



AIMS

African Institute for
Mathematical Sciences
SOUTH AFRICA

ANNUAL REPORT 2015





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 propelling 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 Sénégal (2011), Ghana (2012), Cameroon (2013) and Tanzania (2014). 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 2014 to 31 July 2015. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2014 calendar year.

Since AIMS South Africa opened in 2003, 578 students from 35 different African countries have graduated from its core academic programme. The alumni include 189 women.

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 honours and Master's degree programmes at South African universities
- Research and training workshops
- Local association with the Universities of Cape Town (UCT), Stellenbosch (SU) and the Western Cape (UWC)
- International association with the Universities of Cambridge, Oxford and Paris-Sud XI

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FOREWORD

by the Director



The 2014-15 academic year has been packed with activities at AIMS South Africa. There were new developments to our training programme, significant growth and more activities in our research centre, and broader public engagement activities, which we either organized or co-hosted. We were also pleased to host visits by a number of government representatives and international groups who support the AIMS global network, and who spent time at our centre in Muizenberg. All these activities and events are reported on in this annual report.

An interesting new addition to our academic programme has been the introduction of entrepreneurial and transferable skills courses into the curriculum, providing students with skills especially helpful for those planning to follow a non-academic career after AIMS. Prof. Wulff Plinke, Founding Dean of the European School of Management and Technology (ESMT) in Berlin, offered the course “Skills for Employability, Entrepreneurship and Development.” Later in the year Prof. Graham Richards from Oxford, one of our Council Members, offered a special course on Entrepreneurship, which included case studies of very successful scientific business start-up initiatives he was involved with. These excellent courses point to one of the great strengths of the AIMS model – attracting and benefiting from leading international experts who contribute to our programme in a 24/7 learning environment. With over 250 Master’s students graduating from AIMS centres each year, building links to industry with enabling opportunities for our students is an important consideration and the entrepreneurial courses and network-wide Industry Initiative are meaningful steps in this direction.

The Research Centre has grown significantly over the past three years with three Career Development Research Chairs appointed in mid-2014 and Dr Simukai Utete joining as a Senior Researcher in February 2015. These appointments

have brought the number of research staff to 12 and strengthened the mathematical and physical biosciences and the interdisciplinary focus areas. Eight postdoctoral fellows are based at AIMS South Africa, 9 doctoral and 26 Master’s students were supervised by AIMS researchers during the period under review. Plans are in place to expand the intake of PhD students in the various focus areas represented. The number of publication outputs doubled in 2014, and included a significant contribution from Visiting Professor Martin Kunz from the University of Geneva. This contributed to AIMS now occupying ninth place in Africa for weighted research outputs on the Nature Index, a special achievement we are pleased about. Once again, the 13 workshops hosted by AIMS South Africa attracted many visitors, which included academic and industry representatives.

An important development for the mathematical sciences in South Africa was the establishment of a Department of Science and Technology (DST)/National Research Foundation (NRF) Centre of Excellence in the Mathematical and Statistical Sciences (CoE-MaSS) at the University of the Witwatersrand (Wits), which partners with a number of South African universities. AIMS South Africa is pleased to be a partner of the CoE-MaSS which has kindly sponsored a number of workshop and conference events at our centre. Staff and students have also attended activities they hosted. It has donated video-conferencing equipment to AIMS South Africa, which is now one of the linked facilities within South Africa enabling it to attend and host virtual meetings and seminars.

The AIMS Schools Enrichment Centre (AIMSSEC), plays a very important role in the professional development of teachers, particularly from rural areas in South Africa. From modest beginnings led by Toni Beardon and volunteer teachers, it has grown significantly and now has a staff of 9 members led by Dr Barrie Barnard. This growth has been made possible by the generous support of the National Skills Fund of the South African Department of Higher Education and Training (DHET), and has made an enormous difference to their capacity. AIMSSEC has entered into a new partnership agreement with North-West University (NWU) to accredit certain courses they offer, and each institution will benefit from combined strengths related to the professional development of teachers. AIMSSEC staff are also contributing to the AIMS-MasterCard Foundation Mathematics Teacher Training Programme, which has been launched in Cameroon.

This year saw significant expansion in our public engagement programme with AIMS South Africa participating in a number of exhibitions and career fairs as well hosting two special events of its own. One was the IMAGINARY Workshop and Science Slam which was held in November 2014 and attended by students and school learners, some from as far afield as Heidelberg (Western Cape). The other event was for National Science Week, which was attended by over 1500 learners from the Western Cape.

AIMS South Africa's role within the network continues to grow with wonderfully committed staff who identify with the spirit of AIMS, also contributing their expertise in various network roles and on programme committees.

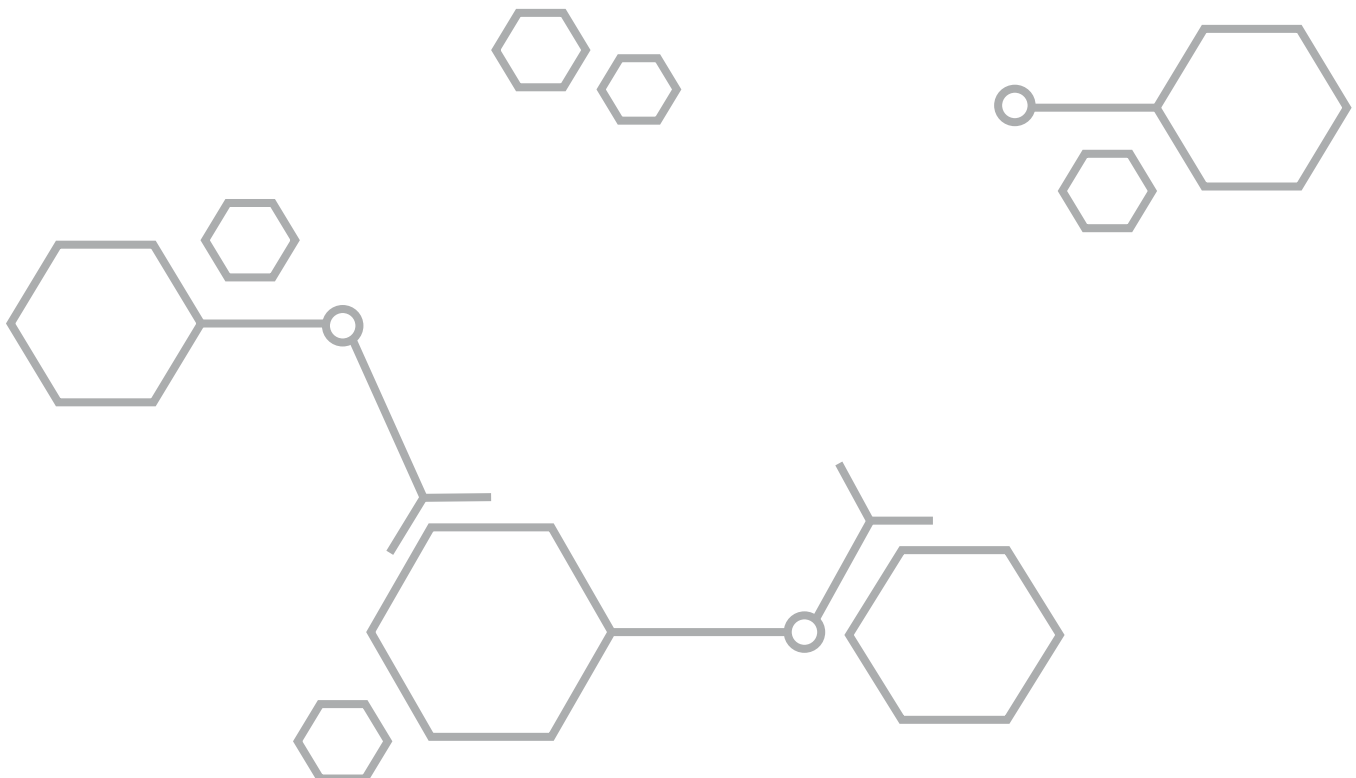
We continually strive to increase the representation of women and South Africans at our centre. Of the 39 staff members

working at AIMS, 19 are women and of the 51 students who graduated from our training programmes this year, 22 were women and 9 were South Africans. Three female tutors were appointed and four female lecturers delivered courses. We were also thrilled to welcome Ms Nasima Badsha, who has served as an Advisory Board member, as a member of the AIMS Trust.

It is a pleasure to thank all who have contributed to the success of AIMS South Africa this year and to congratulate the Chair of the AIMS South Africa Trust, Prof. Neil Turok, who was awarded an honorary doctorate by SU in March 2015.



Barry Green, Director



Academic programmes



This year, we have again been able to offer exciting and innovative courses. This is due to the enthusiasm and interest of international and South African visiting lecturers, combined with the support of a strong team of tutors. The outcome has been another successful year which was run in accordance with the AIMS model designed to graduate independent-thinking students with a broad mathematical foundation and entrepreneurial edge and committed to solving the problems confronting Africa.

Master's in Mathematical Sciences (January 2014 intake)

AIMS attracted eight South African students into its structured Master's in Mathematical Sciences which commenced in January 2014 (from the universities of KwaZulu-Natal, Limpopo, Venda and Zululand). All graduated, with four students completing research projects in financial mathematics, and one in each of pure mathematics, physics, bioscience and statistics. Two thirds of the courses were offered by international lecturers on topics spanning computing, statistics, applied mathematics, physics, biomathematics, mathematical finance and entrepreneurship. A novel feature was the participation of all students in the workshop "Mathematics Iff Computing".

Graduates of the January 2014 intake

	Name	Gender	Origin	Research Project Title	Supervisors
1	Linsay Blows	F	South Africa	A systems level analysis of different Mycobacterium Tuberculosis strains using functional interaction networks	G Mazandu, AIMS
2	Tlou Lazarus Kubjana	M	South Africa	Pricing a European call option on a zero-coupon bond with Vasicek term structure of interest rate	S Mataramvura, Cape Town
3	Matjale Clement Mabula	M	South Africa	On basic topological constructions	Z Janelidze and T Weighill, Stellenbosch
4	William Malose Manamela	M	South Africa	The Liability-Driven Investment Strategies and Concepts	R Ghomrasni, AIMS
5	Africa Mgudlwa	M	South Africa	Pricing an interest rate floor using the Vasicek term structure of interest rates	S Mataramvura, Cape Town
6	Siyabonga Phiwayinkosi Mthiyane	M	South Africa	Risk Measures for Variable Annuities Guaranteed Benefits	R Ghomrasni, AIMS
7	Xolisile Octavia Thusini	F	South Africa	The Discovery of a Standard Model Higgs Boson and its Properties	A Hamilton, Cape Town
8	Valentia Boledi Tlomatsana	F	South Africa	SMAA-ER: Integrating the Evidential Reasoning (ER) approach with Stochastic Multi-criteria Acceptability Analysis (SMAA)	I Durbach, AIMS

Master's in Mathematical Sciences (August 2014 intake)

The Master's programme commencing in August 2014, attracted about 20 applications per place. Again, like last year, there were many last-minute (i.e. post-acceptance) withdrawals, most so late that it was not possible to replace them. The result was a small class of 45 spread over 18 nationalities. Lecturers and tutors also reflected a spread of nationalities: two-thirds of the lecturers were from abroad and tutors (eight at any time) came from Australia, Benin, Canada, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Namibia, South Africa and the United States. For the first time we hosted a tutor provided by Guelph University for six months during the academic year; this was a complete success.

The Master's is accredited by the three local participating universities, between which students are divided equally for purposes of registration. It is funded by the South African DHET and consists of three phases. The compulsory skills courses set the highly interactive and problem-based style of teaching and focus on upgrading students' skills in problem-solving and computation while providing an introduction to computer programming, scientific writing in English, statistics and business and entrepreneurial skills.

The elective review courses introduce students to cutting-edge topics in mathematical science, and are lectured by international and local experts. The AIMS model facilitates a selection of review courses which accommodates the availability of exceptional lecturers and recent important topics. It incorporates continuing assessment to allow students to focus on the acquisition of research skills. This year, the programme included specialised guest lecturers, team entrepreneurial projects evaluated by a panel of experts, and the "Mathematics in Industry Study Group" workshop which provided students with the opportunity for group study of industry-related problems. We were particularly pleased to have Prof. Wulff Plinke offer the first part of our programme in Entrepreneurship; Prof. Graham Richards again contributed case studies. Staff changes meant that we were unable to offer a course in Financial Mathematics. Fortunately Prof. Ronnie Becker offered an extra short course with reading material to cover the harder concepts of the topic and that was attended by a dozen students. Consecutive courses were offered in quantum computing and information, and concurrent courses were offered in computational algebra; moreover, several other new courses were offered. Please refer to the table on page 6.



Student hike with Prof. Bernd Schroers, Dr Gill Marcus
November 2014



Dr Howard Alper

In the third component of the programme students undertake three-month research projects. Supervision again worked smoothly with solid support from the three local universities (60%), growing supervisory support from the Research Centre (22%), with international and other South African supervisors providing the balance. For further details please refer to the table on page 7.

The examiners awarded distinctions to 29% of the research projects, though after moderation with coursework marks the number of distinctions overall dropped to 20%. Of the remaining students, 62.2% achieved 'Good' grades and 13.3% 'Pass' grades. Two students failed to graduate. The external examiners this year were Dr Alan Cornell (Wits), Prof. John Hargrove (SACEMA), Prof. Dirk Laurie (SU), Prof. Phillip Mashele (NWU), Prof. Henry Mwambi (University of KwaZulu-Natal, UKZN), Prof. Justin Munyakazi (UWC), Prof. Bruce Watson (Wits) and Prof. Marcel Wild (SU).

Study breaks allow students the opportunity to consolidate their studies, and to benefit from attending specialised workshops. This year a remarkable variety of topics were covered, including: maths education; financial mathematics; mathematics of industrial problems; non-linear and modern mathematical physics; number theory; epidemiology; astronomy month and space week activities; and Ubuntu for science (see the workshops section on page 21 for the full list). Students attended many *ad hoc* presentations including three by Dr Howard Alper (Member of the AIMS-NEI Board) and a talk by Dr Gill Marcus, as well as presentations on gender, careers in banking and industry (organised by AIMS-NEI), scientific writing and starting their own business. As usual, the year began with one night each week being devoted to mathematical videos and included inspiring presentations by our students to visiting groups of politicians and potential funders. As in previous years, the students went on various outings which included hikes, trips to Cape Town sights and scientific visits.

This year we bid farewell to Ms Frances Aron after her long, active and enthusiastic service at AIMS South Africa, but happily welcomed Ms Noluvuyo Hobana as Language and Communication teacher for three days per week.



Mr Africa Mgudlwa
AIMS South Africa 2014

Mr Africa Mgudlwa, a South African, holds a bachelor's degree with majors in Applied Mathematics, Mathematics, and Economic Science from the University of the Witwatersrand, which he completed in 2011. In 2012 he enrolled for and completed an honour's degree. In the middle of 2013, a former classmate told him about the AIMS Structured Master's programme. The full AIMS scholarship meant that he could now further his studies as he had struggled to solicit funding. He is currently a Research Master's student in the AIMS South Africa Research Centre.

"My experience at AIMS was a great one. AIMS has an approach to studying that traditional universities don't. This consists of training/teaching by experts from all over the world; a strong support structure designed for each student's success; and all other essential resources. The combination of soft skills such as presentation, academic writing, and research skills, together with programming/computing lessons have helped to build me as a person. Also, the wide variety of courses and the support systems in place helped to give me a new perspective on the opportunities available in the world of mathematical sciences."

Africa plans to go into industry as a business or strategic consultant. "I would like to help firms solve their strategic and management problems. This role will expose me to the fundamentals upon which big firms and institutions are built and depend on for continued success. Ultimately, I would like to be an entrepreneur."

Ms Cecilia Muthoni Ndirangu, from Kenya, completed a BSc in Actuarial Sciences at the University of Nairobi. She decided to join AIMS South Africa because of the strong mathematical and computing skills provided by the programme, the world class tutors and the opportunity to meet different people from diverse cultures.

"AIMS exposed me to a diaspora united by common aspirations of Ubuntu, success and prosperity for Africa and the world. Through the different people I shared this incredible experience with, I developed strong leadership and organisational skills and was able to motivate and work effectively with others to achieve objectives. The immense talent, drive and focus evident at AIMS served as a testament to the 'Africa is on the move' mantra."

Cecelia plans on commencing her career as an actuary. "The experiences and insights I gained at AIMS will serve as sentinels on my path to success."



Ms Cecilia Muthoni Ndirangu
AIMS South Africa 2015

Mr Abdullah Khalil Hassan Ibrahim graduated from Cairo University in 2011 specializing in Physics. During his last year of undergraduate studies, one of his friends, an AIMS alumnus, told him about AIMS. He recommended that he told should apply to AIMS, but Abdullah had to complete his military service first.

"I spent about three years of mandatory services in the Egyptian Armed forces that kept me away from doing physics. But here I am doing physics again through AIMS. I have learnt a lot of mathematical and professional skills during my ten months of study at AIMS especially in the final phase. The most important thing about being at AIMS is the AIMS family feeling, I have never missed home during these 10 months, we were a real family living together doing everything together."

After graduating from AIMS South Africa, Abdullah was awarded a post-AIMS bursary so will be doing a Research Master's at UCT.



Mr Abdullah Khalil Hassan Ibrahim
AIMS South Africa 2015

Courses offered at AIMS South Africa

Period	Lecturer	Course	MSc Jan 2014	MSc Aug 2014	MSc Jan 2015	Hons Biomaths 2015
2014						
25 Aug – 30 Sept	Frances Aron, AIMS	English Essentials and Communication Skills		x		
25 Aug – 31 Oct	Jan Groenewald, AIMS	Computing and LaTeX		x		
2 – 13 Sept	Anthony Scopatz, Wisconsin	Scientific Computing 1		x		
1 – 19 Sept	David Aschman, Cape Town	Concepts and Problem Solving in Physics	x	x		
15 Sept – 3 Oct	Abdel Hamid El-Shaarawi, American University, Cairo.	Statistics with Applications to Hydrology		x		
22 Sept – 10 Oct	Karl-Dieter Crisman, Gordon College	Experimental Mathematics with Sage		x		
6 – 10 Oct	Jeff Sanders, AIMS	Programming		x		
14 Oct – 1 Nov	Stephan Wagner and Dimbinaina Ralaivaosaona, Stellenbosch	Mathematical Problem Solving		x		
20 – 25 Oct	Wulff Plinke, ESMT	Skills for Employability, Entrepreneurship and Development	x	x		
10 – 28 Nov	Babette Döbrich, DESY	Introduction to Quantum Physics		x		
10 – 28 Nov	Pierre Schapira, Université Paris VI	Differential Calculus		x		
10 – 28 Nov	Bernd Schroers, Heriot-Watt	Finite-dimensional Quantum Mechanics and Quantum Computing		x		
1 – 19 Dec	Gareth Boxall, Stellenbosch	Model Theory		x		
1 – 19 Dec	David Kribs, Guelph	Quantum Information		x		
1 – 19 Dec	Gabriel Lord and Lyonell Boulton, Heriot-Watt	Numerical Analysis		x		
2015						
5 – 23 Jan	Robert Beezer, Puget Sound	Linear Algebra with Sage		x		
5 – 23 Jan	Michael Grinfeld, Strathclyde	Asymptotic Methods		x		
5 – 23 Jan	Daya Reddy, Cape Town; and Grae Worster, Cambridge	Fluid Dynamics		x		
5 – 23 Jan	Ravi Ramakrishna, Cornell	Mathematical Problem Solving			x	
26 Jan – 13 Feb	Theis Lange, Copenhagen	Statistics with R			x	
26 Jan – 13 Feb	Neville Fowkes, Western Australia	Mathematics in Industry		x		
26 Jan – 13 Feb	Stephane Ouvry, Paris Sud XI	Introduction to Random Systems, Information Theory, and related topics		x		
26 Jan – 13 Feb	Wilson Lamb, Strathclyde	Analytical Techniques in Mathematical Biology		x		x
23 Feb – 13 Mar	Gerhard Pfister and Wolfram Decker, Kaiserslautern	Computational Algebra		x	x	
23 Feb – 13 Mar	Alban Quadrat, Paris Sud XI	Constructive Algebra and Applications			x	
23 Feb – 13 Mar	Liz Parvin, Open University	Medical Physics			x	x
16 – 20 Mar	Graham Richards, Oxford	Entrepreneurship			x	
16 Mar – 3 Apr	Nancy Neudauer, Pacific	Designs, Matroids and Graphs		x		
16 Mar – 3 Apr	Robert de Mello Koch, Witwatersrand	Introduction to Quantum Field Theory		x	x	
16 Mar – 3 Apr	Emma Spurlock, Oldbaum Services	Introduction to Computational Neuroscience		x	x	x
13 Apr – 1 May	Lafras Uys, HealthQ Technologies	Systems Biology			x	x
13 Apr – 1 May	Ronnie Becker, AIMS	Financial Mathematics			x	
4 – 22 May	Emile Chimusa Rugamika, Cape Town	Biostatistics			x	x
25 May – 12 June	Patrick Dorey, Durham	Introduction to Dynamical Systems			x	
25 May – 12 June	Steve Bellan, Texas at Austin; and Jim Scott, Colby College	Mathematical Modelling in Medicine and Public Health			x	x
22 June – 10 July	Jeff Sanders, AIMS	Designing Algorithms			x	

Graduate students of the August 2014 intake

	Name	Gender	Origin	Research Project Title	Supervisors
1	Salma Omar Abdalmageid Adam	F	Sudan	Modeling and Analysis of the Spread of Ebola with Ebola Infected Immigrants	EM Rugamika and N Mulder, Cape Town
2	Adebayo Abayomi Adeleke	M	Nigeria	Image Information measures for predicting Image Registration Performance	N Muller, Stellenbosch
3	Arnaud Andrianavalomahefa*	M	Madagascar	Energy loss of open strings with massive endpoints in AdS/CFT	W A Horowitz, Cape Town
4	Ammar Abdalrhman Ibrahim Babikir	M	Sudan	Counting in Self-Similar Graphs	S Wagner, Stellenbosch
5	Filister Chinake	F	Zimbabwe	A model of substance-abuse rehabilitation with demographic stochasticity	F Nyabadza, Stellenbosch
6	Wilson Mulomba Choongo	M	Zambia	Modelling of Commodity Futures with Convenience Yields	R Becker, AIMS
7	Steve Bicko Cygu	M	Kenya	Establishing appropriate models for age-related changes in lymphocyte cell markers in paediatric data from South Africa	M Nieuwoudt, SACEMA, Stellenbosch
8	Zainab Olabisi Dere	F	Nigeria	A Social Network Analysis of the South African Corporate Network from 1989 to 2008	I Durbach, AIMS
9	Eshetu Belete Derzie	M	Ethiopia	Commutative Banach Algebra and Stone Weierstrass Theorem	W Kotzé, Rhodes; and J Sanders, AIMS
10	Ahmed Reda Ahmed Abdelhamid Elmahalawy	M	Egypt	Differential Cryptanalysis	C Swart, Cape Town
11	Mohammed Akram Fellah	M	Algeria	Where Will Einstein Fail? Hunting Lost Symbols of Black Hole Puzzle In The Theory of Gravitational Aether	N Afshordi, Perimeter Institute; and B Bassett, AIMS
12	Jemal Mohammed Getu	M	Ethiopia	Integer Compositions	D Ralaivaosaona and S Wagner Stellenbosch
13	Ephifania Geza	F	Zimbabwe	Elucidating the role of Arabidopsis Non-expressor Pathogenesis Related 1 (NPR1) defence co-regulator following infection of Arabidopsis thaliana plants with Pseudomonas syringae DC3000-Lux	G Mazandu, AIMS
14	Fatima Yusuf Hussein	F	Somalia	Exploring the Theory and Examples of Private Quantum Codes	D W Kribs, Guelph; and J Sanders, AIMS
15	Abdullah Khalil Hassan Ibrahim	M	Egypt	Next-to-leading order corrections to the elastic scattering of an electron off of a static scattering center	W A Horowitz, Cape Town
16	George Korir Kiprop	M	Kenya	Pricing a European Put Option by Numerical Methods	S Mataramvura, Cape Town
17	Vitalis Kimutai Lagat	M	Kenya	Community structure in the South African company network	I Durbach, AIMS
18	Domini Jocema Leko Moutouo	M	Republic of Congo	Flow and transport by advection, diffusion and chemical reaction	F Ebobisse, Cape Town; and A Tambue, AIMS
19	Malebese Mabotsa	F	Lesotho	Solution of production and inventory problems using optimal control theory	J M Ngnotchouye, KwaZulu-Natal
20	Pempfo Elizabeth Manda	F	Malawi	Demystifying an experimental method for measuring antibodies	W Ndifon, AIMS
21	Mohammad Zaki Elsayed Mansour	M	Egypt	Knots of Light	J Murugan and J Shock, Cape Town
22	Felicien Jordan Masakuna*	M	DRC	Machine Learning Methods for Shark Detection	S Utete and J Sanders, AIMS
23	Nana Adjoah Mbroh	F	Ghana	Sampling Gaussian Distributions in Higher Dimensions	A Tambue, AIMS
24	Comfort Mintah	F	Ghana	Quantum Channels and Dilation Theory	D W Kribs, Guelph; and J Sanders, AIMS
25	Hamza Elsayed Ahmed Mohamed	M	Egypt	Fast Evaluation of Dose Convolution Integrals for a Pencil Beam Model for Proton Therapy	N Muller, iThemba Labs
26	Mozzamil Mohammed Abdalla Mohammed	M	Sudan	Scalar Conservation Laws with a Discontinuous Flux Function: An Application to Highway Traffic Modelling	M Banda, Pretoria
27	Cecilia Muthoni Ndirangu*	F	Kenya	The Black-Litterman Portfolio Selection Framework	R Becker, AIMS
28	Emmanuel Oluwatobiloba Neye*	M	Nigeria	Exploring the relation between ideals and varieties	C Naude, Stellenbosch
29	David Niyukuri	M	Burundi	Fitting a complex stochastic model to data, using Approximate Bayesian Computation	W Delva, SACEMA
30	Chinenye Assumpta Nnakenyi	F	Nigeria	Spectral Methods for Fractional Differential Equations	J A C Weideman and N Hale, Stellenbosch
31	Simon Katema Phiri	M	Zambia	The Effect of Virus Evolution on the Prevalence of Ebola	E Chimusa, Cape Town
32	Vahatra Fenosoa* Rabodonandrianandraina	F	Madagascar	Semigroups of Operators and The Fragmentation Equation	W Lamb, Strathclyde
33	Faniry Nadia Zazaravaka Rahantamialisoa*	F	Madagascar	Constitutive analysis of shear banding in homogeneous 1D simple shear flow of viscoelastic liquids	T Chinyoka, Cape Town
34	Elie Danien Rajaobelina Iarilala*	M	Madagascar	Numerical Investigation of Chaos	H Skokos, Cape Town
35	Haingotiana Safidy Nandrianina Ratsimbazafy*	M	Madagascar	The Law of Quadratic Reciprocity	F Breuer, Stellenbosch
36	Esra Mohammed Shrif Mohammed Salih Shrif Mohammed	F	Sudan	The physics of nuclear fission reactors with a focus on the effect of poisoning fission products	D Aschman, Cape Town
37	Francky Mathieu Solofomananirina Tiantsoa*	M	Madagascar	Topology via logic	W Kotzé, Rhodes; and J Sanders, AIMS
38	Hend Mohammed Ibrahim Mohammed Sroor	F	Egypt	Analysis and Measurement of Ultrashort Electron Bunch Duration	H Schwoerer, Stellenbosch
39	Esmie Kamuloni Tcheza	F	Malawi	Forecasting Sales for a Chain of Pubs	J L Hutton, Warwick
40	Nneka Ozioma Umeorah	F	Nigeria	Pricing an American Call Option by Finite Difference Methods	S Mataramvura, Cape Town
41	Muhammad Aziz Valiallah	M	South Africa	Modelling fractures in shale rock to understand fracture fluid migration in the subsurface	G Mahed, Cape Peninsula
42	Mary Wanjiku Wanjiru	F	Kenya	Finite Activity Jump Models in Finance	R Becker, AIMS
43	Reine Marquise Yemata Mekondjou	F	Cameroon	Numerical investigation of chaos by the Smaller (SALI) and the Generalized (GALI) Alignment Index methods	C H Skokos, Cape Town

* Students who achieved distinctions overall



Master's in Mathematical Sciences (January 2015 intake)

Thirteen students registered for the Master's in Mathematical Sciences programme which commenced in January 2015. They are expected to graduate in December 2015.



Students - January 2015 intake	Gender	Country	Previous institution
Khuthadzo Eshily Hlongwane	F	South Africa	University of Venda
Hangwelani Mamuthubi	F	South Africa	University of Venda
Hulisani Constance Maremahae	F	South Africa	University of Limpopo
Mokgapi London Mashabela	M	South Africa	University of Limpopo
Banele Phumlani Mdakane	M	South Africa	University of KwaZulu-Natal
Robert Ramapulana Motala	M	South Africa	University of Limpopo
Modupi Peter Mphekgwana	M	South Africa	University of Limpopo
Zinhle Emily Mthombothi	F	South Africa	Rhodes University
Juliet Nagawa	F	Ugandan	University of the Western Cape
Evans Otieno Omondi	M	Kenya	University of Eldoret
Lilies Mokganyetsi Phadime	F	South Africa	University of Limpopo
Anas Yusuf	M	Nigeria	Usmanu Danfodio University
Simphiwe Nhlanhla Zitha	M	South Africa	University of Limpopo



Courses towards a BSc Honours in Mathematics with a focus in Biomathematics

For the past eight years AIMS South Africa has offered courses towards SU's Honours in Mathematics with a focus in Biomathematics. Students spend the first half of the year at AIMS undertaking coursework and the second half at SU concentrating on a research project. The AIMS courses offered towards this programme are listed in the combined courses table on page 6.

Six students graduated at the end of 2014 bringing the total number of graduates to 34.

Five students enrolled in the 2014 programme: Winnie W Chabaari, Frieda Geldenhuys, Nolubabalo Conelia Qokoqa, Mulanga Sinyosi and James Bernard Wilsenach. They completed the first semester at AIMS with a full and varied programme including computing, statistics, modelling in biosciences, mathematical epidemiology, systems biology, asymptotic methods and modelling neural systems. They attended the "Clinic on Meaningful Modelling of Epidemiological Data" and are now completing their second semester at SU.

Jeff Sanders, Academic Director

Graduations

January 2014 intake

A special Recognition of Achievement Ceremony was held at AIMS South Africa in Muizenberg on 27 November 2014 to honour the eight students (all South African) for the completion of the programme after enrolment in January 2014.

The guest speaker at the event was Prof. Francis Benyah, from the Department of Mathematics and Applied Mathematics at UWC and a member of the AIMS South Africa Executive Team.

Students graduated officially at their respective universities in 2015.



Prof. Francis Benyah



Guests were entertained by the Hout Bay Music Project.



Recognition of Achievement Ceremony November 2014

August 2014 intake

Forty-three students from 18 different African countries received their Master's Degree in Mathematical Sciences at a graduation ceremony at the Muizenberg Pavilion on 23 June 2015. The guest speaker was Prof. Brian O'Connell, AIMS South Africa Trustee and former Rector and Vice-Chancellor of UWC who said. "It is great to see the potential here. Every generation has the burden of making sense of their environment to understand the past and project the future. For the first time humanity is up against an environmental change of incredible proportions, unprecedented in human history. It will take knowledgeable people who are strong enough and brave enough to deal with hard questions and hard answers and the AIMS graduates are a wonderful example of this."

The graduation ceremony was officiated by Dr Max Price, Vice-Chancellor, UCT; Prof. Vivienne Lawack, Deputy Vice-Chancellor Academic, UWC; and Prof. Eugene Cloete, Vice-Rector: Research and Innovation, SU.



Prof. Brian O'Connell

The AIMS Endowed Scholarships are awarded each year for outstanding achievements in the AIMS Master's programme. This year, the recipients were: Mr Arnaud Andrianavalomahefa (Stephan Hawking Scholarship), Ms Vahatra Fenosoa Rabonandrianandraina (Martin Rees Scholarship), Mr Felicien Jordan Masakuna (Paul G Allen Scholarship), Ms Cecilia Muthoni Ndirangu and Mr Emmanuel Oluwatobiloba Neye (Victor Rothschild Scholarships).



Front row: Mr Arnaud Andrianavalomahefa, Ms Vahatra Fenosoa Rabonandrianandraina, Prof. Jeff Sanders and Ms Cecilia Muthoni Ndirangu. Back row: Mr Emmanuel Oluwatobiloba Neye, Mr Felicien Jordan Masakuna and Prof. Barry Green



Guests were entertained by the AIMS Choir



Graduation Ceremony June 2014

Post AIMS: Support, Opportunities and Alumni

AIMS bursaries for study at South African Universities

Through the generous support of the South African Department of Science and Technology (DST), and the Government of Canada through the International Development Research Centre (IDRC), 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 16 such bursaries for Master's study and one for doctoral studies. Recipients of these bursaries are asterisked in the table below. A further four students will be supported in the AIMS South Africa Research Centre, as indicated below.

Progress of recent students

Student	Gender	Country of Origin	Institution	Programme
Graduates from January 2014 intake				
Linsay Blows	F	South Africa	Pursuing other opportunities	
Tlou Lazarus Kubjana*	M	South Africa	University of Cape Town	Research Master's
Matjale Clement Mabula	M	South Africa	South African National Space Agency via DST-NRF	Intern
William Malose Manamela	M	South Africa	Pursuing other opportunities	
Africa Mgudlwa	M	South Africa	AIMS Research Centre/University of Cape Town	Research Master's
Siyabonga Phiwayinkosi Mthiyane	M	South Africa	Future Talent	Employed
Xolisile Octavia Thusini*	F	South Africa	University of Cape Town	Research Master's
Valentia Boledi Tlomatsana	F	South Africa	Pursuing other opportunities	
Graduates from August 2014 intake				
Salma Omar Abdalmageid Adam	F	Sudan	University of Cape Town	PhD
Adebayo Abayomi Adeleke*	M	Nigeria	Stellenbosch University	Research Master's
Arnaud Andrianavalomahefa	M	Madagascar	Durham University, UK	Research Master's
Ammar Abdalrhman Ibrahim Babikir	M	Sudan	Pursuing other opportunities	
Filister Chinake*	F	Zimbabwe	Stellenbosch University	Research Master's
Wilson Mulomba Choongo	M	Zambia	Pursuing other opportunities	
Steve Bicko Cygu	M	Kenya	Stellenbosch University	Research Master's
Zainab Olabisi Dere	F	Nigeria	Pursuing other opportunities	
Eshetu Belete Derzie	M	Ethiopia	Pursuing other opportunities	
Ahmed Reda Ahmed Abdelhamid Elmahalawy	M	Egypt	Pursuing other opportunities	
Mohammed Akram Fellah*	M	Algeria	Pursuing other opportunities	
Jemal Mohammed Getu*	M	Ethiopia	University of the Witwatersrand	Research Master's
Ephifania Geza	F	Zimbabwe	AIMS Research Centre/University of Cape Town	PhD
Fatima Yusuf Hussein	F	Somalia	University of Guelph	Research Master's
Abdullah Khalil Hassan Ibrahim*	M	Egypt	University of Cape Town	Research Master's
George Korir Kiprop	M	Kenya	AIMS Research Centre/ Stellenbosch University	Research Master's
Vitalis Kimutai Lagat	M	Kenya	AIMS Research Centre/ Stellenbosch University	Research Master's
Domini Jocema Leko Moutouo*	M	Republic of Congo	University of Cape Town	Research Master's
Malebese Mabotsa	F	Lesotho	University of KwaZulu-Natal	Research Master's
Pempho Elizabeth Manda	F	Malawi	Pursuing other opportunities	
Mohammad Zaki Elsayed Mansour*	M	Egypt	Pursuing other opportunities	
Felicien Jordan Masakuna	M	DRC	AIMS Research Centre/ Stellenbosch University	PhD
Nana Adjoah Mbroh*	F	Ghana	University of the Western Cape	Research Master's
Comfort Mintah	F	Ghana	University of Guelph	Research Master's
Hamza Elsayed Ahmed Mohamed*	M	Egypt	iThemba Labs/ UNISA	Research Master's
Mozzamil Mohammed Abdalla Mohammed	M	Sudan	Pursuing other opportunities	
Cecilia Muthoni Ndirangu	F	Kenya	Pursuing other opportunities	
Emmanuel Oluwatobiloba Neye	M	Nigeria	University of Saskatchewan, Canada	Research Master's
David Niyukuri	M	Burundi	University of Burundi	Teaching Assistant
Chinenye Assumpta Nnakenyi*	F	Nigeria	Stellenbosch University	Research Master's
Simon Katema Phiri	M	Zambia	Pursuing other opportunities	
Vahatra Fenosoa Rabodonandrianandraina	F	Madagascar	International Centre for Theoretical Physics	Pre-PhD Programme
Faniry Nadia Zazaravaka Rahantamalisoa*	F	Madagascar	University of Cape Town	Research Master's
Elie Danien Rajaobelina Iarilala*	M	Madagascar	University of the Witwatersrand	Research Master's
Haingotiana Safidy Nandrianina Ratsimbazafy	M	Madagascar	International Centre for Theoretical Physics	Research Master's
Esra Mohammed Shrif Mohammed Salih Shrif Mohammed *	F	Sudan	University of the Witwatersrand	Research Master's
Francky Mathieu Solofomananirina Tiantsao*	M	Madagascar	University of Cape Town	Research Master's
Hend Mohammed Ibrahim Mohammed Sroor*	F	Egypt	University of the Witwatersrand	PhD
Esmie Kamuloni Tcheza	F	Malawi	Pursuing other opportunities	
Nneka Ozioma Umeorah	F	Nigeria	North-West University	Research Master's
Muhammad Aziz Valiallah	M	South Africa	University of the Witwatersrand	PhD
Mary Wanjiku Wanjiru	F	Kenya	Pursuing other opportunities	
Reine Marquise Yemata Mekondjou*	F	Cameroon	University of Cape Town	PhD

DAAD bursaries for doctoral study



Ms Lucia Puttrich, Minister of European and Federal Affairs and Representative of the State of Hessen (pictured fourth from the left) with DAAD scholarship holders and other representatives from DAAD.

This year, the German Academic Exchange Service (DAAD) generously awarded six scholarships within its DAAD/AIMS agreement. Based on recommendations by AIMS, DAAD awards annual in-region scholarships to students from sub-Saharan Africa (excluding South Africa) for PhD studies in the Mathematical Sciences. In addition to the new awards, scholarships for 13 DAAD scholars in their second and third year of study were renewed.

A number of DAAD scholarship holders graduated during this period: Alex Samuel Bamunoba, Andry Nirina Rabenantoandro, Jacob Mahau Mateyisi and Nitin Chadan Rughoonauth in December 2014 and Ammar Abdalgabar in July 2015.

New awards for 2015 were made to:

Students	Gender	Country	University
Arielle Stela Nkwinkwa Njoudo	F	Cameroon	University of Cape Town
Chacha Marwa Issarow	M	Tanzania	University of Cape Town
Fikreyohans Solomon Assfaw	M	Ethiopia	University of the Western Cape
Justine Nasejje	F	Uganda	University of KwaZulu-Natal
Sultan Hassan	M	Sudan	University of the Western Cape
Zusage Kossi Amouzouvi	F	Toga	University of the Witwatersrand

Alumni

The table below summarises the progress of students who have completed the programme at AIMS South Africa for which information is available.

	Total	Male	Female
Graduated	578	389	189
PhD completed*	90	71	19
PhD in progress*	184	132	52
Research Master's completed*	280	191	89
Research Master's in progress*	82	53	29
Researcher Incl. PostDoc*	39	25	12
Teacher/ Lecturer*	120	90	30
Industry*	60	40	20

* As at December 2014

Alumni Updates

Mr Ermias Kassaye (2012 AIMS alumnus and a former Research Master's student in the AIMS Research Centre) and his team of collaborators from Ethiopia won the 2014 Business Plan proposal for Raspberry Pi. Raspberry Pi is business partner of the AIMS Industry Initiative. Ermias is currently doing a PhD at Rhodes University (RU).

AIMS graduates currently completing graduate programmes at the University of British Columbia include Mr Felix

Oghenekohwo (PhD geophysics), Ms Mekdes Tessame (PhD glaciology), Ms Jummy Funke David and Ms Sarafa Iyaniwura (MSc epidemiology).

Ms Savannah Nuwagaba, a 2011 AIMS South Africa graduate, who is currently pursuing her PhD at SU, has been awarded one of the prestigious Faculty for the Future Fellowships from the Schlumberger Foundation to support her PhD research in mathematical modelling of ecological systems. The Schlumberger Foundation is an independent non-profit body supporting science, technology, engineering, and mathematics (STEM) education. The fellowships are awarded through the foundation's flag-ship programme the Faculty for the Future programme. Fellowships are awarded to talented women from developing countries and who are pursuing advanced degrees in science and engineering at leading universities worldwide.

Six AIMS 2014 graduates are in two ICTP programmes in Italy: Ms Angela Ankomaah Tabiri and Mr Prosper Delanyo Akrobotu (AIMS Ghana) and Ms Leticia Agyemang Konadu (AIMS Cameroon) are in the ICTP Postgraduate Diploma Programme; Ms Saga Elasyed Ibrahim Abdalla (AIMS South Africa), Ms Nehad Attaelmanan Abdelrahim Mabrouk (AIMS Sénégal), and Mr Ayooluwa Olakunle Odufowora, (AIMS Cameroon) are in the ICTP Laurea Magistralis programme (in cooperation with the University of Trieste).



Dr Angelina Lutambi
AIMS South Africa 2005

Dr Angelina Lutambi from Tanzania graduated from AIMS South Africa in 2005. She then pursued a Master's in mathematics at SU and a PhD in epidemiology at the Swiss Tropical and Public Health Institute, at the University of Basel in Switzerland.

Angelina is currently a leading researcher at Tanzania's Ifakara Health Institute where she is developing and simulating mathematical models to investigate the role of mosquito dispersal on malaria transmission and vector control. The WHO estimates that there were about 207 million cases of malaria in 2012, resulting in over half a million deaths in Africa, mostly among children. It is a huge health burden and priority in Africa, where, in 2010, about 57% of the population lived in areas where transmission remains moderate to intense.

"I research models to explore the impact of health interventions to help inform policies in Tanzania." Angelina has also worked on mathematical modelling of a range of infectious diseases including HIV/AIDS which is one of Africa's major challenges.

Angelina has become a prominent woman scientist in Africa and around the world. She is a fellow of the Third World Organization of Women Scientists and has spoken on her work in several forums, including the 7th European Congress on Tropical Medicine and International Health in Barcelona in 2011. In 2014, she returned to AIMS South Africa as a lecturer.

Dr Gift Muchatibaya from Zimbabwe was among the first graduating class at AIMS in 2004. Prior to AIMS, he completed a Bachelor of Science (Honours) in Mathematics from the University of Zimbabwe in 1991.

Since graduating from AIMS, he went on to pursue a PhD in Mathematics at UCT and was a postdoctoral fellow in Industrial Mathematics at AIMS South Africa in 2010, where he also worked as a tutor.

Following a career as a lecturer at UCT and the Cape Peninsula University of Technology in South Africa, he decided to return to Zimbabwe in 2014 where he currently works as a Senior Lecturer in the Department of Mathematics at the University of Zimbabwe. The decision to return home to teach in Zimbabwe was motivated in large part by his strong desire to build the pipeline of students skilled in mathematical sciences at all levels.

"My country needs me. After developing my skills in mathematical sciences and research, I saw the need to go back home where the need is greatest to give back and enable more young people to excel in mathematics through teaching."

He has a strong passion to inspire people in his country, especially the youth, to develop an interest and pursue further studies in mathematics, as it is a fundamental subject for most careers in modern society.

Gift says "AIMS enabled me to realise my potential and dreams as a young African mathematician and to build a professional network that has given me access to various opportunities."



Dr Gift Muchatibaya
AIMS South Africa 2004

Since his graduation from AIMS, and with the support of a post-AIMS bursary, Prosper Ngabonziza, from Rwanda, undertook a Research Master's in Experimental Physics at the University of Johannesburg where he graduated in 2012. He is currently doing his PhD in Experimental and Engineering Physics at the University of Twente, MESA and the Institute for Nanotechnology in the Netherlands. "My interest is in the field of nanotechnology, focused on nanomaterials of unusual electronic properties and their interfaces, working specifically on a recently discovered material known as Topological Insulators."

A topological insulator is a material with non-trivial topological order that behaves as an insulator in its interior but whose surface contains conducting states, meaning that electrons can only move along the surface of the material. When a topological insulator is interfaced with a superconductor, a mysterious particle called Majorana fermion emerges, which can be used to fabricate a quantum computer that will run faster than any current computer. Searching for Majorana fermions based on a topological insulator-superconductor interface has thus become a hot race as the world prepares for the Quantum Age. Topological insulators can be implemented in computer processing devices as well as in memory and storage devices.

The design of computer-based materials has demonstrated its power in scientific research, saving resources and also accelerating the search for new materials for specific purposes.

In addition to their use in quantum computers, topological insulators hold great potential for the emerging technology of spintronics and thermos-electrics for energy harvesting. Prosper is at the forefront of research underway in this field.

Prosper is also a junior researcher at the Foundation for Fundamental Research on Matter (FOM) in Netherlands. He was recently nominated by AIMS to attend the 65th Lindau Nobel Laureate Meeting (2015) dedicated to physics, physiology or medicine and chemistry where he had a chance to network and build collaborations with Nobel Laureates and more than 200 other young global leaders in science.



Mr Prosper Ngabonziza
AIMS South Africa 2010

Research Centre



In February 2015, AIMS South Africa welcomed Dr Simukai Utete as Senior Researcher in the AIMS Research Centre (see profile on page 17). Her appointment brings the total number of resident researchers to twelve.

AIMS South Africa is proud to report that the NRF awarded an A2 rating to Prof. Romeel Davé (SARChI in Cosmology with Multi-wavelength Data jointly held between AIMS South Africa, UCT and SAAO). Prof. Bruce Bassett head of the Cosmology Group was awarded a B1 rating. NRF ratings are allocated based on a researcher's recent research outputs and impact as perceived by international peer reviewers. An A rating is given to leading international researchers and a B rating is given to internationally acclaimed researchers.

Prof. Martin Kunz (Geneva) completed his three-year Square Kilometre Array (SKA) visiting professorship at the Research Centre in May 2015. AIMS South Africa is grateful to

Prof. Kunz for his significant contributions to our research outputs (including more than 70 papers with the AIMS affiliation) and co-supervision of Master's and PhD students.

Three resident researchers departed during this period. Dr Sehun Chun, whose research is in the multidisciplinary field of mathematical and physical biology; Dr Lafras Uys who works in biomathematics and who was initially appointed as a postdoctoral fellow in 2010; and Dr Raouf Ghomrasni who held the position of resident researcher in financial mathematics from 2009. In addition to the supervision of Master's students, all three researchers made valuable contributions in the Centre's focus areas: Dr Chun arranged regular interdisciplinary discussion groups; Dr Uys and Dr Ghomrasni both taught review courses on the Structured Master's programme, and Dr Ghomrasni was part of the organising committee of the annual Summer School in Mathematical Finance. Seven research Master's students graduated under Dr Ghomrasni's supervision.



Postdoctoral Fellows

Two postdoctoral fellows joined during this period. Dr Andre Mialebama Bouesso, joined in January 2015 and he spent two months at the University of Kaiserslautern where he is collaborating with AIMS Distinguished Research Fellows Profs Wolfram Decker and Gerhard Pfister.

AIMS South Africa alumnus, Dr Franck Kalala Mutombo has joined the group of AIMS ARETÉ Chair, Dr Antoine Tambue.

Dr Rejoyce Gavhi-Molefe contributed significantly to AIMS public engagement activities during this period (see page 27 for further details).

Name	Citizenship	Gender	Start date to end date	Research Field	Supervisor/Host
Aniyan, Arun	India	M	17 June – December 2014	Astroinformatics, astrophysics, machine learning, artificial intelligence, big data.	B Bassett
Mialebama Bouesso, Andre Saint Etudes	Republic of Congo	M	15 January 2015	Computational algebraic geometry.	B Green
Mutombo, Frank Kalala	Democratic Republic of Congo	M	1 February 2015	Numerical analysis, complex networks, dynamical systems.	A Tambue
Gavhi-Molefe, Mpfareleni Rejoyce	South Africa	F	15 June 2013	Optimal C3 interpolatory subdivision scheme with fractal curves	J de Villiers
Jackson, Mark	United States	M	1 March – 31 August 2015	Theoretical cosmology and superstring theory - understanding how fundamental physics can be extracted from cosmological observables.	B Bassett
Ramanantoanina, Andriamihaja	Madagascar	F	1 March 2014	Coupling ecological and evolutionary dynamics.	C Hui
Sivanandam, Navin	United Kingdom	M	24 October 2011 – 23 October 2014	Early universe cosmology and inflation.	B Bassett

Postgraduate students in the Research Centre

The numbers of students hosted by the AIMS Research Centre and supervised by AIMS resident researchers totalled 27 during the period under review. Five of these are doctoral students.

The eight students who have graduated are highlighted in the table below. Ms Lise du Boisson and Ms Tanjona Ralaivasona achieved distinctions.

Name of student	Citizenship	Gender	Programme	Study duration	Supervisor/Host
Dufourq, Emmanuel	South Africa	M	PhD	31 May 2015 (ongoing)	B Bassett
Kassai, Eli	Namibia	M	PhD	1 March 2013 (ongoing)	B Bassett
Rajaona, Fortunat	Madagascar	M	PhD	1 March 2013 (ongoing)	J Sanders
Ranirina, Dinna	Madagascar	F	PhD	1 January 2015 (ongoing)	J de Villiers
Razafindramahatsiaro, Christalin	Madagascar	M	PhD	1 January 2013 (ongoing)	B Green
Amar, Gilad	South Africa	M	Master's	1 July 2014 (ongoing)	B Bassett
Attipoe, David	Ghana	M	Master's	February 2015 (ongoing)	A Tambue
Du Boisson, Lise	South Africa	F	Master's	1 August 2013 – December 2014	B Bassett
Eteko, Kossi	Togo	M	Master's	1 February 2015 (ongoing)	A Tambue
Galane, Lesiba Charles	South Africa	M	Master's	1 February 2013 – November 2014	R Ghomrasni
Gebremariam, Zoe Zerihun	Ethiopia	F	Master's	11 November 2014 (ongoing)	G Mazandu
Kassaye, Ermias Abebe	Ethiopia	M	Master's	August 2012 – December 2014	B Bassett
Koffi, Rock Stephane	Ivory Coast	M	Master's	1 February 2015 (ongoing)	A Tambue
Leboho, Nakedi Wilson	South Africa	M	Master's	1 July 2013 – March 2015	R Ghomrasni
Mamba, Wanele Gcinumuzi	Swaziland	M	Master's	1 February 2015	J Sanders and R Becker
Mbongo Nkouna, Jeffrey Ted Jonattan	Republic of Congo	M	Master's	1 July 2013 – March 2015	R Ghomrasni
Mgudla, Africa	South Africa	M	Master's	1 February 2015 (ongoing)	I Durbach
Mootoovalo, Arrykrishna	Mauritius	M	Master's	1 June 2015 (ongoing)	B Bassett
Namundjebo, Elia Nghilifavali	Namibia	M	Master's	1 January 2015 (ongoing)	J Sanders and R Becker
Ochiaga, Evans Otieno	Kenya	M	Master's	1 October 2014 (ongoing)	C Hui
Phaweni, Thembani	South Africa	M	Master's	1 February 2015 (ongoing)	I Durbach
Rakotonirainy, Rosephine Georgina	Madagascar	F	Master's	1 October 2014 (ongoing)	I Durbach
Ralaivaosaona, Tanjona Fionana	Madagascar	F	Master's	1 July 2013 – March 2015	J Sanders
Sall, Mamadou	Senegal	M	Master's	21 October 2013 – 31 July 2015	S Chun
Staats, Kai	United States	M	Master's	1 March 2014 (ongoing)	B Bassett
Tafeni, Phumza	South Africa	F	Master's	1 Feb 2013 – December 2015	R Ghomrasni
Walljee, Rabia	South Africa	F	Master's	1 February 2013 – November 2014	R Becker



Prof. Doug Rawlings



Dr Andre Saint Eudes Mialebama Bouesso



Prof. H. Phillip Mashele

Research activities

Research Day

An AIMS South Africa research day was held on 17 June 2015. Guest speaker for the day was Prof. Doug Rawlings who shared his own experience in building a research career. PhD students gave short presentations on their research and Dr Rosita Yocgo, Research Manager at the AIMS-NEI Global Secretariat updated researchers and students on developments in the network.

Talks and workshop attendance

Research staff and students participated in the following workshops and conferences during this period:

- Prof. Bruce Bassett, undertook an extended research visit to multiple institutions in the United States, United Kingdom, France, and Italy during August and September 2014.
- Prof. Cang Hui, delivered a presentation at the 18th Evolutionary Biology Meeting at Marseilles in France in September 2014.
- Dr Gaston Mazandu gave a talk at the European Conference on Computational Biology in September 2014 and the ISCB Africa ASBCB Conference on Bioinformatics held in Tanzania in March 2015.
- Prof. Barry Green attended the Oberwolfach Forschungsinstitut workshop on Valuation Theory and its Applications from 26 October to 1 November 2014.
- AIMS researchers and Master's students gave presentations at the South African Mathematical Society (SAMS) Annual Congress held at UNISA from 29 to 31 October 2014.
- Prof. Jeff Sanders attended the Computational Topology and Data Analysis Workshop hosted by the Centre for Mathematical and Computational Sciences, Wits from 17 to 21 November 2014.
- In December 2014, Dr Tambue attended the 4th African Mathematical School at the University of Douala in Cameroon where he taught the course "Pricing debt and equity in corporate finance".
- Dr Tambue and Dr Gavhi-Molefe presented papers at the 39th Symposium of Numerical and Applied Mathematics (SANUM) at the University of Pretoria from 30 March to 1 April 2015.
- Dr Wilfred Ndifon was invited to advise the World Health Organization's Immunisation and Vaccines Implementation related Research Advisory Committee (IVIR-AC) and he attended a meeting in Geneva from 9 to 11 June 2015.
- Dr Gavhi-Molefe presented her research at the 33rd Southern Africa Mathematical Sciences Association Annual Conference (Zimbabwe) and at the International Conference on Wavelets and Applications 2015 (St. Petersburg, Russia).

- Ms Zoe Gebremariam and Dr Frank Kalala Mutombo attended the 7th High Performance Computing School for graduate students held at the University of Johannesburg from 28 June to 5 July.
- On 21 July 2015, Prof. Ronnie Becker, attended "The Planet Earth Institute #ScienceAfrica UnConference Africa's scientific independence: no more business as usual" which took place in London.
- On 10 August 2015, Dr Andre St Etudes Mialebama Bouesso gave a talk on the theory of Groebner bases and some applications in algebraic geometry at the first Nairobi Workshop on Algebraic Geometry.

Seminars

Regular journal club meetings were held during the period under review. Students and visiting researchers presented their work to members of the Research Centre in this forum. Highlights of the year included:

- "Fluctuations in stochastic systems with memory" presented by Dr Rosemary Harris (Queen Mary University of London).
- "Groebner based over non-commutative rings" by Dr Andre Saint Eudes Mialebama Bouesso, AIMS.
- "Application of weighted orthogonal polynomials in finance" by Prof. H Phillip Mashele, NWU, Potchefstroom Campus.

The AIMS Cosmology group continued its series of seminars. Among the notable talks this year were:

- "The LCDM Model: Successes and Future Challenges" presented by Prof. Adam Amara (ETH Zurich).
- "Polarized dust emission and searching for primordial B modes from cosmic inflation" by Prof. Martin Bucher (UKZN).
- "Analogue models of gravity: the ubiquitous space-time" by Prof. Stefano Liberati (International School for Advanced Studies (SISSA), Italy).

A number of other seminars were presented to the broader student body (see academic report on page 4).

Building the AIMS network

A number of AIMS South Africa researchers are developing links with other centres in the AIMS network: Prof. Barry Green chairs the Network Research and Innovation Committee; the IDRC Junior Research Chairs, Drs Wilfred Ndifon and Gaston Mazandu, are assisting with the establishment of the AIMS Ghana Research Centre; and Prof. Bruce Bassett is assisting with curriculum design for the AIMS Sénégal Co-operative Master's programme.



Dr Simukai Utete
Senior Researcher

Dr Simukai Utete's undergraduate degree was in electrical engineering from the University of Zimbabwe. She completed her MSc and DPhil studies at the University of Oxford and went on to complete a Junior Research Fellowship and further research there. She moved to South Africa in 2008 to join the Council for Scientific and Industrial Research (CSIR) Mobile Intelligent Autonomous Systems (MIAS) field robotics group and was appointed Research Leader of MIAS in 2009. She led the group for over four years.

Dr Utete's research area is robotics, in particular, the development of methods to achieve systems which can operate with high levels of autonomy, for robotics and related applications. This includes the study of problems in data fusion and decision fusion, and intelligent sensor networks, including decentralised sensing systems. One of her related areas of interest is intelligent monitoring – applying techniques for coordination and communication in intelligent sensor networks so that they can be used, for example, in environmental monitoring. She is also interested in the intersection of robotics and condition monitoring, and the application of methods spanning both areas to the development of intelligent systems.

Dr Franck Kalala Mutombo is originally from the DRC where he completed an honours degree in Mathematics in 2004 at Lubumbashi University and where he also worked as a teaching assistant. He graduated from AIMS South Africa in 2006 and then went back home to teach. In 2008 he did his Master's in fundamental mathematics in the field of Partial Differential Equations at the University of Paris Sud XI, France. He completed his PhD in 2012 at the University of Strathclyde, Glasgow, UK under the supervision of Prof. Ernesto Estrada. He spent four months as a research associate with a joint affiliation between Strathclyde University and Isochron, a company based in Edinburgh, UK. In April 2013 he was appointed as an associate professor (senior lecturer) and head of the young Department of Mathematics and Computer Sciences at Lubumbashi University. He joined the AIMS South Africa Research Centre as a postdoctoral fellow in February 2015. This fellowship has a joint affiliation to AIMS and the Centre for Research in Computational and Applied Mechanics (CERECAM) at UCT.

His interest is in developing an efficient implementation of new numerical methods for multiphase flow in porous media, fractured geothermal reservoirs. He is also interested in the field of complex networks (theory and application) looking at the propagation of information in a networks (such as epidemics, rumours, etc.) through non-random long range interactions between nodes via weighted 'ghost' links. He contributed to the implementation of the subgraph centrality and communicability algorithm in NetworkX, a Python package for the creation, manipulation and study of the structure, dynamics and functions of complex networks. Franck has supervised one Master's student at AIMS Sénégal and several honours students in his home country.



Dr Franck Kalala Mutombo
Postdoctoral Fellow

Ms Dinna Ranirina graduated from AIMS South Africa in 2014. During her time at AIMS, she grew more interested in the area of computational mathematics, especially in wavelets and subdivisions. She is currently doing a PhD in this area in the AIMS South Africa Research Centre under the supervision of Prof. Johan de Villiers.

Her current research is on multi-wavelet analysis. In fact, this will be an extension of the book written by Charles K Chui and Johan de Villiers titled "Wavelet Subdivision Methods" (2010). The aim of her project is to introduce a more general approach to (vector-valued) multi-wavelet construction in which orthogonality is not a requirement and which yielded significant advantages in some application areas.

Dinna is very glad to be part of AIMS through this programme. "I think that AIMS is a good place to study and do research. Being close to the beach makes learning mathematics more enjoyable, and more importantly, you can focus on giving the best of yourself to achieve your goals. Having this opportunity in Africa for African students to develop their skills in mathematical sciences is amazing."



Ms Dinna Ranirina
PhD Student

"Interacting with researchers from different fields of interest has expanded my horizons and the perception of my research," she said after giving a talk on her research project in May 2015 in the Journal Club. "Furthermore, AIMS is also about sharing knowledge with the community." Dinna participated in National Science Week, an event hosted at AIMS South Africa in August 2015, where she ran the activity "Mathematics in nature".

Visiting Researchers

AIMS South Africa continues to run a successful visiting researchers programme which allows for visitors from South Africa, and further afield to spend time focussing on their research and interacting with resident researchers and

students. Many visitors are workshop or conference attendees who extend their stay for quality research time. Forty-nine visitors spent time in the Research Centre this year.

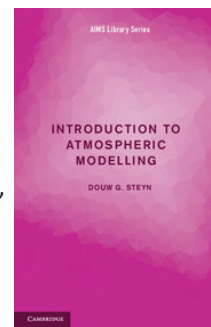
Name	Nationality	University (Affiliation)	Research	Dates of visit
Agyingi, Collins Amburo	Cameroon	UNISA	Topology	21 – 31 July 2015
Amara, Adam	Switzerland	ETH Zurich	Astronomy and Cosmology	8 – 14 February 2015
Athreya, Jayadev	United States	Illinois University at Urbana-Champaign	Mathematics	22 – 27 January 2015
Attan, Sylvain	Benin	University of Benin	Computational Algebra	1 – 9 August 2015
Bere, Alphonse (PhD student)	Zimbabwean	University of Limpopo / Western Cape	Modelling bivariate data using mixtures of rotated copulas	13 – 28 September 2014
Berhane, Tesfahun	Ethiopia	Bahir Dar University	Mathematical modeling (bio-fluidity)	12 January – 3 April 2015
Bleher, Frauke	United States	University of Iowa	Representation theory of groups and of finite-dimensional algebras	20 May – 2 June 15
Bombieri, Enrico	United States	IAS, Princeton	Number theory and analysis	14 – 24 January 2015
Bruni, Marco	Italy	ICG, Portsmouth University	Theoretical and observational Cosmology and Astrophysics	25 – 26 November 2014
Bucher, Martin	Austria	University of Paris	Theoretical Cosmology	9 – 5 February 2015
Chang, Chialin	Taiwan	National Tsing Hua University	Microeconomics and Empirical Industrial Organization	17 – 19 August 2014
Chinburg, Ted	United States	University of Pennsylvania	Number Theory	20 May – 2 June 2015
Decker, Wolfram	Germany	University of Kaiserslautern	Computational Algebraic Geometry/ Complex analysis	23 February – 14 March 2015
Dikande, Alain Moise	Cameroon	University of Buea	Nonlinear Science	21 June – 18 July 2015
Freire, Filipe	Netherlands	Utrecht University	Particle Physics/Cosmology interface	1 – 17 March 2015
Guerrero Cardenas, Diego	United States	MIT	Cosmology	31 May – 15 August 2015
Heisenber, Lavinia	Germany	University of Geneva	Galileon Cosmology	7 April – 31 May 2015
Kameni, Stephane Tchuiaga	Cameroon	Utrecht University	Symplectic Topology	18 September – 30 October 2014
Katz, Nick	United States	Princeton	Algebraic Geometry	11 – 25 January 2015
Kenfack, Anatole	German	Freie Universität Berlin	Theoretical Physics and Chemistry	30 September – 5 November 2014
Kubayi, David	South Africa	North-West University	Approximation Theory and Orthogonal Polynomials	6 – 18 December 2014
Kunz, Martin	Switzerland	University of Geneva	Non-Gaussianity, the CMB, and generally the early universe	18 February – 13 May 2015
Lablanche, Pierre-Yves	France	AIMS Tanzania	Astrophysics	31 January – 9 February 2015
Liberati, Sefano	Italy	International School for Advanced Studies (SISSA)	Quantum Physics	20 – 26 November 2014
Likibi Pellat, Rhoss Beauneur	Republic of Congo	Mariem Ngouabi University	Novel Numerical Schemes for Stochastic Differential Equations	11 July – 30 September 2015
Mabula, Mokhwetha	South Africa	University of Pretoria	Functional Analysis	27 June – 18 July 2015
Mashele, Phillip	South Africa	University of North-West	Financial Mathematics	1 March – 29 May 2015
McAleer, Michael	Taiwan	National Tsing Hua University	Financial Mathematics	17 – 19 August 2014
Mohammed, Mogtaba	Sudan	University of Pretoria	Homogenization of stochastic linear hyperbolic equations	15 June – 30 July 2015
Mothebe, Mbakiso	Botswana	University of Botswana	Algebraic Topology	17 July – 16 August 2014
Motsumi, Teko Ganakgomo	Botswana	University of Botswana	Mathematics	6 – 31 July 2015
Mvogo, Alain	Cameroon	University of Yaoundé	Physics	2 October – 30 November 2014
Nunhokee, Ridhima	Mauritius	Rhodes University	Astronomy	27 April – 2 May 2015
Pfister, Gerhard	Germany	University of Kaiserslautern	Computational Algebraic Geometry/ Complex analysis	23 February – 14 March 2015
Rabarison, Patrick	Madagascar	University of Antananarivo	Number Theory and Algebraic Geometry	18 – 30 January 2015
Razafimanantsoa, Gerard	Madagascar	University of Antananarivo	Mathematics: Drinfeld Modules	18 – 30 January 2015
Razafinjatovo, Mahefason Heriniaina	Madagascar	University of Antananarivo	Pure mathematics	18 January – 18 February 2015
Ruck, Hans-Georg	Germany	University of Kassel	Computational Mathematics	18 – 24 January 2015
Sango, Mamadou	South Africa	University of Pretoria	Partial Differential Equations, Stochastic Processes and Differential Geometry	4 – 12 October 2014 and 20 June – 18 July 2015
Sarnak, Peter	South Africa/ United States	IAS, Princeton	Mathematics	10 – 24 January 2015
Scholten, Lisa	Switzerland	Eawag, Swiss Federal Institute of Aquatic Science and Technology	Multi-criteria decision analysis and urban water management and planning	25 February – 8 March 2015
Shozi, Franklin	South Africa	Mangosuthu University of Technology	Mathematics education	6 – 10 October 2014
Simpore, Yacouba	Burkina Faso	University of Ouagadougou Lanibio	Control of the linearized Crocco Equation	2 May – 28 July 2015
Sutter, Paul	Italy	INAF Astronomical Observatory of Trieste	Cosmology	26 April – 2 May 2015
Tabi, Conrad	Cameroon	Stellenbosch University	Non-linear dynamics	15 July – 14 September 2014
Tadesse, Yabebal Fantaye	Ethiopia	University of Rome	Cosmology	3 – 8 February 2015
Tegegn, Tesfalem Abate (PhD student)	Ethiopia	University of Pretoria	Harmonic Analysis	12 December 2014 – 21 January 2015
Toure, Ibrahima	Ivory Coast	Université Felix Houphouet Boigny Cocody	Harmonic Analysis	4 October – 30 November 2014
Tschinkel, Yuri	United States	Simons Foundation	Mathematics and Physical Science	21 – 24 January 2015

Research outputs

The AIMS Research Centre continues to increase its publications outputs with 83 papers appearing in 2014 and 42 (to date) in 2015.

The seventh book in the AIMS Library Series titled, *Introduction to Atmospheric Modelling* by Douw G Steyn was published in April 2015. Alan Beardon continues as the editor of the AIMS

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



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- J Adamek, R Durrer and **M Kunz**. N-body methods for relativistic cosmology. *Classical and Quantum Gravity*. 31 (2014) 234006.
- AIMS Class 2013-14 and AF Beardon**, Removing a vertex from a tetrahedron. *The Mathematical Gazette*. 99 (544) (2015) 90-96.
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- R Davé** et al. ZFOURGE/CANDELS: On the Evolution of M* Galaxy Progenitors from z = 3 to 0.5. *The Astrophysical Journal*. 803(1) (26) (2015) 24pp.
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- K Finlator, R Thompson, S Huang, **R Davé**, E Zackrisson, BD Oppenheimer. The reionization of carbon. *Monthly Notices of the Royal Astronomical Society*. 447(3) (2015) 2526-2539.
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- J Adamek, R Durrer, **M Kunz**. N-body methods for relativistic cosmology. *Classical and Quantum Gravity*. 31(23) (2014) 234006.
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Workshops and conferences

Thirteen workshops and conferences were hosted by AIMS South Africa during the period under review:

The **2nd Machine Learning JEDI Workshop** was run by the Cosmology Group from 20 to 24 October 2014. The Kaggle International Epilepsy Prediction Challenge was the focus of this workshop which was attended by fifteen participants from the fields of statistics, astronomy and computer science selected for their machine learning and data skills.

AIMS South Africa hosted the **Explore the Financial Markets with Maths Student Workshop** from 24 to 28 November 2014. The 20 participants included senior undergraduates (third year), honours students in financial mathematics, actuarial sciences or statistics, and two AIMS South Africa students. Participants were introduced to essential concepts and the main instruments in finance. They were taught computing skills and shown how to use them to analyse financial data, design portfolios and hedge against losses. Theoretical sessions were followed by lab sessions.

A **Big Data and Machine Learning JEDI** for students, conducted by Prof. Bruce Bassett (AIMS Cosmology Group leader) and Dr Nadeem Oozeer (Commissioning Scientist at SKA and AIMS South Africa Associate Research Fellow), was held at the University of Mauritius from 12 to 15 January 2015. The JEDI workshops teach research skills through interactive group work on real problems. Due to a cyclone warning part of the workshop was held online. Mauritian PhD Student, Rajin Ramphul (SAAO/UCT) led a pre-JEDI workshop focusing on Python. This two-day workshop was attended by 23 undergraduate students from the University of Mauritius. The skills acquired by the students were then used for tackling a Big Data challenge.

Leading mathematicians in the application of mathematics in industry participated in the **12th Mathematics in Industry Study Group (MISGSA)** held at AIMS from 12 to 16 January 2015. This workshop was co-hosted with the Wits and the lead organiser was Prof. David Mason from the Wits School of Computational and Applied Mathematics. Academic researchers and graduate students from South African universities worked collaboratively on five problems submitted by local industry. The workshop was preceded by a four-day graduate workshop. Invited guests included Prof. Neville Fowkes, University of Western Australia; Prof. Tim Myers, Centre de Recerca Matemàtica, Barcelona; Prof. Graeme Hocking, Murdoch University, Dr Sarah Mitchell, University of Limerick and Dr Chris Breward, University of Oxford.

The **AIMS-SU Number Theory Workshop** was held at AIMS South Africa from 19 to 23 January 2015. It was supported by the Clay Mathematics Institute, USA, and the Wits CoE-MaSS. The goal of the workshop was to give a broad perspective of

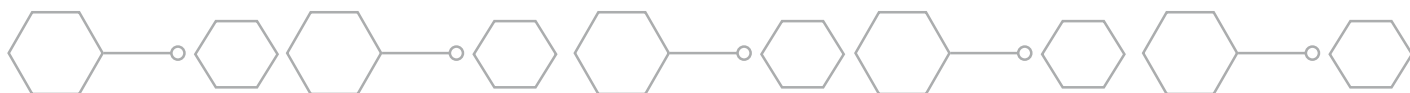
areas of modern number theory and to highlight some recent advances. Internationally renowned mathematicians who attended the workshop included:

- Prof. Enrico Bombieri, Fields Medalist and one of the world's leading authorities on number theory and analysis.
- Prof. Nick Katz, working in the fields of algebraic geometry and currently a professor in the Mathematics Department at Princeton University, New Jersey.
- Prof. Peter Sarnak, South African-born American mathematician and currently Eugene Higgins Professor of Mathematics at Princeton University and permanent faculty member of the School of Mathematics of the Institute for Advanced Study. He is also the recipient of the 2014 Wolf Prize in Mathematics.
- Dr Yuri Tschinkel, Director of Mathematics and the Physical Sciences at the Simons Foundation

This conference was attended by 35 participants from the United States, India, Israel, Europe and Africa and was one of the biennial Number Theory meetings which have been held at SU since 1997.

The **8th Summer School in Mathematical Finance** was held at AIMS South Africa from 19 to 21 February 2015. This workshop provides a forum 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. Keynote speakers were: Dr Massimo Morini, IMI Bank of Intesa San Paolo; Prof. Peter Ritchkin, Weatherhead School of Management Case, Western Reserve University, Ohio; and Prof. Ajay Subramanian, Finance, Risk Management and Insurance, Georgia State University.

The **3rd International Workshop on Nonlinear and Modern Mathematical Physics**, held from 9 to 11 April 2015, was co-organised by AIMS South Africa, the University of South Florida and NWU. The primary goals of the workshop were to promote and encourage cooperation, understanding and collaboration in the nonlinear mathematical physics community and to bring together mathematicians and physicists who attempt to understand nonlinear phenomena and solve nonlinear problems. The workshop surveyed recent advances on a wide range of topics of current interest in nonlinear and modern mathematical physics including: integrable and near-integrable equations, physical and engineering applications such as nonlinear optics, Bose-Einstein condensates and fluid dynamics, and numerical aspects of nonlinear phenomena. Thirty-three scientists and researchers participated. The organising committee was Prof. Wen-Xiu Ma (South Florida), Prof. Masood Khalique (NWU), Prof. Barry Green (AIMS), Prof. Fazal Mohammed (CoE-Mass, Wits) and Prof. David Mason (Wits).





2nd Machine Learning JEDI Workshop



The 8th Summer School in Mathematical Finance



Explore the Financial Markets with Maths Student Workshop



The 3rd International Workshop on Nonlinear and Modern Mathematical Physics



12th Mathematics in Industry Study Group (MISGSA)



Medical population genetics and Genome-Wide Association (GWAS) for complex diseases workshop



The AIMS-SU Number Theory Workshop



African Symposium on Genome-Wide Association Studies for complex diseases (ASGWAS) conference

The **Medical population genetics and Genome-Wide Association (GWAS) for complex diseases workshop** was held at AIMS South Africa from 20 to 22 April 2015. It introduced an interdisciplinary audience to the potential of GWAS and to key strategic considerations in designing and performing genome-wide association studies, as well as bringing all participants up to speed on the basic principles of human genetic variation, genotyping and disease scoring statistics. In addition, the workshop bridged the gap between statistics, bioinformatics and genetics. The workshop was organised by H3ABioNet, AIMS and the CPGR node of H3ABioNet and attended by 45 participants.

The **African Symposium on Genome-Wide Association Studies for complex diseases (ASGWAS) conference** was held from 23 to 24 April 2015. It informed an interdisciplinary group of 65 scientists about the potential of GWAS and the key strategic considerations in designing and performing gene-mapping studies on the African continent. The symposium was held at False Bay College, Muizenberg and showcased state-of-the-art advances in the dynamic fields of advanced medical and population genetics, bioinformatics of diseases mapping, and drug discovery, personalised and precision medicine. Exhibitors at the symposium were Inqaba Biotechnical, Elsevier Egypt, Illumina and CPGR.

The South African Centre for Epidemiological Modelling and Analysis (SACEMA), in collaboration with AIMS South Africa, held a two-week **Clinic on the Meaningful Modelling of Epidemiological Data** from 1 to 12 June 2015. This modelling clinic emphasised the use of data in understanding infectious disease dynamics. The clinic brought together a total of 67 graduate students, postdoctoral fellows and researchers from Africa and North America, who engaged in epidemiological modelling projects that use real data to grapple with practical questions in a meaningful way.



Computing the Quantified Self Workshop

The **Computing the Quantified Self Workshop** for senior undergraduate or honours students in Mathematical Sciences from South African universities was held at AIMS South Africa from 6 to 10 July 2015. The 25 participants included 13 AIMS students. The workshop was organised by Dr Simukai Utete and Prof. Jeff Sanders of AIMS. Attendees were taught programming and related software for modelling, analysing and interpreting data. They were given demonstrations by experts in the field and worked on their own projects which were presented at the end of the workshop. Visits to the Biomedical Engineering Lab in Newlands and the Magnetic Resonance Imaging Lab in Observatory were arranged.

Another **Mauritian Machine Learning JEDI** took place from 16 to 27 July. Attended by 22 undergraduate and graduate students, it was organised by Prof. Bruce Bassett, head of the Cosmology Group at AIMS South Africa and Dr Nadeem Oozeer (SKA, AIMS and NWU). The workshop was funded by the Royal Society Newton fund and the SKA and saw two problems tackled using machine learning algorithms: (1) identification of extended sources in radio images and (2) classification of diabetes using images of the eye (diabetic retinopathy). The research workshop was very successful with one of the students describing it as the most important educational experience of his life.

The **CIMPA Research School in Representation Theory 2015** with themes in Algebraic Representation Theory and Applications was hosted at AIMS South Africa from 19 to 31 July 2015. The school was attended by 58 participants from 18 countries. The workshop was organised by Director Claude Cibilsn (CIMPA), Dr Bernardo Rodrigues (UKZN), Prof. Barry Green (AIMS) and Prof. Jamshid Moori (NWU). This is the fourth workshop hosted at AIMS South Africa which forms part of the Memorandum of Understanding signed with CIMPA.



Clinic on the Meaningful Modelling of Epidemiological Data



Mauritian Machine Learning JEDI



CIMPA Research School in Representation Theory 2015

AIMS Schools Enrichment Centre

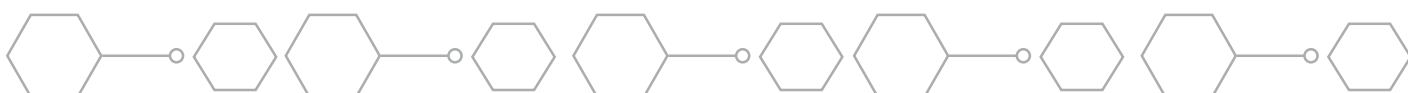
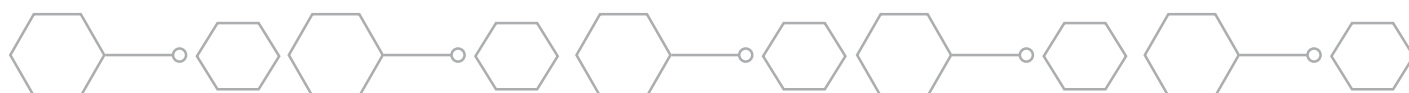
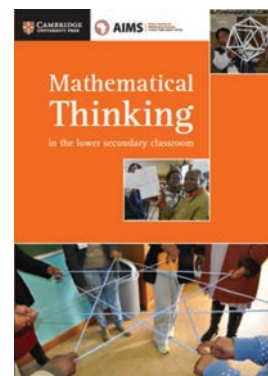


AIMSSEC

AIMSSEC continues to provide continuous professional development opportunities for previously disadvantaged rural South African teachers. Opportunities are designed to cover gaps in content knowledge and pedagogical skills in order to improve the quality of teaching and learning of mathematics. Activities this year have included the compilation of chapters for a book series, participation in public engagement programmes through workshops and conferences, and the delivery of teacher training courses for in-service teachers. AIMSSEC's research department continues to engage with teachers and learners in developing a toolkit based on formative assessment.

Aiming High Book Series

Local AIMSSEC staff and a team of international volunteers are developing a series of books to support teachers in developing countries. Cambridge University Press will publish the first book in the series by March 2016: "Mathematical Thinking in the lower secondary classroom" (edited by Christine Hopkins from the United Kingdom and Ingrid Mostert from AIMSSEC). Each book consists of a number of chapters with workshop guidelines for teachers and classroom activities for learners. All the activities included in the book were trialed by teachers enrolled for the Advanced Certificate in Education, a two-year university accredited course offered by AIMSSEC between 2012 and 2015.



Public Engagement programmes

AIMS South Africa hosted a National Science Week event from 3 to 8 August 2015. During the five-day schools programme, AIMSSEC presented learner-centred fun activities including the murder mystery, investigating Euler's theorem and making three dimensional objects using paper and string. On the sixth day AIMSSEC presented a workshop specifically for teachers.

The 21st Annual National Congress of the Association for Mathematics Education in South Africa was held from the 29 June to 3 July 2015 at the University of Limpopo in Polokwane. AIMSSEC contributed four presentations titled: "Teaching vocabulary in mathematics classrooms"; "Teaching someone else's lesson: Adopt or adapt"; "Using innovative resources to teach exponents" and "Using geogebra to teach differentiation".

At regional level, AIMSSEC presented a workshop titled "Improving the quality of teaching and learning mathematics in schools" at the African Mathematical Union Commission on Women in Mathematics in Africa/ African Women in Mathematics Association workshop in Kenya in July 2015 under the theme of "Women in Mathematics for Social Change and Sustainable Livelihoods". In January 2015 AIMSSEC also participated in the SAARMSTE Conference held in Maputo to present the work being done on the FaSMEd toolkit.

Dr Barrie Barnard, the Academic Manager of AIMSSEC participated in the official launch of the AIMS Teacher Training (TT) Pilot Project funded by The MasterCard Foundation held in March 2015, in Yaoundé, Cameroon. At the launch, the AIMSSEC model was outlined highlighting lessons learnt in working with the professional development of teachers, particular risks and points of convergence and where AIMSSEC can support the TT program in Cameroon. AIMSSEC will continue to support similar programmes based in AIMS Sénégal, AIMS Ghana, AIMS Cameroon and AIMS Tanzania. Between April and August 2015, AIMSSEC partnered with Deloitte South Africa to provide teacher training courses for the National Education Collaboration Trust (NECT) in two poorly performing districts in Limpopo Province namely the Waterberg and Vhembe districts. These training sessions inspired some of the teachers to enrol for other teacher training courses offered by AIMSSEC.

FaSMEd

AIMSSEC's research on the European Union funded project FaSMEd (Formative Assessment in Science and Mathematics Education) began in January 2014 and will end at the end of 2016. FaSMEd involves eight partners from European countries as well as the South African researchers based at AIMSSEC (Dr Marie Joubert and Ms Ingrid Mostert). The research aims to produce a toolkit of resources to support teachers in the use of formative assessment in their classrooms. The researchers plan the lesson with the teacher, lesson to plan, observe and video the lesson and then interview the teachers afterwards.

All participants meet once a term to share their thoughts, to advise and support one another and to celebrate what has already been done.

All partners in the project will produce case studies of at least two teachers and their use of the FaSMEd tools. The Norwegian partner, based in Trondheim, will synthesise the case studies, which will inform the development of the final toolkit.

In the second half of 2014, in order to establish a cluster of teachers to work with, Ingrid and Marie ran workshops and seminars to demonstrate the sorts of classroom activity the project promotes ("active learning" or "student-centred") and to explain more about the project and what taking part in the project would involve. They also directly invited some schools to take part. Twenty teachers volunteered.

Dr Joubert and Ms Mostert, attended project meetings in Turin (Italy) in October 2014 and Lyon (France) in April 2015. They have also presented their ongoing work at conferences and seminars in Africa and Europe.



National Science Week activities with scholars





MT24 Group photo

Mathematical Thinking (MT) Short Course

The MT Short Course is now endorsed by the South African Council for Educators (SACE) to be offered to in-service teachers. The course is intended for mathematics teachers who want to be more effective classroom practitioners including heads of departments and subject advisors.

The MT course focuses on learner-centred approaches to facilitate a deeper understanding of mathematical concepts. The MT course has been run 24 times and collectively boasts a total of 1,430 teachers across South Africa. Two alumni returned as lecturers on the MT24 course held in July 2015 and six alumni returned as teaching assistants.

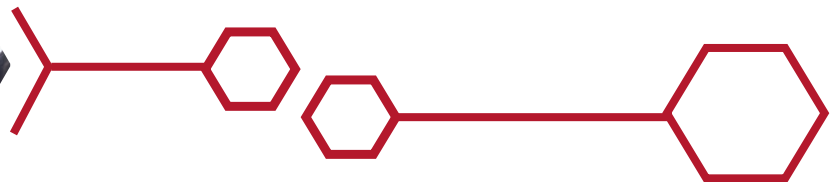
University accredited qualifications

AIMSSEC is partnering with North-West University (NWU) through their Unit for Open Distance Learning at the Potchefstroom campus to jointly deliver the new Advanced Certificate in Mathematics Teaching (ACT) for all phase groups and the Advanced Diploma in Education (ADE) for the Intermediate Phase. The memorandum of agreement for the partnership was signed in July 2015 and the first cohort of students to begin in 2016 will be recruited. The partnership with NWU will benefit underqualified teachers and teachers aspiring to get university accredited qualifications e.g. graduates of teacher training colleges who had limited access to further education. The ACT (NQF Level 6) followed by the ADE (NQF Level 7) pave the way for a journey towards a Master's in mathematics education.

In May 2015, 60 teachers graduated from the Advanced Certificate in Education (ACE) delivered in partnership with the University of Fort Hare.



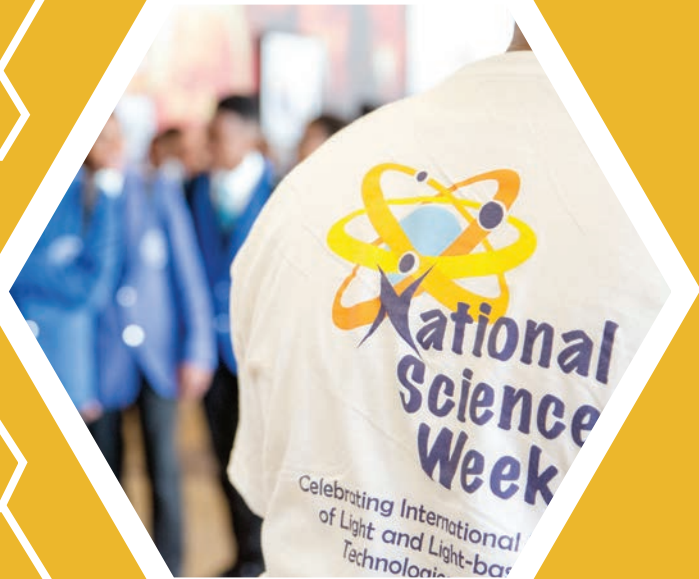
ACE graduates



Teachers on the MT24 course



Public engagement, joint initiatives and meetings



Exhibitions and talks

To promote mathematical sciences in general, and the programmes of AIMS, AIMS South Africa has participated in a number of exhibitions this year. Staff and researchers hosted exhibition stands or gave talks at the following events:

- Dr Rejoyce Gavhi-Molefe gave a keynote address titled: “Embarking on a PhD” at the NRF’s SA PhD Project Conference 2014 held in Mahikeng, North West Province on 14 September 2014.
- Prof. Green represented AIMS at the Mathematics in Emerging Nations: Achievements and Opportunities Conference (MENA0) held in Seoul, Korea on 12 August 2014.
- AIMS staff hosted stalls at SciFest Africa (Grahamstown, March 2015), the African Young Graduates and Scholars Conference (UCT, 30 March to 2 April 2015), the NRF SA PhD Regional Conference (Somerset West, 30 March 2015) and the Career Fair of the Department of Mathematical Statistics and Actuarial Science (University of the Free State, 25 April 2015).

Public engagement events at AIMS

To commemorate the launch of the first man-made satellite and the treaty on principles for governing space-related activities the United Nations declared 4 to 10 October as **World Space Week**. AIMS South Africa celebrated the week with the screening of documentaries about space exploration, a public lecture, and a student visit to the South African Astronomical Observatory.

From 4 to 7 November AIMS hosted the **IMAGINARY Exhibition-Workshop**. IMAGINARY is an interactive travelling exhibition curated by the Mathematisches Forschungsinstitut Oberwolfach. The exhibition presents visualisations, interactive installations, virtual realities, 3D objects and their theoretical background in algebraic geometry and singularity theory, in an attractive and understandable manner. Demonstrations provide insights into the theoretical background. Visitors to the exhibition had the opportunity to talk to mathematicians, watch fascinating movies and create their own mathematical artwork. The exhibition also included a series of hands-on exhibits from the UNESCO mathematics exhibition “Experiencing Mathematics”. The exhibition was visited by around 370 people, consisting of school and university students, teachers, researchers and the general public. A **Science Slam** event titled “From the Big Bang to the Brain” took place on 7 November. The goal of the workshop was to showcase interactive mathematics learning tools, to work on dedicated activities for Africa, and to jointly plan future activities.

Two workshops held at AIMS South Africa during 2014 and 2015 were specifically designed for third-year and honours students at South Africa universities. AIMS provided a transport allowance, meals and accommodation for 55 students to attend these workshops, refer to pages 21-23.



IMAGINARY Exhibition



IMAGINARY Workshop participants



For the first time, AIMS South Africa hosted one of the **National Science Week** Western Cape events from 3 to 8 August 2015. Over 1500 learners, educators and members of the public within the township and urban areas of the Overberg and City of Cape Town municipalities participated. All learners were sponsored to attend the event, with the costs of bus trips and lunch covered by the organisers.



National Science Week – an initiative of the DST - is a country-wide celebration of science involving various stakeholders and/or role players conducting science-based activities during the week. The events showcase local innovations in science and technology to make these areas of study appealing to learners, and to popularise science in the broader South African Society. The 2015 theme was the International Year of Light and Light-Based Technologies.

The AIMS programme for learners consisted of scientific experimentation and demonstrations, hands-on applied mathematics activities, a public lecture series, career guidance and role-modelling. Current students and alumni facilitated most of the activities. A special workshop for educators, facilitated by AIMSSEC, was held on 8 August 2015.



AIMS alumni, current students, and staff, who volunteered at the event, together with Ms Elna Taljaard, a representative from the DST (pictured centre left).



Public lecture series

AIMS South Africa continued its public lectures series with the following lectures taking place during the period under review:

On 30 September 2014, **Prof. Karl-Dieter Crisman, Department of Mathematics and Computer Science, Gordon College, Wenham** gave a lecture titled: "A sampler of the Mathematics of Voting and Choice." The lecture touched on a wide range of connections between mathematics and choice.

On 6 October 2014, **Dr Lindsay G Magnus, Commissioning Manager at the Square Kilometer Array (SKA)** gave a talk titled: "Radio Astronomy Technology in South Africa". This talk formed part of AIMS South Africa's celebration of National Science Week (4-10 October). Dr Magnus spoke on the relevance of radio astronomy in South Africa and its contribution towards science and technology in the country.

On 25 November 2014, **Prof. Bernd Schroers (Heriot-Watt University)** gave a talk titled: "What is a particle?" The talk was about the smallest units of matter and the different ways they are currently being modelled.

On 9 December 2014, **Dr Paul Taylor, Postdoctoral Research Fellow, Division of Biomedical Engineering, UCT** presented a talk titled: "Gaining insight into brain matters with magnetic resonance imaging".

On 21 January 2015, **Prof. Helen Nissenbaum, Information Law Institute, New York University** gave a talk titled: "What Privacy Means Online". Prof. Nissenbaum outlined challenges to privacy online, advocating that an alternative approach to protecting privacy.

Prof. George Ellis, Mathematics Department, UCT, gave a talk titled: "Causality in the real world" on 24 February 2015.

On 19 March 2015, **Prof. Graham Richards CBE, Oxford Centre for Innovation and a member of the AIMS South Africa Council** gave a talk titled: "The commercialisation of academic science." He outlined the role academic science plays in creating new industries and jobs for young people.

Prof. John Hargrove, South African Centre for Epidemiological Modelling and Analysis (SACEMA), gave a talk on 9 June 2015 titled: "New biomarkers for estimating HIV incidence in southern Africa. Which should we use? How should we use them?"

AIMS South Africa also hosted two public lectures as part of its National Science Week activities. The first was held on 4 August 2015 titled: "Computing the Universe" by **Prof. Romeel Davé, the SARChI Chair in Cosmology with Multi-wavelength Data**. "The Role of Science in Water and Sanitation within the Municipal Environment" was presented by **Dr Rembu Magoba, Head of Research and Development Section, Scientific Services, City of Cape Town** on 6 August 2015.





IDRC delegation

Joint initiatives and meetings

A high-level IDRC delegation comprising of IDRC President Jean Lebel, IDRC Acting Chairperson, the Hon. Monte Solberg, IDRC Governor Gordon Houlden, IDRC Vice-President Programs and Partnerships Stephen McGurk, and IDRC Regional Director for Sub-Saharan Africa Simon Carter visited AIMS South Africa on 6 September 2014. IDRC is one of AIMS major donors and collaborates with various institutions in the Sub-Saharan Africa

region. On their visit they were given presentations on AIMS South Africa, the expansion of the AIMS Network, and the AIMS-NEI Secretariat. They were also given an opportunity to meet some AIMS alumni and the current students. In his address to the students President Lebel wished them all the best for the coming year and commented on how energising the interaction with the students had been for him and his colleagues.



Ms Reeta Roy, and H.E. Gaston Barban, with AIMS alumni and staff.

On 26 September 2014 Prof. Green attended a one-day workshop towards the establishment of a South African Basic Sciences Network (SABSNET) hosted by the DST's sub-programme Basic Sciences and Infrastructure. The workshop was organised by Dr Daniel Adams, Chief Director for Basic Sciences and Infrastructure of the DST. A discussion document on the Basic Sciences Development and Support Framework was presented and discussed.

Prof. Barry Green and Ms Lynne Teixeira attended the 2nd NEPAD STI Flagship Coordinators Workshop hosted by the DST in Pretoria on 20 November 2014.



On 25 November, following on from a meeting at the AIMS-NEI Secretariat, Prof. Michel Carton, Executive Director of NORRAG visited AIMS South Africa to meet with Prof. Green.

On 28 November, Naser Faruqi: Director at IDRC and responsible for the AIMS portfolio, visited the AIMS-NEI Secretariat where he met staff and had a round table discussion with the some of the Research Chairs, AIMS alumni and staff. He then took the opportunity to visit AIMS South Africa where he met staff, toured the Research Centre and watched a student presentation. In his address to the students he told them, "People all around the world, including Canada, are all inspired by what you do."

Panel discussion with a Canadian delegation and AIMS alumni and researchers on 12 February 2015.

On 1 December the German Secretary of State for Education, Dr Georg Schütte, visited AIMS South Africa and interacted with staff and students. This visit was facilitated by Dr Maja Clausen, Head of Education, Research, Science and Innovation at the German Embassy in Pretoria.

On 2 December, Ms Reeta Roy, President and CEO of The MasterCard Foundation and H.E. Gaston Barban, Canadian High Commissioner to South Africa, toured AIMS South Africa after meeting AIMS-NEI Secretariat staff, AIMS researchers and alumni in the morning.

H.E. Gaston Barban was also part of a delegation including the Canadian High Commissioner to Mozambique, H.E. Shawn Barber and Director General Patricia Malikail (Africa Bureau Department of Foreign Affairs and International Trade) which visited the AIMS-NEI office and AIMS South Africa on 12 February 2015. Presentations by AIMS researchers and alumni were followed by a conversation on Canada's commitment to science education in Africa, and a panel discussion with AIMS alumni and researchers.

Prof. Barry Green attended the African Higher Education Summit in Sénégal from 10 to 12 March 2015. On behalf of AIMS, Prof. Green contributed to a plenary session titled: "Science, Technology and Innovation." The African Higher Education Summit was a three-day continental summit focused on revitalising higher education for Africa's future.

In a visit to AIMS South Africa on 18 March 2015 by a German delegation led by Mr Volker Bouffier, President of the Federal Council of Germany and Prime Minister of the state of Hessen, it was announced that five scholarships and travel grants had been awarded to AIMS South Africa for students to visit the Hessen International Summer Universities from June to August this year.

Prof. Green visited the United Kingdom from 29 March to 3 April 2015 where he met with Prof. John Towland of the Isaac Newton Institute and Prof. Grae Worster from the University of Cambridge to discuss future collaboration and joint activities. Prof. Green together with AIMS South Africa alumnus Ms Doaa El-Sakout, presently working on a PhD at Heriot-Watt University, gave a presentation at the joint British Mathematics and Applied Mathematics Conference.

On Friday 24 April 2015, a delegation from Leiden University made up of Prof. Simone Buitendijk, Vice Rector, Prof. Robert Tijssen, Centre for Science and Technology Studies at Leiden University and Visiting Professor at SU, Dr Jeroen 't Hart, Director Student and Educational Affairs and Dr Marieke te Booij, Associate Director International Relations, visited AIMS South Africa. Leiden University is part of a joint programme in the field of Algebra Geometry and Number Theory (ALGANT - <http://www.ufr-mi.u-bordeaux.fr/ALGANT/>) of which AIMS is also one of the partner institutions.

Ms Ann Weston, Director of Special Initiatives Division, and Ms Pèlagie Lefebvre, Program Management Officer with Science and Innovation (both from the IDRC), visited AIMS South Africa on 27 April.

On 11 and 12 June 2015, Prof. Green visited the University of Paris Sud for discussions related to their involvement as one of the partners of AIMS South Africa. He also attended the General Assembly of CIMPA (The International Centre for Pure and Applied Mathematics) which was held at the Institut Henri Poincare in Paris.

Dr Gill Marcus visited AIMS South Africa on 15 June 2015 where she spent time meeting and giving an inspirational talk to the students.



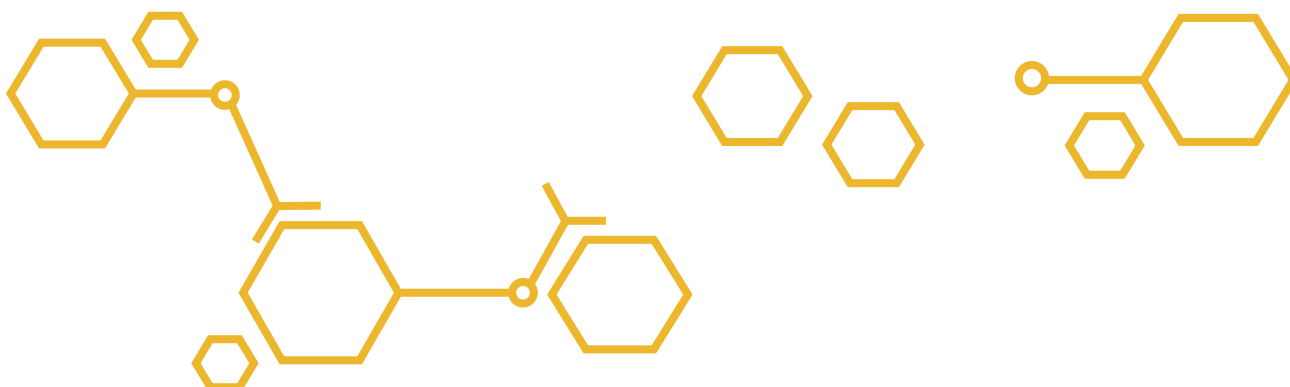
Leiden visitors, Prof. Green with Leiden University visitors: Dr 't Hart, Prof. Tijssen, Prof. Buitendijk and Dr te Booij



Profs Vincent Rivasseau, Barry Green, Jacques Bittoun (the President of the University of Paris Sud) and Stéphane Ouvry



Mr Volker Bouffier with Prof. Green



The AIMS network



AIMS | African Institute for
Mathematical Sciences
NEXT EINSTEIN INITIATIVE

AIMS Tanzania

The official academic opening of AIMS Tanzania took place on 20 October 2014. The centre was temporarily co-located with the Nelson Mandela African Institute for Science and Technology in Arusha. The following appointments were made: Prof. Richard Mark Roberts, Rector (President); Dr Wilson Mahera Charles, Deputy Rector Academic (Academic Director); and Mr Anthony Kennedy Nzuki, Deputy Rector Operations (Chief Operating Officer).

AIMS-NEI Orientation Workshop

AIMS-NEI hosted an Orientation Workshop for new network staff in Cape Town from 27 to 29 October 2014. Attendees at the workshop included new staff members from AIMS centres, the Chapters and the Secretariat. The session also included a trip to AIMS South Africa where participants met staff and students.

The Next Einstein Forum (NEF)



NEXT EINSTEIN FORUM
An AIMS initiative in partnership with the Robert Bosch Stiftung

The NEF is a platform that brings together leading thinkers in science, policy, industry and civil society in Africa to leverage science to solve global challenges. An initiative of AIMS and the Robert Bosch Stiftung, the NEF mobilizes the brightest minds to address the most pressing problems through Science, Technology, Engineering and Mathematics (STEM) as well as the social sciences. The NEF has two programmes:

- NEF Global Gatherings which are held biennially and seek to bring together an elite group of scientists, policymakers, industry leaders, civil-society representatives and entrepreneurs to share ideas and go beyond discussion to action. The first NEF Global Gathering will be held in Sénégal on 8 to 10 March 2016.
- The NEF Platform - an online hub for the best information on science, innovation and policy. The NEF Platform will share information with scientific leaders, and young innovators about the transformative potential of science, the advances being made in Africa and opportunities to get involved.

In January 2015, the NEF held the first meeting of the prestigious Scientific Programme Committee which selected the first round of NEF Fellows and provided direction for the NEF as a global scientific platform as well as the Global Gathering agenda. The committee visited AIMS South Africa on Friday 16 January where they gave a presentation to students.

UNESCO has endorsed the NEF for its vision to reinforce capacities and policies in the basic and applied sciences, particularly as they pertain to young people. The International Basic Sciences Programme (IBSP) of UNESCO – the Organisation’s main tool for triggering scientific innovation and harnessing international cooperation for capacity building in the basic sciences and science education – is therefore taking an active role in the fulfilment of the objectives of the NEF.

Gender Summit 2015

AIMS alumni and AIMS-NEI staff attended this Summit which was held in Cape Town from 28 to 30 April 2015. The theme for the Summit was “Poverty Alleviation and economic empowerment through scientific research and innovation: Better Knowledge from and for Africa”. Dr Dorothy Nyambi, Executive Vice-President, AIMS-NEI gave a presentation titled: “Increasing female participation in Science through International collaboration,” as part of the panel session, “International Collaboration in Gender and Science”. In a parallel session on Youth Engagement in STEM, alumni Dr Tendai Mugwagwa, Mr Wole Solana, and Ms Karen Craggs-Milne, Director of Gender Equality and Inclusion, AIMS-NEI, elaborated on how the AIMS educational model engages women and men in the promotion of gender equality and inclusion in science. Alumni who attend the Summit included: Ms Savannah Nuwagaba, Ms Justine Nasejje, Ms Mpeli Takane, Ms Armeline Dembo Mafuta, Ms Lindsay Blows, Ms Eva Liliane Ujeneza, Ms Sylvie Djiomba Njankou, Mr Ssekajja Samuel Buwaga, Ms Winnie Nakiyingi, and Ms Nancy Achieng Odhiambo.



AIMS alumni who attended the summit

AIMS and The MasterCard Foundation launch \$25 million partnership

On 4 June 2015, The MasterCard Foundation announced a \$25 million commitment to AIMS over the next five years. This commitment will enable 500 academically talented yet financially disadvantaged students to pursue their Master’s level education in science, technology, engineering and mathematics. It will also support the launch of a new Co-operative Master’s in Sénégal and the creation of a teacher training programme which will improve the quality of secondary-level math and science teaching in Cameroon. The partnership was announced alongside a panel “Investing in STEM for Africa’s future” with H.E. Naledi Pandor, Minister of Science and Technology, South Africa, Mr Thierry Zomahoun, President and CEO of AIMS-NEI, Prof. Phillip Clay, former Chancellor of MIT and member of The MasterCard Foundation Board of Directors and Dr Tolu Oni, a 2015/16 Next Einstein Forum Fellow, and was moderated by the BBC’s Mr Alan Kasujja, Presenter of Newsday. H.E. Gaston Barban, Canada’s High Commissioner to South Africa, gave an introductory speech.



Panelists at The MasterCard Foundation launch

The University of Chicago and AIMS announce new partnership

On Tuesday 21 July 2015, the University of Chicago and AIMS announced a new partnership to educate and train talented African students at AIMS centres across Africa. The new agreement will bring university faculty members and graduate students and scientists from Argonne National Laboratory to Africa to participate in the education and training of AIMS students. University faculty will join AIMS faculty in the development of new curriculum and experimental programme content and scholars from both the university and AIMS will work together on joint research and future academic collaborations. The partnership will also help to identify talented and qualified AIMS students to apply to graduate programmes at the university and it will support the university’s faculty members who are interested in developing joint research projects or advising on new research programmes developed at AIMS centres.



The University of Chicago and AIMS partnership announcement

Strengthening STEM on the African continent

The African Union Commission (AUC) and AIMS signed a Memorandum of Understanding (MOU) aimed at strengthening the teaching and learning of STEM on the African continent. The signing took place at the headquarters of the AUC in Addis Ababa, Ethiopia on 30 June 2015. The AUC-AIMS MOU will serve as a critical tool for the implementation of the ten-year Science, Technology and Innovation Strategy for Africa (STISA-2024), adopted by the Assembly of Heads of State and Government of the African Union in June 2014. Among the areas of collaboration are strengthening linkages between STEM education and research with Industry; and working together on the Next Einstein Forum (NEF).

Graduations

In this reporting period 212 students (including 51 women) graduated from the AIMS network, bringing the total number of graduates to 960, 31% of them women, from 42 African countries.



AIMS Sénégal graduated 52 students (including 16 women) from 21 countries on 13 June 2015



AIMS Cameroon graduated 40 students (including 8 women) from 12 African countries on 26 June 2015



AIMS Ghana graduated 40 students (including 12 women) from 16 African countries on 22 June 2015



AIMS Tanzania graduated its first cohort of 37 students (including 12 women) from 9 countries on 2 August 2015

Governance and Administration

Trust

The AIMS Trust is a registered charitable trust with tax exemption. AIMS South Africa is pleased to welcome Ms Nasima Badsha to the AIMS Trust. Ms Badsha joins Prof. Neil Turok (Chair), Prof. Fritz Hahne, Prof. Keith Moffatt, Prof. Brian O'Connell, Prof. Daya Reddy, and Prof. Ben Turok. The Trust held its annual meeting on 25 March 2015.

Council

AIMS South Africa is governed by a Council which includes representatives of each of the six partner universities. The AIMS South Africa Council meeting took place on 17 February 2015. Prof. Cheryl de la Rey (University of Pretoria), Prof. Grae Worster (University of Cambridge), Prof. Stéphane Ouvry (Université Paris-Sud), Prof. Aggrey Ambali (Director, African Science, Technology and Innovation Indicators, NEPAD), Prof. Daya Reddy (UCT), Prof. Frederik Scholtz (representing Prof. Hendrik Geyer), Prof. Neil Turok (Chair), Prof. Balazs Szendroi (University of Oxford), Dr Dorothy Nyambi (AIMS-NEI Executive Vice-President) and Prof. Barry Green (ex-officio). Prof. Graham Richards (University of Oxford) joined the meeting via Skype.

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 Zebulon Vilakazi (Wits).

Executive Team

The AIMS Executive Team assist the Director with the selection of students for the structured Master's and facilitates the relationship between AIMS and the three participating South African universities. Current members of this team are: Dr Hannes Kriel and Prof. Ingrid Rewitzky (SU); Prof. Nicola Mulder and Dr Jesse Ratzkin (UCT); and Dr Sylvain Halindintwali and Prof. Kailash Patidar (UWC).



AIMS South Africa Council Members with Dr Dorothy Nyambi, Executive Vice-President AIMS-NEI

Staff

New appointments this year included: Ms Noluvuyo Hobana as Language and Communication Teacher, Mr Jonathan Carter as Systems Architect, Ms Ntombomzi Magqazolo and Ms Caroline Chiwah as Senior Finance Officers and Ms Joan Africa-Brown, Senior Administrative Officer. Mr MacDonald Chapwanya joined AIMSSEC as a part-time IT Coordinator.

The Director of AIMS South Africa, Prof. Barry Green, is assisted by the Management Team consisting 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).

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 the visiting lecturers during the period under review: Mr Yae Olatoundji Kowowale Gaba, Ms Liesbeth-Helena Gouws, Mr Mohau Jacob Mateyisi, Dr Samuel Ross Meehan, Ms Martha Ndeyapeuomagano Kamkuemah, Mr Tovondrainy Christalin Razafindramahatsioro, Ms Zoe Elizabeth Wyatt, Mr Eddy Kimba Phongi, Mr Evans Ocansey, Mr Jeremy Lewick and Mr Georges Ferdinand Randriafanomezantsoa Radohery. Mr Iain Carson was a tutor at AIMSSEC.

AIMS South Africa



AIMSSEC



Information technology

During the year under review the AIMS South Africa IT department focussed on server virtualisation using Linux Containers, improving the AIMS Desktop software distribution and branding, the netboot and imaging infrastructure on campus, testing and packaging Sagemath for distribution, teaching, and upgrading network devices.

In addition to assisting with teaching, Mr Evans Ocansey, Mr Mohau Mateyisi, and Mr Yae Gaba provided general assistance in the IT department. Mr MacDonald Chapwanya took over IT operations at AIMSSEC. Mr Jonathan Carter joined the IT team as Systems Architect.

The 130 campus desktops are 6 years old but functioning well, with replacement planned for 2016 or 2017. Ten new desktops were purchased for researchers and 3 laptops for staff members. AIMS Desktop is installed on all students' (and many visitors') personal laptops.

Upgrading of the wireless access points has started: the lecture room, lab, and researcher buildings have been completed. Further upgrading of the network which will include switches, cabling, and a new IP address layout, is planned for 2016. In November 2014, the international internet connectivity increased from 4.8MB to 8.1MB at the same cost, and additional software mirroring was deployed on campus. The Muizenberg campus now consumes almost 5TB per month.

Our 1GB virtual server in Cape Town was migrated to two dedicated servers in Germany of 32GB RAM and 8 core CPUs each. Migrated services were updated and split into LXC containers, and work continues on modernizing monitoring and backups. These servers now run the AIMS South Africa and AIMSSEC websites, database and library sites, nameservers, sagemath buildbots and more - with plenty of room for expansion.

The DST-NRF CoE-MaSS provided funds for a video-conferencing and remote teaching system which uses TENET's Vidyo service. This has been used for remote examiners and to virtually attend CoE-MaSS seminars and administrative meetings. AIMS South Africa's link to SaNREN will be upgraded from microwave to fibre to add stability and improve latency and increase the national link from 84M to 100M.

Workshops at AIMS were supported in their deployment of science software, in particular, statistical packages and version control tools. AIMS Desktop allows visitors to continue to use the tools they learnt.

Classes in Computing and LaTeX, Ubuntu for Science, online collaboration, revision control, and software development with Python were taught to the AIMS South Africa August and January Structured Master's intakes. The IT tutors developed new supporting material for this.

Communications and new media

The AIMS South Africa logo has been brought in line with the rest of the AIMS Network. This necessitated that all marketing material be updated and the newsletter was redesigned. A second edition of the ARC Report was produced and other literature created for the various events and exhibitions that were attended.

By creating multimedia documentary material for social media, AIMS South Africa has tapped into the network of its students and alumni, which is needed to spread awareness of AIMS objectives. A continued emphasis on the student experience, has led to an expansion in online media reach with students now more willing to share the content with their contacts. For example, a short video snippet which was taken at a choir rehearsal in preparation for the graduation ceremony was viewed by more than 2 300 people.

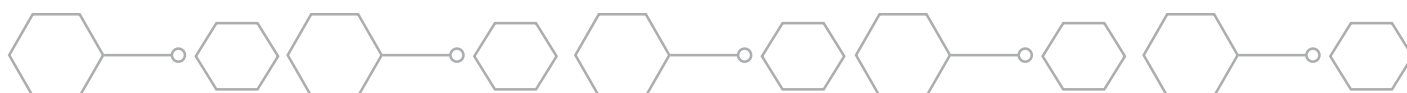
A new video "#IamAIMS" gave the AIMS South African graduates of June 2015 the opportunity to reveal some insights on the AIMS spirit (https://youtu.be/FPIRtsXj_vE). This video was screened at the graduation ceremony and pre-released on YouTube and on Facebook.

As in previous years, events are documented though photographs with special events such as the public lecture series, being recorded and uploaded to the YouTube channel (<https://www.youtube.com/user/AIMSacza>). Blog style posts have created a platform to share links to material and photographs. An example of this was the visit by Dr Gill Marcus; some of her motivating thoughts were shared and this post reached 888 people on Facebook.

AIMS has begun uploading short format videos directly onto Facebook to achieve greater reach. (YouTube demographic analysis reveals that long video formats are still problematic in many African countries.) Longer videos are broken into bites with shareable content. Full lecture recordings this year included "Radio Astronomy Technology in Africa" – a public lecture by Dr Lindsay Magnus. Sections from our existing video archive have been further promoted and distributed to new AIMS centres to be used for training.

Facilities

Work on AIMS facilities included the completion of fire prevention and management items including the installation of a new fire alarm system, fire doors and an extractor fans in the lift shaft. To facilitate the uninterrupted provision of power in the lecture hall and kitchen, a generator was installed in the basement of the main AIMS building.



Financial Reports



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AIMS SOUTH AFRICA

Financial Statement for the year ended 31 December 2014

	General		Taught Masters		Honours		PRIOR YEAR	
	Overhead	Costs	Programme	Academic	Post AIMS	Programme	Endowed	
TOTAL			Bursaries	Programme	Bursaries	Bursaries	Scholarships	
	R	R	R	R	R	R	R	
INCOME	17 852 175	2 261 679	5 712 889	6 450 000	3 220 287	-	207 321	19 005 654
DAAD	R 1 784 287				R 1 784 287			R 1 743 765
Department of Higher Education (2014/15)	R 4 800 000			R 4 800 000				R 4 594 000
Department of Science and Technology	R 2 200 000			R 1 650 000	R 550 000			R 2 250 000
Friends of AIMS	R -							R 43 500
Foreign Exchange Profit	R 398	R 398						R 1 267
Give and Gain	R 3 999		R 3 999					R 2 440
IDRC/DFID	R 3 247 002		R 2 361 002		R 886 000			R 5 640 930
Martin Rees (Endowed Scholarship)	R 85 000		R 85 000					R 85 000
National Skills Fund	R 2 149 026		R 2 149 026					R 895 428
One for Many	R -							R 1 350 926
Stephen Hawking (Endowed Scholarship)	R 85 000		R 85 000					R 85 000
Sundry Income	R 443 386	R 443 386						R 361 974
The Paul G. Allen Family Foundation (Endowed Scholarship)	R 80 000		R 80 000					R 80 000
Universite Paris Sud	R 204 929		R 204 929					R -
University of Witwatersrand	R 175 439	R 175 439						R -
Victor Rothschild Endowed Scholarship	R 713 456		R 713 456					R -
Workshops and Conferences	R 921 659	R 921 659						R 921 022
Other income: Contribution by Cost Centre: NRF	R 806 660	R 607 905					R 198 755	R 724 483
Other Income: Interest Received	R 151 935	R 112 892	R 30 477				R 8 566	R 225 919
EXPENDITURE	19 170 936	3 563 504	5 650 188	6 522 913	3 042 052	222 278	170 000	18 712 962
Accommodation (General Overhead Levy)	R -	R -1 930 324	R 1 417 599	R 414 035		R 98 690		R -
Administration Fees (General Overhead Levy)	R -	R -1 280 000	R 630 000	R 650 000				R -
Advertising: Posts	R 22 221	R 22 221						R -
Audit Fee	R 30 324			R 30 324				R 28 853
Affiliation, Registration, Membership and Subscriptions	R 133 710		R 132 750	R 960				R 282 448
Bank costs	R 3 258	R 3 258						R -
Book and periodicals	R 13 433			R 13 433				R 8 716
Building, Building Refurnish Costs, Equipment & Furn	R 168 544	R 168 544						R 231 697
Bursaries	R 3 212 052				R 3 042 052		R 170 000	R 3 043 847
Catering	R 3 176 170	R 1 283 084	R 1 390 460	R 415 038		R 87 588		R 3 698 808
Cleaning and Sanitation	R 73 621	R 73 621						R 37 346
Computer Materials	R 154 002	R 154 002						R 78 558
Consultation Fees and Services	R 491 453			R 491 453				R 542 325
Consumable Materials	R 189 419	R 189 419						R 200 862
Copying and Printing	R 71 046	R 71 046						R 44 105
Courses	R 3 490	R 3 490						R 24 400
Flowers and Gifts	R 4 430	R 4 430						R 7 356
Foreign Exchange Loss	R 1 337	R 1 337						R 1 775
General Office Expenses	R 12 834	R 12 834						R 13 720
General Vehicle Expenditure	R 244 137	R 244 137						R 251 987
Insurance	R 112 232	R 112 232						R 75 750
Internal Transfer of Funds	R 356 728	R 356 728						R -
Internet Expenses	R 180 714	R 8 262	R 47 484	R 124 968				R 517 354
Medical Expenses	R 345 677	R 29 622	R 288 628	R 27 427				R 285 068
Municipal Expenses	R 1 366 686	R 1 366 686						R 1 338 863
Postage	R 5 554	R 5 554						R 5 650
Remuneration	R 6 242 302	R 2 378 889	R 338 038	R 3 525 375				R 5 572 631
Repairs & Maintenance (Equipment)	R 28 214	R 28 214						R 5 233
Security Services	R 20 820	R 20 820						R 14 690
Stationery	R 52 345	R 52 345						R 57 248
Student Stipends	R 770 930		R 734 930			R 36 000		R 883 645
Telephone and Cell Phone Costs	R 46 047	R 46 047						R 74 515
Travel Expenses	R 1 637 208	R 137 008	R 670 299	R 829 901				R 1 385 512
NET INCOME/(SHORTFALL) OVER EXPENDITURE	-1 318 761	-1 301 825	62 700	-72 913	178 235	-222 278	37 321	292 692
ACCUMULATED FUNDS AT 1 JANUARY 2014	4 947 290	-978 746	1 055 184	3 395 577	904 471	-54 588	625 392	4 654 598
FUNDS AVAILABLE AT 31 DECEMBER 2014	3 628 529	-2 280 571	1 117 884	3 322 664	1 082 706	-276 866	662 713	4 947 290

Notes on the financial statement for AIMS South Africa for the year ended 31 December 2014

These financial statements are official documents of Stellenbosch University which provides financial administration services to AIMS South Africa.

Income

1. For the 2014 financial year, funding received via AIMS-NEI from the IDRC and DFID was lower. This funding was for support towards 47 structured Master's student bursaries for the period 1 January to 30 June 2014 (2013/2014 academic year) and for 46 structured Master's student bursaries for the period 1 July to 30 December 2014 (2014/2015 academic year) plus 17 half-bursaries for post-AIMS studies.
2. The grant received from the DHET is for the Academic Programme.
3. The funds received from the DST cover:
 - 3.1 A grant for African tutors
 - 3.2 A contribution to core funding
 - 3.3 A contribution to half-bursaries for post-AIMS studies.
4. The grant received from the National Skills Fund are for 9 South African structured Master's student bursaries.
5. The donations received from Avery Tsui Foundation, Peter Kellner and Neil Turok which have been endowed and called the Stephen Hawking and Martin Rees Endowed Scholarships respectively, provide AIMS South Africa with 2 structured Master's student bursaries per annum.
6. An endowed scholarship received from The Paul G. Allen Family Foundation provides AIMS South Africa with 1 structured Master's student bursary per annum.
7. An endowed scholarship received from the Victor Rothschild Memorial Fund, provides AIMS South Africa with 2 structured Master's student bursaries.

Expenses

1. All expenses shown for 2014 refer to actual costs directly attributable to the relevant AIMS South Africa Projects, as detailed on the financial statement.
2. Accommodation costs refer to costs for students, lecturers, and tutors residing at 6 Melrose Road and 16 Watson Street for the duration of the academic year and for visiting researchers residing at 14 Watson Street during the year under review. These costs include, municipal services, repairs and maintenance to buildings and insurance.
3. Administration costs include general administration and other general expenses of the institution, departmental administration, sponsored projects administration, student administration and services which include affiliation costs, computer materials costs, consumables, general office costs, staff costs, telephone costs etc.
4. Bursaries and stipendia, staff remuneration, accommodation and meals for students, conferences and visitors, and travel costs (students and lecturers) comprise the largest portion of the expenses.

Balance

As per the financial statement for the year ended 31 December 2014, accumulated funds include earmarked funds as listed. Any project shortfalls are taken from existing funds available.

Notes on the financial statement for the AIMS Research Centre for the year ended 31 December 2014

Income

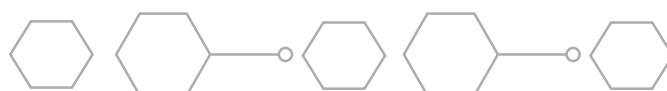
1. Funding from NRF only reflects the last tranche for the 3 year funding cycle ending 31 March 2014. Funding for the next cycle commencing 1 April 2014 was approved but income was only received in April 2015.
2. The grant received from the DST is for visiting African Researchers and Postdoctoral awards for fellows from SADC countries.
3. Funding received from The Robert Bosch Stiftung is for the first ARETÉ Junior Chair start-up grant.
4. Funding received from the IDRC is for two Joint Career Development Chairs. (These chairs are shared with AIMS Ghana).

Expenditure

1. Accommodation and catering costs refer to costs for visiting researchers, postdoctoral fellows, doctoral and Master's students residing at 14 and 16 Watson Street, Muizenberg, during the year under review.
2. Bursary costs include bursaries paid to postdoctoral fellows, doctoral and Master's students.
3. Medical expenses refer to medical costs for visiting researchers, doctoral and Master's students for the duration of their stay at AIMS.
4. Remuneration costs and consultation fees include salaries for research chairs, resident and senior researchers, Administrative Officers, part costs for Administrative and Research Manager, and honorarium stipends to visiting researchers.

Other – Joint SARChi Chairs

AIMS South Africa currently co-hosts two Joint SARChi Chairs, one with Stellenbosch University and the other with the University of the Western Cape. All chair costs are managed by the respective universities.





AIMS RESEARCH CENTRE

Financial Statement for the year ended 31 December 2014

	<u>TOTAL</u>	<u>NRF</u>	<u>DST</u>	<u>IDRC (Joint Development Chairs)</u>	<u>The Robert Bosch Stiftung (ARETE Chair)</u>	<u>PRIOR YEAR 31/12/2013</u>
	R	R	R	R	R	R
INCOME	4 541 807	2 878 612	800 000	481 680	381 515	8 428 988
NRF	2 800 000	2 800 000	-	-	-	7 800 000
DST	800 000	-	800 000	-	-	550 000
IDRC	481 680	-	-	481 680	-	-
The Robert Bosch Stiftung	381 515	-	-	-	381 515	-
Interest received	78 612	78 612	-	-	-	77 209
Foreign Exchange Profit	-	-	-	-	-	1 779
EXPENDITURE	8 308 820	6 986 543	397 363	476 860	448 054	6 843 074
Accommodation and Catering	257 394	14 404	229 990	4 000	9 000	164 137
Administrative Fees	194 700	167 700	-	10 500	16 500	152 460
Affiliation and Registration Expenses	22 384	22 384	-	-	-	18 240
Books	1 529	1 529	-	-	-	-
Bursaries (Postdocs, PhD & MSc)	1 314 626	1 196 266	118 360	-	-	1 165 308
Consultation Fees	1 079 971	1 079 971	-	-	-	939 474
Consumables	60 429	58 469	-	-	1 960	76 587
Foreign Exchange Loss	185	185	-	-	-	2 343
Furniture & equipment	-	-	-	-	-	15 734
General Office Expenses	83 497	83 497	-	-	-	43 204
Internet	115 752	111 752	-	2 500	1 500	128 414
Medical Expenses	55 293	44 393	2 524	-	8 376	71 072
Printing and Stationery	98 531	97 847	-	684	-	139 952
Remuneration: Research Staff	3 115 507	2 521 463	-	289 758	304 286	1 893 220
Remuneration: Support Staff	821 959	687 885	-	76 574	57 500	630 551
Rent of premises	227 140	186 000	-	22 600	18 540	152 460
Special Events and conferences	-	-	-	-	-	466 637
Travel Expenses	859 923	712 798	46 489	70 244	30 392	783 280
NET INCOME/(SHORTFALL) OVER EXPENDITURE	-3 767 013	-4 107 931	402 637	4 820	-66 539	1 585 915
ACCUMULATED FUNDS AT 1 JANUARY 2014	3 269 010	2 903 805	365 205	-	-	1 683 095
FUNDS AVAILABLE AT 31 DECEMBER 2014	-498 003	-1 204 126	767 842	4 820	-66 539	3 269 010

SIGNED.....*F. Majiet*.....

F Majiet
Director: Financial Services



AIMSSEC

Financial Statement for the year ended 31 December 2014

	<u>SU Cost centre</u>				<u>PRIOR YEAR</u>
	<u>TOTAL</u>	<u>R268</u>	<u>NSF</u>	<u>EC FASMED</u>	<u>31/12/2013</u>
INCOME					
Donations	R 6 933 791	R 3 126 705	R 3 154 130	R 652 956	R 4 087 549
Comhousing Association	R 58 500	R 58 500	R -	R -	R 19 500
Datatec Education and Technology Trust	R 306 214	R 306 214	R -	R -	R 317 803
False Bay College	R -	R -	R -	R -	R 32 500
Give and Gain	R 16 031	R 16 031	R -	R -	R 43 764
Hamdan Prize (UAE)	R 360 722	R 360 722	R -	R -	R 422 537
Kelelo Consulting	R 50 000	R 50 000	R -	R -	R 5 000
Mondi Limited	R -	R -	R -	R -	R 97 500
UAE	R 26 778	R 26 778	R -	R -	R -
Old Mutual Foundation	R 300 000	R 300 000	R -	R -	R 264 543
Rand Merchant Bank Fund	R 500 000	R 500 000	R -	R -	R 500 000
St John's College, Cambridge	R -	R -	R -	R -	R 13 551
The Grove Primary School	R 20 000	R 20 000	R -	R -	R -
Victor Rothschild	R 356 728	R 356 728	R -	R -	R -
Winston Charitable Foundation	R -	R -	R -	R -	R 106 611
Zenex Foundation	R -	R -	R -	R -	R 60 200
National Skills Fund	R 3 154 130	R -	R 3 154 130	R -	R -
EC FASMED	R 652 956	R -	R -	R 652 956	R -
Department of Education: Eastern Cape	R 1 027 500	R 1 027 500	R -	R -	R 2 138 920
Department of Education: Mitchells Plain	R 70 000	R 70 000	R -	R -	R -
Foreign Exchange Profit	R 183	R 183	R -	R -	R 62
Interest Received	R 34 049	R 34 049	R -	R -	R 65 058
EXPENDITURE	R 5 730 849	R 1 918 623	R 3 167 271	R 644 955	R 4 691 547
Accommodation and Catering	R 559 662	R 434 228	R 125 434	R -	R 490 571
Administration Costs	R 119 346	R -	R 119 346	R -	R -
Advertising	R 31 090	R 31 090	R -	R -	R 33 950
Affiliation and Registration Fees	R 10 695	R 1 300	R 9 395	R -	R 3 400
Books	R 5 849	R -	R 5 849	R -	R -
Bursaries	R 493 050	R 493 050	R -	R -	R 1 346 295
Computer Materials	R 78 423	R 24 630	R -	R 53 793	R 36 137
Consultation Fees and Services	R 17 728	R 17 728	R -	R -	R 9 832
Consumable Materials	R 9 171	R 9 171	R -	R -	R 9 714
Courses	R 7 000	R 7 000	R -	R -	R 2 166
Smaller Furniture and Equipment	R 152 690	R 45 832	R 58 852	R 48 006	R 52 408
General Office Expenses (incl. stationery packs)	R 45 012	R 18 601	R 26 411	R -	R 55 972
IT Services (Telematic and course IT)	R 103 959	R 164	R 103 019	R 776	R 165 117
Medical Expenses	R 5 158	R 5 158	R -	R -	R 9 087
Printing and Stationery	R 117 975	R 8 023	R 109 447	R 505	R -
Postage	R 1 595	R 524	R 1 071	R -	R 7 780
Remuneration	R 2 537 000	R 2 612	R 2 118 958	R 415 430	R 1 562 391
Rental of Equipment	R 49 178	R -	R 49 178	R -	R -
Rent of Premises	R 230 802	R -	R 230 802	R -	R -
Services	R 70 138	R 70 138	R -	R -	R 59 182
Travel Expenses	R 1 085 328	R 749 374	R 209 509	R 126 445	R 847 545
NET INCOME/(SHORTFALL) OVER EXPENDITURE	R 1 202 942	R 1 208 082	R -13 141	R 8 001	R -603 998
ACCUMULATED FUNDS AT 1 JANUARY 2014	R 1 124 518	R 1 108 596	R 15 922	R -	R 1 728 516
FUNDS AVAILABLE AT 31 DECEMBER 2014	R 2 327 460	R 2 316 678	R 2 781	R 8 001	R 1 124 518

Supporters for the period under review

AIMS South Africa donors

AIMS Endowed Scholarships contributors

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

DAAD - German Academic Exchange Service

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

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

Government of South Africa,

- DHET and the National Skills Fund
- DST
- NRF

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

Google Inc.

The MasterCard Foundation Scholars Program

ForExcellence Program (formerly the One for Many Scholarship Programme)

- Research in Motion
- Simon Fraser University
- University of British Columbia
- University of Guelph
- University of Ottawa
- University of Paris Sud
- University of Victoria
- University of Waterloo
- University of Chicago

Perimeter Institute for Theoretical Physics

Robert Bosch Stiftung

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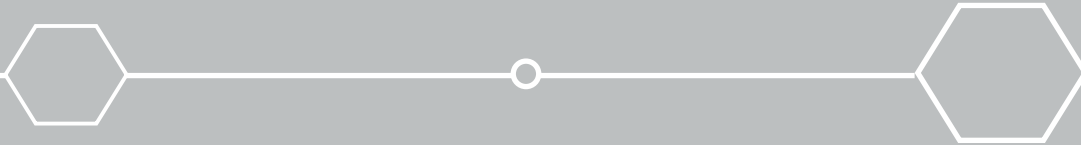
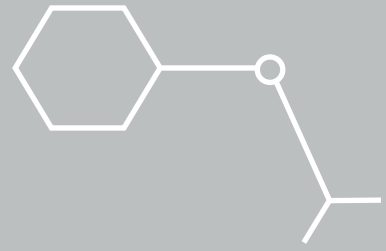
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