Panel discussion: 'Courageous Women with Careers in STEM'

Business entrepreneur Ms Mokiti giving a motivational talk to learners

Mentors and participants at the second mentoring session

MENTORING SESSIONS FOR WOMEN STUDENTS

Two mentoring sessions for women students at AIMS were held during this period. They were facilitated by AIMS researcher Dr Rejoyce Gavhi-Molefe, with Dr Simukai Utete (Senior Researcher, AIMS South Africa) and AIMS alumni Ms Ephie Geza, Ms Eva Liliane Ujeneza, Ms Omowunmi Elizabeth Isafiade and Ms Savannah Nawugaba as mentors.

Dr Gavhi-Molefe hosting a discussion during the first mentoring session.

EXHIBITIONS ATTENDED

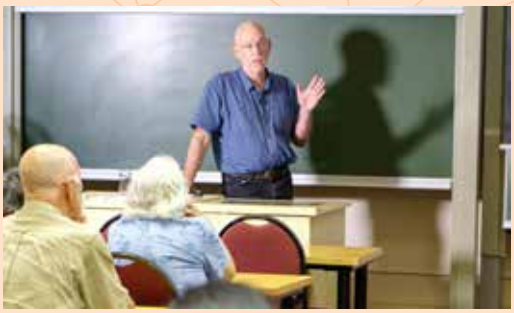
SCIFEST 2016

The 20th edition of South Africa's National Science Festival (Scifest Africa 2016) was held in Grahamstown, in the Eastern Cape, from 2 to 8 March 2016. The theme this year was 'A Matter of Time' and AIMS South Africa was represented by Ms Lindiwe Tshuma and Mr Dakalo Ramufhi from AIMSSEC.

> They conducted learner-based practical activities for learners of all age groups."

Prof. Mike Bruton

Dr Ian McCallum



Prof. Alan R. Kay

Dr Jonathan Shock

Prof. Bruce Bassett

PUBLIC LECTURE SERIES

During the period under review AIMS presented a series of public lectures. The lectures listed below were attended by members of the public and AIMS students.

On 8 September, **Prof. Mike Bruton, MSc, PhD, DSc, FRSSAfr. Exhibition Consultant and Imagineer**, gave a talk titled: 'When I was a fish. Tales of an ichthyologist.' The talk recounted his extraordinary life as one of the leading fish biologists in Africa. He also discussed his views on how society values science; whether science is in danger; and the value of informal science education.

In October, AIMS South Africa hosted two lectures in association with the Muizenberg Festival and the Zandvlei Trust: **Dr Ian McCallum, Nelson Mandela Metropolitan University Graduate School of Business**, spoke on 'Zandvlei – The Geography of Identity'; and **Ms Loubie Rusch**, landscape designer by trade, gave a talk titled: 'Growing a taste for Veldkos – getting to know, grow and use indigenous food plants.'

On 27 October, **Prof. Alan R Kay, University of Iowa**, gave a talk titled 'Biology & Mathematics – the unbreakable link.' He discussed how verbal accounts of biological processes, however detailed, often remain incomplete and unsatisfactory. But mathematical models can go beyond what can be said in words. He used the example of cell size regulation to explore this further.

On 26 November, **Dr Matthias Ihl, University of Porto**, gave a lecture titled 'Is the universe a hologram?' Dr Ihl discussed how recent progress in our understanding of the physics of black holes, quantum information and string theory has led to a new paradigm: *The holographic universe*.

On 9 February, **Dr Jonathan Shock, UCT**, gave a talk titled 'Bows, halos and flashes: A tour of atmospheric optics'. In this talk Dr Shock showed the audience effects from common (and not so common!) rainbows to the most incredible displays of ice halos, through to high atmosphere effects and the mysterious green flash, with photographs from experts and amateurs along the way. He explained some of these effects to encourage people to look up at the sky and appreciate the amazing natural beauty they meet every day but so commonly miss.

On 24 February, **Prof. Bruce Bassett, Cosmology Group AIMS South Africa**, gave a lecture titled 'Gravitational waves – Einstein's final legacy and a revolution for astronomy'. Gravitational waves – ripples in the fabric of space and time itself caused by colliding black holes – were recently discovered by LIGO, opening up a new window on the universe. In this talk Prof. Bassett explored what they are and why Einstein predicted them 100 years ago, how they are created and why it has been so hard to find them. He then discussed how gravitational waves will revolutionise astronomy by giving astronomers a new sense, one that may potentially see right back to the Big Bang. This lecture can be viewed at https://youtu.be/5F5FnaN8aOI.

A lecture titled 'Women in Science and the science of women – studying microbiomes' by **Prof. Nicola Mulder, UCT**, was held on 8 March at AIMS South Africa as part of the International Women's Day activities. The lecture can be viewed at https://youtu.be/FYAZHbi3Wxk.

On 5 May **Prof. Mark Lewis, University of Alberta**, gave a talk titled 'How to Understand Territories with Mathematics'. He discussed how organisms ranging from human beings to wolves have found ways to signal which regions in space they lay claim to. He looked at how these territories are formed and maintained and the fact that mathematical models have a role to play. He also showed how a version of this territorial model has been applied to human populations in understanding spatial patterns arising from conflict between urban gangs. This talk can be viewed online at https://youtu.be/YIH2bz7O4-E.

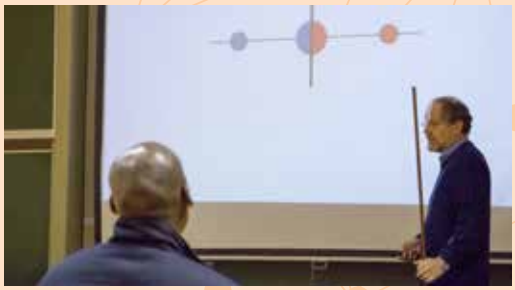
On 13 June, a public lecture titled 'Is mathematics useful?' by **Prof. Martin Grotschel, President Berlin-Brandenburg Academy of Sciences and Humanities,** was held at Stellenbosch University.

On 17 June, a public lecture titled: 'Identifying homogenous risks – Theory and practical issues' by **Prof. Peter Gritzmann, Munich TU,** was presented at AIMS South Africa.

Prof. Nicola Mulder

Prof. Mark Lewis

Prof. Martin Grotschel



Prof. Peter Gritzmann

JOINT INITIATIVES AND MEETINGS

Prof. Green was invited by the DST and the Council for Scientific and Industrial Research (CSIR) Meraka Institute to serve on a Review and Evaluation Panel to adjudicate proposals received from consortia of South African higher education institutions to develop, host and deliver a National e-Science Postgraduate Teaching and Training Platform (NEPTTP), centred on a proposed national multi-institutional and multidisciplinary research Master's degree. He attended the meeting on 27 May 2016.

Prof. Steven Richardson from Howard University, visited the centre on 1 September. He met with Prof. Green and gave a presentation to students.

Dr Howard Alper, a member of the AIMS-NEI Board, visited AIMS South Africa on 3 September. He met with Prof. Green and Prof. Sanders and had an informal discussion with the Master's students.

On 19 October, a Canadian delegation from the government of Ontario province visited AIMS South Africa. They were taken on a tour of the facilities and given presentations by Prof. Green, Prof. Sanders, Ms Carime Umulisa (tutor and AIMS alumna from Rwanda). The delegation comprised: Dr Reza Moridi, Minister of Research and Innovation and Minister of Training, Colleges & Universities, Dr Cory Mulvihill, Chief of Staff, Ministry of Research and Innovation and Ministry of Training, Colleges & Universities, Mr Bill Mantel, Assistant Deputy Minister, Ministry of Research and Innovation, and Mr Lee Marsden, Senior Policy Advisor, Ministry of Research and Innovation as well as Mr Bradley Belanger, from the Canadian Embassy in Pretoria.

Prof. Richardson

Prof. Sanders, Dr Alper and Prof. Green

Mr Marsden, Dr Mulvihill, Mr Belanger, Dr Moridi, Prof. Green, Prof. Sanders, Mr Heerden (Director AIMS Industry Initiative) and Mr Mantel.

Prof. Turok, Dr Qhobela, Dr Utete, Prof. Green and Prof. Bassett

HE Ms Sandra McCardell and the delegation with AIMS South Africa staff and researchers.

Dr Molapo Qhobela, the recently appointed CEO of the National Research Foundation visited AIMS South Africa on 27 January 2016. He met with Prof. Green, Prof. Neil Turok and members of the research centre, Prof. Bassett, Dr Utete and Dr Gavhi-Molefe. After the meeting Prof. Qhobela had the opportunity to meet with staff and students at a special tea.

> "I am very pleased that Canada has been involved with AIMS for such a long time. This visit was a dose of optimism and I heard some very inspiring stories about your commitment to your communities as well as doing great science and your progress with regards to gender equality."
>
> *HE Ms Cardell*

On 11 February, Her Excellency Ms Sandra McCardell, Canadian High Commissioner to South Africa, together with a delegation consisting of Ms Louise Holt, Director Kenya and South Africa Program (Development); Ms Leslie Norton, Visiting Chief Director for Eastern and Southern Africa; and Mr Greg Goldhawk, Trade Office, visited AIMS South Africa. The delegation was welcomed by Prof. Green and Dr Dorothy Nyambi, AIMS-NEI Executive Vice President. They were given presentations on AIMS and AIMSSEC and had the opportunity to hear from researchers, alumni and staff. They were later joined by the AIMS Master's students at tea.

On 29 April, Ms Anisa Khan, Newton Fund and Higher Education Programme Manager from the British Council, visited AIMS South Africa to find out more about its programes and how the two institutes may perhaps work together in the future. She met with members of the AIMSSEC team, Dr Barnard and Ms Kenny. Dr Gavhi-Molefe, a postdoctoral fellow in the Research Centre, Ms Ephie Geza, a PhD student and Ms Linda Camara, Communications Officer, were also in the meeting.

On the same day, Dr Barbara Becker, Director Global Transformation Affairs; Ms María Ubierna, Programme Manager; and Patricia Heuberger, Programme Manager, all from ETH Global, were given a presentation on AIMS by Prof. Sanders, Academic Director, followed by discussions on the current collaboration between AIMS South Africa and ETH Global and how this can be expanded.

A delegation from the Alexander von Humboldt Foundation and representatives from the German Federal Ministry for Education and Research, the German Embassy and DAAD visited AIMS South Africa from 13 to 17 June 2016. The selection committee from the Humboldt Foundation selected the candidate for the German Research Chair in Mathematics with a Specialisation in Data Science who will be based at AIMS South Africa. Members of the delegation included Prof. Peter Gritzmann, Prof. Martin Groetschel, Dr Andrea Binder, Dr Anne Pflug, Dr Simone Heil, Ms Michaela Kreilos and Ms Daniela Mager. The delegation was joined by Ms Phillina Wittka (DAAD) and Ms Eva Ziegert from the German Embassy.

Other visitors included Prof. Gillet, Provost and Vice-President of the Ecole Polytechnique fédérale de Lausanne (EPFL); Ms Melissa Gibson, University of Southamption; and Mrs Bianca Clausen, German Development Bank.

From left: (Front row): Dr Barnard, Ms Ziegert, Dr Bah, Dr Diop, Ms Mager , Ms Kreilos. (2nd row): Prof. Bassett, Prof. Reddy, Prof. Rewitsky, Dr Heil, Dr Utete (3rd row): Dr Ndifon, Prof. Gritzmann, Dr Yocgo, Prof. Green, Dr Pflug (Back row): Prof. Sanders, Dr Binder, Prof. Groetschel, Dr Vollmer, Prof. Becker and Ms Wittka

AIMS NETWORK

AIMS | African Institute for Mathematical Sciences
NEXT EINSTEIN INITIATIVE

Highlights of the year for the Network included the relocation of the AIMS-NEI secretariat and the establishment of the AIMS centre in Rwanda; the Next Einstein Forum (NEF) Global Gathering; and the development of a network-wide research strategy.

GRADUATIONS

Across the network, 237 students, including 78 women, graduated from their respective centres. This brings the total number of alumni to 1 210, with 32% of them women from 42 African countries.

AIMS IN RWANDA

In December 2015, Prof. Neil Turok (founder of AIMS), the AIMS International Board of Directors and the Executive team met with President Kagame of Rwanda in Kigali. After the meeting Prof. Turok made the announcement that AIMS would open a centre in Rwanda as well as relocate the AIMS-NEI secretariat to Rwanda. The Rwandan Minister of Education, the Honorable Dr Musafiri Papias Malimba, said that AIMS coming to Rwanda and the pan-African talent which it will draw will benefit Rwanda's research community. Members of he AIMS-NEI secretariat began relocating to Rwanda in early 2016 and the AIMS centre in Kigali opened in August 2016. Rwanda is now home to the AIMS headquarters and the NEF secretariat and plans are progressing for Africa's first quantum research centre, Quantum Leap Africa.

NEXT EINSTEIN FORUM GLOBAL GATHERING 2016

The Next Einstein Forum's (NEF) Global Gathering, Africa's premier global science and technology forum, was held in Dakar from 8 to 10 March 2016. The gathering ended with a clear road map on how best to drive development across the continent through science, technology and innovation.

The NEF Fellows with the President of Senegal, HE Macky Sall and the President of Rwanda, HE Paul Kagame, on the opening day.

The NEF Global Gathering 2016 brought together more than 1 000 global scientific and industry thought-leaders, political leaders and young scientists uniting to chart a new course for science-led development in Africa.

"This is a transformational moment for Africa and we would like to thank the President, Prime Minister and people of Senegal for welcoming the international scientific community to Dakar," said Mr Thierry Zomahoun, NEF chairperson and President and CEO of AIMS. "Over the past three days, our scientists have shown us and the world that given the opportunity, they are able to do extraordinary things. Taking our African scientists out of the shadows and giving them the exposure on a global level, we're creating a youth-driven pan-African scientific community that must be sustained and expanded starting with our NEF Fellows and Ambassadors."

Moving forward, the NEF will focus on implementing the Dakar Declaration, a set of bold commitments to enable science-driven development by forging strategic partnerships, securing increased investment, developing research capacity, encouraging education, empowering young African scientists and promoting diversity and women in STEM.

AIMS Cameroon graduated 47 students (including 17 women) on 29 June 2016.

At AIMS Senegal, 41 students (including 9 women) graduated on 21 June 2016.

On 25 June 2016, 48 students (including 18 women) graduated at AIMS Ghana.

On 2 July 2016, AIMS Tanzania graduated 47 students (including 13 women).

Conference highlights and outcomes included:

- IBM Research and the NEF announced the launch of a Visiting Scientist Program, joining forces to promote the future of African scientific talent and advance the continent's knowledge economy. Through the collaborative agreement, five NEF Fellows will become visiting IBM scientists at IBM's global network of research labs in countries such as Kenya, the US, Switzerland, China, India, Brazil, Israel, and Australia. The program is designed to give a boost to Africa's most promising young scientists and help set the pace and direction for the continent's cutting-edge scientific research.
- The signing of a memorandum of understanding between AIMS and Germany's Federal Ministry of Education and Research (BMBF). The organisations announced the establishment of five research chairs to strengthen research and support scientific exchange. The first chair – NEF Fellow, Prof. Moustapha Fall – has already been set up at AIMS Senegal with other chairs in South Africa, Ghana, Cameroon and Tanzania to follow. In total, the program is valued at nine million euros.
- Alongside Prof. Turok, AIMS founder and chairman and current Director of the Perimeter Institute for Theoretical Physics, NEF President Mr Zomahoun signed a letter of intent with the government of the Federal Republic of Nigeria to open an AIMS centre in Nigeria.
- The AIMS Women in STEM Initiative (AIMSWIS) was also launched at the NEF Global Gathering 2016. As our flagship program focused on accelerating progress for African women in STEM, AIMSWIS has quickly earned commendations from the African Union Commission, the Government of Senegal, Human Sciences Research Council South Africa and the Forum for African Women Educationalists, Johnson & Johnson the International Development Research Centre, among others.

The next NEF Global Gathering will be held in Kigali, Rwanda, in 2018.

AIMS-IMAGINARY WORKSHOP AT AIMS SENEGAL

An AIMS-IMAGINARY Roadshow, Exhibition and Workshop was hosted by AIMS Senegal in Mbour from 2 to 5 November 2015, in partnership with IMAGINARY and the Mathematisches Forschungsinstitut Oberwolfach in Germany. The event attracted 14 schools/ institutions in Senegal. At least 880 participants attended, of which 40% were females.

CAMEROON TEACHER TRAINING PROGRAM LAUNCHED

AIMS-NEI in partnership with The MasterCard Foundation officially launched the Mathematics Teacher Training Program on 19 January 2016 in Yaoundé, Cameroon. The event was supported by other partners, including the Government of Cameroon through the Prime Ministry and Ministries of Secondary Education and Higher Education, Google and CAMTEL. The event officially marked the start of the training program in Cameroon. It also raised the awareness of all stakeholders about the concept, objectives, expected results, process and time-line of that pilot programme in Cameroon.

GERMANY-AFRICA MATHS RESEARCH COLLABORATION LAUNCHED

African and German experts have identified five priority areas for collaborative research in mathematical sciences which will be pursued over the next three years under a new initiative expected to build research networks and help advance maths in Africa. The DDeutsche Forschungsgemeinschaft (DFG) – the German Research Foundation – and AIMS met for two days ahead of the Next Einstein Forum's Global Gathering 2016 in Dakar. The meeting between African and German mathematicians, which included
Prof. Green and Dr Ndifon, started off as a topic-finding discussion in areas drawn from mathematical modelling in the life sciences and the physical sciences, optimisation, statistical modelling, geometry and topology, and algebraic structures. Outcomes included funding for workshops at AIMS centres.

PRIZE USED TO CREATE AIMS SCHOLARSHIP AWARD

Prof. Turok, founder of AIMS and the 2016 winner of the American Institute of Physics' John Torrence Tate Award for International Leadership in Physics, announced that he is donating the monetary portion of the award, a US$10,000 cash prize, to AIMS. The donation will be used to initiate the Thierry Zomahoun Scholarship, which will be awarded upon graduation to an African student currently taking the AIMS Master's at one of the AIMS centres of excellence.

NETWORK MEETINGS

Other network meetings during the course of the year included:

- The AIMS Program Manager and Student Development Officer Training meeting, which was held in Limbe, Cameroon from 24 to 29 September 2015 and attended by Ms Lynne Teixeira, AIMS South Africa Administration and Research Manager, and Ms Sinobia Kenny, Senior Programme Coordinator for AIMSSEC. Topics discussed at the meeting included grant compliance, gender mainstreaming in the network, preliminary recommendations of the mid-term evaluation of AIMS, the Teacher Training Program and implementation of the AIMS Industry Initiative. The meeting was attended by staff at centre, chapter and secretariat level and donor representatives.
- The AIMS Research and Innovation Meeting was held at AIMS South Africa from 5 to 9 October. The main purpose of the meeting was to develop a strategic plan for AIMS research and the five-year vision. Members of the AIMS Research and Innovation Committee who attended the meeting were Prof. Green, Prof. Sanders, Prof. Mama Foupouagnigni (Academic Director: AIMS Cameroon) Prof. Francis Allotey (President: AIMS Ghana), Prof. Mark Roberts (Rector: AIMS Tanzania) and Prof. Moustapha Fall (Endowed Humboldt Research Chair, AIMS Senegal) and Dr Rosita Yocgo (Research Manager, AIMS-NEI). They were joined by senior researchers and staff from the AIMS South Africa Research Centre.
- An AIMS Academic and Research Meeting was held from 11 to 12 March 2016 at AIMS Senegal. In attendance were members of the AIMS Academic and Research Advisory Council and the AIMS Academic and Research Committee. Including Prof. Green, Prof. Basset and Dr Utete from AIMS South Africa.

School learners at the AIMS-IMAGINARY workshop

TRUST

The AIMS South Africa Trust meeting took place on 28 January 2016. 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 28 January 2016. Prof. Daya Reddy was appointed as Chair for a period of two years. Council members are Prof. Ramesh Bharuthrum (UWC), Prof. Cheryl de la Rey (Pretoria), Prof. Hendrik Geyer (SU), Prof. Grae Worster (Cambridge), Prof. Stéphane Ouvry (Paris-Sud XI), Prof. Daya Reddy (UCT), Prof. Graham Richards (Oxford), Prof. Balazs Szendroi (Oxford) and Prof. Neil Turok (Perimeter Institute).

AIMS South Africa Council meeting

Prof. Daya Reddy, appointed as the chair of the AIMS South Africa Council, has been involved with AIMS since its inception in 2003. He is also the president-elect of the International Council for Science (ICSU), the President of the Academy of Science of South Africa (ASSAf), Co-Chair of the InterAcademy Council and fellow of The World Academy of Sciences (TWAS) and holds the South African Research Chair in Computational Mechanics at UCT.

STAFF

Prof. Barry Green continued as Director assisted by the Management Team of Dr Barrie Barnard (AIMSSEC Manager), Mr Jan Groenewald (IT Manager), Mr Igsaan Kamalie (Facilities Manager), Prof. Jeff Sanders (Academic Director), Ms Lynne Teixeira (Administration and Research Manager) and Ms Deborah Wilsnagh (Finance and Human Resources Manager).

Staff changes this year were the departures of Mr Waseem Elliot from the IT department; Ms Caroline Chiwa and Ms Ntombomzi Magqazolo from the finance department; and the appointment of Ms Joanne Louw as Senior Finance Officer from January 2016.

AIMS South Africa Trust meeting

ADVISORY BOARD

The AIMS Advisory Board advises on strategic and academic aspects of the AIMS programme, in particular, its integration with existing courses and research projects in South African and other African universities. 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 Zeblon Vilakazi (Wits).

EXECUTIVE TEAM

The AIMS Executive Team assists the director and academic director of AIMS with the selection of students for the Master's programme and facilitates the relationship between AIMS and the three participating universities. Members during this perod were Dr Hannes Kriel and Prof. Ingrid Rewitzky (SU), 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 the Honours programme (see page 6).

The following tutors assisted visiting lecturers during the period under review: Ms Martha Kamkuemah (head tutor), Mr Alberto Cazzaniga, Mr Yae Gaba, Mr Mahmoud Hashim, Mr Gael Mboussa-Anga, Mr Elbasher Mohamed, Mr Michal Morzywolek, Ms Grace Mwakyoma, Ms Carine Umulisa, Mr Mebratu Wakeni and Mr Pascal Wild. Ms Loveness Mahwire and Mr Dakalo Ramufhi assisted on the AIMSSEC programmes.

AIMS South Africa

AIMSSEC

INFORMATION TECHNOLOGY

In the period under review the AIMS South Africa IT department's focus was on continued server virtualisation using LXC and KVM; upgrading the wireless infrastructure on campus; network renumbering to cater for more devices; SSL certificate updates; upgrading the access tag server; additional sagemath buildslaves; and migrating AIMS Desktop from Ubuntu to Debian to allow free redistribution. Backup servers both on- and offsite were rebuilt from scratch.

Tutors Mr Evans Ocansey and Mr Yaé Gaba assisted in the IT department and with teaching duties. Mr MacDonald Chapwanya continues in IT operations at AIMSSEC and Mr Jonathan Carter as Systems Architect at AIMS South Africa.

The 130 campus desktops are seven years old and replacement is planned for 2017. Three new desktops with additional storage and memory were deployed as servers. The two dedicated servers in Germany (32GB RAM) and 8 core CPUs each were upgraded to new 64G servers at a lower cost. File servers, switches, and significant cabling and electrical infrastructure will need replacement over the next few years.

Workshops were supported in deploying science software – in particular, statistical packages and version control tools for the Clinic on the Meaningful Modelling of Epidemiological Data - and general support provided for the AIMS Network research meeting, Quadratic Differentials meeting, Data Science in Industry workshop, and System Identification and Forecasting of Complex Systems workshop.

The Vidyo video conference system was used to attend WITS CoE-MaSS seminars, conduct remote interviews, allow supervisors to attend AIMS examinations, conduct the MasterCard Foundation scholars meetings and enable student interaction across the AIMS network.

Classes in Computing and LaTeX, Ubuntu for Science, online collaboration, revision control, and in the software development with Python were taught to the both Master's intakes. Mr Jan Groenewald, Mr Jonathan Carter and Mr Yaé Gaba gave a presentation at the AIMS Journal Club on information security and privacy. Mr Yaé Gaba and Mr Jordan Masakuna attended software and data carpentry instructor training and will return to co-teach software courses in 2016-17.

COMMUNICATIONS REPORT

As in previous years, New Media continued building an archive of professional quality photographs and videos that are used internally as well as for public engagement on social media platforms, for various print applications and as source material for AIMS roadshows.

On social media platforms, the reach has steadily expanded, with more than 2 000 followers on Facebook and more than 3 000 subscribers on YouTube. An Instagram account was established this year and has attracted 150 followers. Viewer statistics show that the AIMS audience on YouTube is dominated by non-African countries, while Facebook has a greater impact on the target market in Africa. The 'Courageous Women with Careers in STEM' panel discussion recording, posted in March 2016, had the top reach, with 45% of viewers from South Africa and 40% of viewers overall being women. This indicates the need to create more content integrating Africans and women to attract others to follow.

Content featuring our students as representatives of their home countries has achieved good reach in Africa, because these are shared via student online networks. Another example of what worked well was the social media campaign on Heritage Day 2015, during which the South African students and the AIMS communications teacher presented what the word 'heritage' means to them. This was presented as a quote on their portrait photograph. Top-reach posts are generally those that emphasise the unity and diversity of AIMS and those that show the progress of the network expansion – building science in Africa.

A new development has been to include New Media in the communication classes. Ms Noluvuyo Hobana, communications teacher, and Ms Yasmin Hankel, New Media specialist, have been working on a series of workshops with the January intake and the Biomathematics students to build their professional development skills by strengthening their understanding of verbal and non-verbal communication. Sessions have included convincing first impressions, interview situations, pitching in the professional environment, and appropriate and effective use of the digital realm as tools for communication. Students built an online presence, grew in confidence, exercised team building, and learned analytical, creative and entrepreneurial skills in the process.

FINANCIAL REPORT 2015-2016

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 have also been consolidated into these financial statements.

Figure 1: Total income per main component

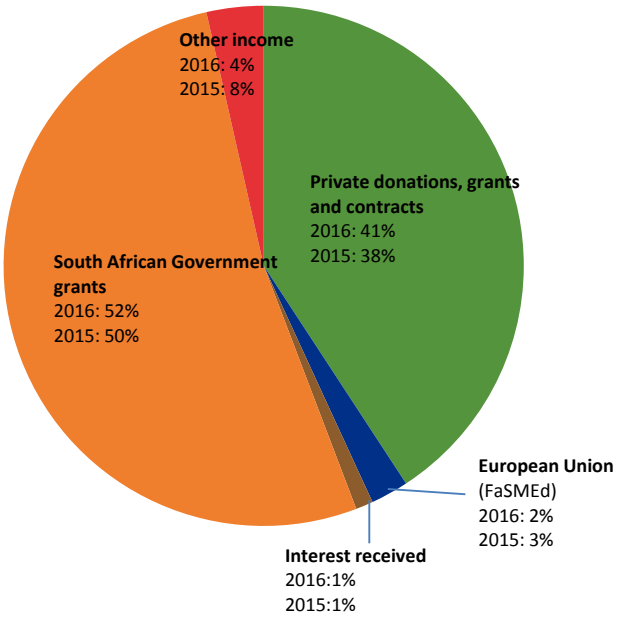


Figure 1: shows the comparison of AIMS South Africa's income per main component as well as the relative ratio to total income

Total income decreased by 6% to R37,684 million from R40,296 million. Variance is due to restricted funding received during 2015, earmarked for 2016 and reduction in conference and workshop income.

South African Government grants for the 2016 and 2015 years are as follows:

Department	Programme	2016	2015
Department of Higher Education	Academic Programme	R 5 000 000	R 4 800 000
Department of Science and Technology	Academic Programme, Research Programme and Post AIMS Bursaries	R 3 350 000	R 3 000 000
National Research Foundation	Research Programme	R 5 275 000	R 7 300 000
National Skills Fund	Teacher Training Academic Programme, South African Taught Masters and Teacher Training bursaries	R 6 064 487	R 5 327 956
Total South African Government Grants		**R 19 689 487**	**R 20 427 956**

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 and The Robert Bosch Foundation toward the first ARETÉ Junior Chair.

Private donations, grants and contract income for the 2016 and 2015 years are as follows:

Department	Programme	2016	2015
IDRC Main Grant	Taught Masters Programme	R 4 596 206	R 4 131 360
IDRC Research Grant	Research Programme	R 1 566 031	R 893 251
MasterCard Foundation	Taught Masters Programme and Teacher Training Bursaries	R 2 704 907	R 1 009 064
The Robert Bosch Foundation	Research Programme	R 1 663 150	R 946 352
DAAD	Bursaries/Scholarships	R 2 116 500	R 1 312 750
Rand Merchant Bank	Teacher Training Bursaries	R -	R 1 500 000
Other private donations	Taught Masters Programme and Teacher Training	R 2 721 997	R 5 447 886
Total Private donations, grants and contract income		**R 15 368 791**	**R 15 240 663**

Figure 2: Total expense per main component

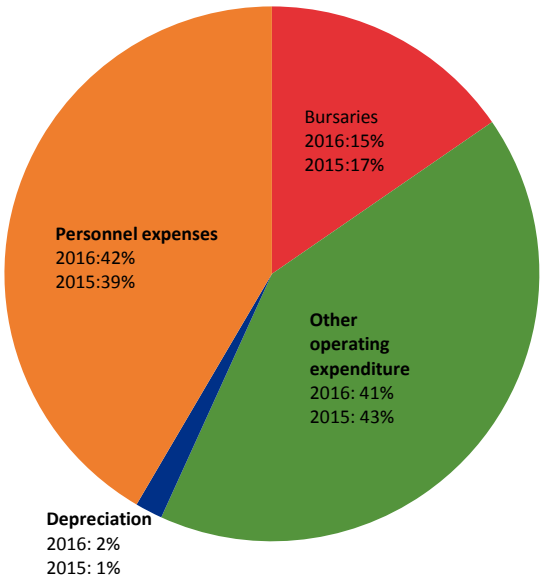


Figure 2: shows the comparison of AIMS South Africa's expenditure per main component as well as the relative ratio to total expenditure.

Total expenditure for 2016 increased marginally to R38,084 million from R37.994 million. Expenditure is monitored carefully, within prescribed limits.

The increase in personnel costs of 8% can be attributed to the approved annual cost of employment adjustment of 7% for all qualifying staff and includes certain contract appointments which commenced early in 2016.

Our full consolidated financial statements, audited by PwC, are available on our website 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 2016

	2016	2015
	R	R
ASSETS		
NON-CURRENT ASSETS	34 557 401.17	34 673 045.09
Property, plant and equipment	30 040 471.40	30 637 575.54
Available-for-sale financial assets	4 516 929.77	4 035 469.55
CURRENT ASSETS	10 874 473.82	11 245 592.59
Cash and cash equivalents	2 401 946.60	3 885 022.85
Trade and other receivables	7 170 173.09	2 343 553.26
Stellenbosch University receivable	1 302 354.13	5 017 016.48
TOTAL ASSETS	**45 431 874.99**	**45 918 637.68**
FUNDS AND LIABILITIES		
FUNDS AND RESERVES	44 128 670.10	44 105 015.04
Accumulated funds	39 076 186.82	36 261 641.14
Restricted reserve: endowment fund	1 775 482.57	1 716 272.41
Restricted reserve: other	535 553.51	3 807 904.35
Fair value reserve	2 741 447.20	2 319 197.14
CURRENT LIABILITIES	1 303 204.89	1 813 622.64
Trade and other payables	1 303 204.89	1 813 622.64
TOTAL FUNDS AND LIABILITIES	**45 431 874.99**	**45 918 637.68**

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2016

	2016	2015
	R	R
Income	37 224 539.48	39 979 960.26
Operating expenses	(38 083 853.13)	(37 994 485.24)
Operating (deficit)/surplus	(859 313.65)	1 985 475.02
Profit on sale of assets	53 846.01	-
Finance income	406 872.64	316 285.02
(Deficit)/surplus for the year	(398 595.00)	2 301 760.04
Other comprehensive income:		
Item that may be subsequently reclassified to profit or loss		
Change in value of available-for-sale financial assets	422 250.06	334 634.67
Total comprehensive income for the year	23 655.06	2 636 394.71

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