

ANNUAL REPORT | 2011/2012



About us

This is the annual report of the African Institute for Mathematical Sciences for the period 1 August 2011 to 31 July 2012. It includes an overview of all activities at AIMS and its associated projects, as well as the financial statements for the 2011 calendar year.

AIMS is a partnership project between the following local and international universities:

University of Cape Town
Stellenbosch University
University of the Western Cape
University of Cambridge
University of Oxford
Université de Paris Sud

Since the Institute opened in 2003, 412 students have graduated (including 125 women), from 33 African countries.

The goals of AIMS are:

- To promote mathematics and science in Africa;
- To recruit and train talented students and teachers;
- To build capacity for African initiatives in education, research and technology.

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Foreword by the Director

It is a pleasure to report on the activities of AIMS-South Africa during the 2011/2012 academic year. Following a very positive international review and report in 2011, the three-year grants by the Department of Science and Technology and the South African National Research Foundation were renewed for a further term. This confirmation of support for AIMS along with continued funding for our core programmes from the Department of Higher Education and Training, marked the start of the 2011/2012 year, and resulted in the implementation of a number of plans involving our Academic Programme, our Research Centre, the Schools Enrichment Centre and our outreach activities.

Two new academic programmes were launched in January 2012, the first being a second stream of the core Postgraduate Diploma and the second, a joint Mathematical Finance Honours programme with the Universities of Cape Town and Stellenbosch. Since opening in 2003, AIMS has been challenged to attract South African students to enrol for the Postgraduate Diploma, which runs from August to June of the following year. This academic timetable is followed by most of Africa and countries in the northern hemisphere, but is not suitable for South African students. A decision was taken to start a second stream of the Postgraduate Diploma running from January to November and overlapping with the activities of the other stream as far as possible. Nine students were accepted in this programme, bringing the total Postgraduate Diploma group to 61. Six South African students registered for the joint Mathematical Finance Honours programme.

The academic programme has been strengthened by the appointment of Professor Jeff Sanders in February 2012. He joins us from the International Institute for Software Technology, United Nations University, Macao. Prior to that, he was a lecturer at Oxford University. We are delighted to have attracted him to AIMS as Academic Director. He has taught at AIMS several times, has supervised many AIMS students and, having been the Director of Graduate Students for the Oxford University Computing Laboratory, adds strength and experience to the AIMS Academic and Research programme.

The AIMS Research Centre has grown substantially, with over 350 scientists visiting for workshops, conference and research activities during the 2011/2012 year. The Cosmology and Astrophysics Group, led by Professor Bruce Bassett, has been most successful in generating a fine research environment, attracting students, postdoctoral fellows and visitors, and hosting exciting workshop and conference activities which are mentioned in the report. Dr Sehun Chun joined our Research Centre in January and has strengthened our Mathematical and Physical Biosciences area. His interests are in Mathematical Cardiology with scientific computing and numerical analysis.

One of our most significant achievements to date was the award of two joint Research Chairs by the Department of Science and Technology. The first is in the Mathematical and Physical Biosciences with the University of Stellenbosch, and the second, is in Observational Cosmology, awarded jointly with the South African Astronomical Observatory and the University of the Western Cape. We are thrilled to be partners in the scientific growth of these areas, including becoming involved in the Square Kilometre Array project.

AIMS is a centre for education, research and outreach in the mathematical sciences, and our Schools Enrichment Centre (AIMSSEC) plays an important role in offering professional development courses for teachers. Established partnerships with the University of Fort Hare and Stellenbosch University have enabled AIMSSEC to offer a number of residential and distance learning courses which have contributed to the development of mathematics teachers at all levels in rural and urban areas in the Western and Eastern Cape.



This year AIMSSEC was honoured together with the Rato Bangala Foundation (Nepal) and the Banco del Libro (Venezuela) in being awarded the UNESCO-Hamdan Bin Rashid Al-Maktoum Prize for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers. The ceremony took place in Dubai on 24 April 2012, and is an achievement we are proud of.

The achievements of AIMS-South Africa are underpinned by a number of very dedicated people. AIMS staff members give far more than one would normally expect in running, maintaining and caring for the Institute, ensuring it is a 24/7 learning environment for talented young Africans. Our Executive Team, Council, Advisory Board and Trust bring experience, decision-making, advice and good governance to our Centre. This year it is a privilege to thank Professor Jan van Bever Donker, the former Dean of Science from UWC, and Professor Keith Moffatt from Cambridge University who have retired from our Council. Over the years they have served AIMS with distinction, and it is a pleasure to acknowledge and thank them for this. Professor Van Bever Donker retires from our Trust too, and we are pleased to announce that this position will be filled by Professor Brian O'Connell, Vice-Chancellor at UWC. Professor Ramesh Bharuthram, Deputy Vice-Chancellor Academic at UWC and Professor Grae Worster from Cambridge University, who is a member of the Associate Faculty of AIMS, will be joining the Council.

A handwritten signature in black ink, which appears to read 'Pillay'.

Director

Academic Programmes

Postgraduate Diploma in Mathematical Sciences

The flagship programme at AIMS is the Postgraduate Diploma in Mathematical Sciences (PGD), which continues to attract hundreds of applications from all over Africa each year. 52 students (including 18 women) from 21 countries were selected for the programme during the 2011 academic year, and all 52 successfully completed the Diploma in June 2012. (For a list of students see table on page 6.)

The Diploma is accredited by the three local participating universities, and students are divided between these universities for purposes of registration. The delivery of the programme is funded by the South African Department of Higher Education and Training.

The Diploma consists of three phases. The skills courses focus on upgrading the students' skills in problem-solving and computational skills while providing an introduction to computer programming and scientific writing in English; the review courses introduce the students to cutting-edge topics in the mathematical sciences; and in the third and final phase, each student writes a research essay on a topic proposed by local academics.

Students are all required to present their research to a panel of external examiners which this year included: Professor Fritz Hahne, Professor Mamadou Sango, Professor Christopher Gilmour, Professor Tertius de Wet, Professor David Sherwell, and Professor Kailash Patidar.



Skills Courses 2011-2012

| Period | Lecturers | Course Title |
|------------------|---|--|
| 22 Aug – 28 Oct | Jan Groenewald, AIMS | Introduction to AIMS computing facilities, LaTeX |
| 22 Aug – 28 Oct | Frances Aron, AIMS | English Essentials, Communications Skills |
| 29 Aug – 16 Sep | Alan Beardon, Cambridge, Stephan Wagner, Stellenbosch | Mathematical Problem Solving |
| 29 Aug – 16 Sept | Juan Rodrigues-Aquilar, Spanish National Research Council | Software Development using Python and SciPy |
| 19 Sep – 7 Oct | Jamshid Moori, North West | Finite Groups and Combinatorial Structures |
| 19 Sep – 7 Oct | Gaston Mazandu, AIMS | Numerical Computing using Python and SAGE |
| 10 – 28 Oct | David Aschman, Roger Fearick, Cape Town | Physical Problem Solving |
| 10 – 28 Oct | Dirk Laurie, Stellenbosch | Experimental Mathematics with SAGE |

Review Courses 2011-2012

| Period | Lecturers | Course Title |
|-----------------|---|---|
| 7 - 25 Nov | Florian Breuer, Stephan Wagner, Stellenbosch Robert de Mello Koch, Witwatersrand Bernd Schroers, Heriot-Watt | Topics in Complex Analysis Electromagnetism Quantum Computing |
| 28 Nov - 16 Dec | Gabriel Lord, Heriot-Watt, Natacha Lord, Strathclyde Robert Mann, Waterloo Henry Mwambi, KwaZulu-Natal | Numerical Analysis An Introduction to Quantum Mechanics/Particle Physics Statistics |
| 2 - 20 Jan | Rob Beezer, Puget Sound Patrick Dorey, Durham Tadashi Tokeida, Cambridge | Topics in Algebraic Graph Theory Solitons Topology and Geometry |
| 23 Jan - 10 Feb | Neville Fowkes, Western Australia David Perkinson, Reed College Stephane Ouvry, Paris Sud XI | Industrial Modelling/Applicable Techniques Sandpiles Statistical Mechanics |
| 20 Feb - 9 Mar | Bharat Biswal, Paul Taylor, New Jersey Gerhard Pfister, Kaiserslautern Simukai Utete, Jonathan Classens, Natasha Govender, CSIR | Biomedical Signal Processing Computational Algebra and Applications An Introduction to Field Robotics |
| 12 - 30 Mar | Bruce Bassett, AIMS, Roberto Trotta, Imperial College Martin Bucher, Cambridge, Kavilan Moodley, KwaZulu-Natal Moshe Jarden, Tel Aviv | Probability Theory and Statistical Inference The Mathematics of Radio-Astronomy Topics in Number Theory |



Professor Robert de Mello Koch, visiting lecturer

Robert de Mello Koch is an AIMS Associate Faculty member and has been giving courses at AIMS in Electromagnetism and Special Relativity since 2004. He holds the Chair of Fundamental Physics and String Theory at the University of the Witwatersrand, where he has been a faculty member since 1999. After completing a Bachelor of Science in engineering, he switched to Physics, obtaining a PhD from the University of the Witwatersrand and completing a Postdoctoral Fellowship at Brown University in 1998-1999.

Professor de Mello Koch has published widely on the large N limit of quantum field theories, string theory and gauge theory / gravity dualities, which are providing profound insights into the problem of uniting Einstein's theory of General Relativity with Quantum Mechanics to produce a single theory of Quantum Gravity.

"Teaching at AIMS reminds me of why I started teaching in the first place - for the joy of sharing what you know and watching the delight it gives your students to grapple with and then master a new concept. The interactions with students and other lecturers are truly unique. It is entirely accurate to say that teaching Electromagnetism at AIMS allows me to "recharge my batteries!" AIMS has come a long way - from an exciting ambitious idea to a concrete functioning Institute. It has been immensely satisfying to watch AIMS' progress and to have the chance to collaborate on this project."



Professor Bernd Schroers, visiting lecturer

Professor Bernd Schroers is from the Department of Mathematics at Heriot-Watt University. His research area is mathematical physics, particularly quantum gravity in three dimensions and soliton models for particles. He is a founding member of the Edinburgh Mathematical Physics Group (EMPG) and also the principal organiser of the North British Mathematical Physics Seminars (NBMPS).

Professor Schroers has lectured at AIMS-South Africa since 2005, and ran a skills course in 2011 at AIMS-Sénégal. "I find the whole AIMS initiative hugely inspiring, and continue to enjoy teaching at AIMS. AIMS brings together the best students from across Africa with outstanding researchers and lecturers from around the world. The combination leads to a very exciting learning environment. It is now well-known internationally that AIMS offers excellent training in mathematical sciences but it is perhaps less well-known that it also has become a real laboratory for innovative teaching. Apart from the academic side it is also culturally a very interesting place to visit. Where else would you be able to share daily meals, discussions and even mountain hikes with people from over 20 different African countries?"

Professor Schroers also participated in several steering committee meetings leading to the establishment of AIMS-Ghana and he will be one of the first visiting lecturers there.



Dr Simukai Utete, visiting lecturer

Dr Simukai Utete is the Research Leader of the Mobile Intelligent Autonomous Systems Group (MIAS) at the Council for Scientific and Industrial Research (CSIR), South Africa.

In 2012, Dr Utete, together with MIAS group members, Natasha Govender and Jonathan Claassens, lectured a course on Robotics as part of the Postgraduate Diploma programme, and Dr Utete supervised the work of an AIMS postgraduate diploma student during the year. Dr Utete also gave a public lecture as part of the AIMS series titled: "Real-world" field robotics.

"Together with my colleagues Natasha Govender and Jonathan Claassens, I presented a course on robotics at AIMS. I hope that by the end of the course the students had a sense of some of the mathematics that underpins robotics. As course lecturers, all of us found it very rewarding to work with the lively, interested and committed students we met at AIMS, and to contribute a small part to the AIMS project of promoting mathematics education."

Dr Utete holds a DPhil in Engineering Science (Robotics) from the University of Oxford, as well as an MSc in Computation from the Computing Laboratory, Faculty of Mathematics at Oxford.



Agyingi Collins Amburo, PGD student

Agyingi Collins Amburo. was born in Limbe, Cameroon, to a family of four. In 2006 he graduated from the University of Buea, Cameroon, with BSc (Hons) in Mathematics. In 2009, he won a World Bank scholarship to study for an MSc in Mathematics at the African University of Science and Technology, Abuja, Nigeria, and graduated in December 2010. In 2012 he graduated from AIMS with distinction and was awarded the AIMS Victor Rothschild Scholarship. He is currently at the University of Cape Town doing a PhD in Pure Mathematics (Topology).

"The research environment at AIMS and the exposure to world class researchers were some of the factors that motivated me to come to AIMS. During my time at AIMS, I hoped to learn various techniques of doing research. I was also interested in diversifying my knowledge. In this regard, I had to choose courses in Applied Mathematics, Physics and Computer Science. I also hoped to learn to work as a group which is what AIMS encourages. During my stay at AIMS, all the above were achieved. Moreover AIMS helped me to realize my dreams by giving me half funding to study towards a PhD degree at the University of Cape Town. I would like to encourage students all over Africa with talents to consider coming to AIMS. The experience is enriching, and you learn a great deal. You also learn how people perceive things in other parts of the Africa and the world since the background at AIMS is so diversified."



Morenikeji Deborah Akinlotan, PGD student

Morenikeji Deborah Akinlotan, from Nigeria, completed the AIMS PGD in June 2012. She was also awarded the Paul G. Allen Family Foundation Scholarship. She is currently pursuing her Master's degree in Biomathematics at Stellenbosch University.

"AIMS gave me an almost entire paradigm shift as to what science actually is. I felt making good grades was it, until I started learning how to actually think and write like a scientist (mathematician), starting with the Mathematical Problem Solving course. I was exposed to a lot of scientific knowledge such as writing scientific materials with LaTeX and scientific-programming languages, which I ordinarily might not have even in 10 years to come if I had remained in my country. I always thought that it was only the male folks that can thrive with computational mathematics, but I have now become a contradiction to that 'theory'. In addition, I made a good network of renowned academics and scholars for long-term academic purposes. Also, learning under several international and highly devoted academics, tutors and other brilliant students from several African countries added great spice to the programme. This has greatly sharpened my image of what a real academic should be. I can't help but spread the 'gospel of AIMS' to my lecturers and junior colleagues. I keep telling them, as a colleague once said, that "...an admission to AIMS is a farewell to years of ignorance".

"The current expansion of AIMS is another great achievement that gladdens my heart, as more of my country-men are now enrolled for the PGD. It is a rare privilege that AIMS is giving us African students, especially females who are often seen as a minority. I honestly believe, beyond any reasonable doubt, that AIMS can someday produce the next Einstein."



Postgraduate Diploma in Mathematical Sciences (January 2012 intake)

To make the Postgraduate Diploma programme more attractive to South African students following the usual academic calendar, a second stream was opened in January 2012. Students are expected to graduate from this programme in December.

| Student | Gender | Previous Institution |
|--------------------------|--------|----------------------|
| Hellen Thabo Mogashoa | F | Limpopo |
| Isia Tebogo Dintoe | M | Witwatersrand |
| Lesiba Charles Galane | M | Limpopo |
| Musa Kurhula Baloyi | M | Limpopo |
| Nakedi Wilson Leboho | M | Limpopo |
| Phumza Thafeni | F | Western Cape |
| Raabia Walljee | F | Western Cape |
| Valrie Mabu Serumula | F | Limpopo |
| Vuyokazi Patience Ndlebe | F | Western Cape |



Skills and Review Courses completed in the reporting period

| Dates | Lecturer | Course | Skills/Review |
|-----------------|--|---|---------------|
| 3 - 20 Jan | Alan Beardon, Cambridge, Stephan Wagner, Stellenbosch | Mathematical Problem Solving | Skills |
| | Tadashi Tokieda, Cambridge | Topology and Geometry | Skills |
| 23 Jan – 10 Feb | Gaston Mazandu, Cape Town | Numerical Computing using Python and Sage | Skills |
| | Neville Fowkes, Western Australia | Industrial Modelling/ Applicable Techniques | Review |
| | Wilson Lamb, Strathclyde | Analytical Techniques in Mathematical Biology | Review |
| | Stephane Ouvry, Paris Sud XI | Statistical Mechanics | Review |
| | David Perkinson, Reed College | Sandpiles | Review |
| 20 Feb – 9 Mar | Bharat Biswal, Paul Taylor, New Jersey | Biomedical Signal Processing | Review |
| | Gerhard Pfister, Kaiserslautern | Computer Algebra with Applications | Review |
| | Simukai Utete, CSIR | An Introduction to Field Robotics | Review |
| 12 - 30 Mar | Bruce Bassett, SAAO/AIMS, Roberto Trotta, Imperial College | Probability Theory and Statistical Inference | Review |
| | Moshe Jarden, Tel Aviv | Topics in Number Theory | Review |
| | Dan Jacobson, Stellenbosch | Computational Biology | Review |
| 10 - 27 Apr | Jacek Banasiak, KwaZulu-Natal | Structured Models of Population Dynamics | Review |
| | Jeff Sanders, AIMS | Designing Algorithms | Review |
| 30 Apr – 18 May | Jeff Orchard, Waterloo | Modelling Neural Systems | Review |
| | Raouf Ghomrasni, AIMS | Introduction to Financial Mathematics | Review |
| 21 May – 8 Jun | Jullief Pulliam, Fogarty | Introduction to Biomedical Sciences | Review |
| | Johan de Villiers, Stellenbosch | Mathematics of Approximation | Review |
| 11 – 22 June | Gaston Mazandu, Cape Town | Experimental Mathematics | Skills |

Essay Phase

During the third semester, students write an essay on a topic which they select from a list proposed by local academics. This essay phase provides an introduction to the research skills necessary for specialisation, and to topics which could become the focus of further studies.

Twelve students were supervised by researchers based in the AIMS Research Centre. A full list of the essay topics is included below.

| Name | Gender | Origin | Essay Topic | Supervisors | University Affiliation |
|---|--------|------------|---|----------------------------------|---------------------------------|
| Abdul-Karim Iddrisu | M | Ghana | Bayesian Modelling with Gaussian Process | R Guo | Cape Town |
| Ahmed Mohamed Ali Omer Hassan | M | Sudan | Challenges and Solutions in Cryptography | J Sanders | AIMS |
| Alice Ikuzwe | F | Rwanda | Interior Illumination System Design Using Solar Lighting | B Sebitosi | Stellenbosch |
| Alinune Musopole | M | Malawi | Longitudinal Data Modelling | H G Mwambi & T N O Achia | KwaZulu-Natal |
| Alma Prell Bimbabou Maboulou | M | R.Congo | Convex Analysis in Financial Mathematics | R Ghomrasi | AIMS |
| Aminat Oyiza Suleiman | F | Nigeria | Electron Transport in Quantum Dots | M Blumenthal | Cape Town |
| Armeline Dembo Mafuta | F | DRC | Spatial placement methods for robots and sensors | S Utefe & J Sanders | CSIR/AIMS |
| Assionvi Hove Kouevi | M | Togo | Numerical Solution of Some Boundary Layer Equations | P Sibanda | KwaZulu-Natal |
| Aurelie Mpoyi Mbula | F | DRC | Traffic Scheduling to provide Quality of Service in Wireless Mesh Networks | I M Venter & C Rey-Moreno | Western Cape |
| Babiker Yousif Babiker Ali | M | Sudan | Some Ergodic Aspects of Dynamical System | M Sango | Pretoria |
| Balembo Tresor Matindi | M | DRC | Investigation of Dielectric Materials using THz Time Domain Spectroscopy (TDS) Technique | E G Rohwer & P Neethling | Stellenbosch |
| Chama Bensmail | F | Morocco | Efficient algorithms for selecting the best proxy ancestry in recently admixed populations: Application to infer the local ancestry in the Maghreb and South African Coloured populations | N Mulder & E Chimusa Rugamika | Cape Town/AIMS |
| Chilufya Mwewa | F | Zambia | Statistical Analysis of ATLAS Data in Search of the Standard Model Higgs Boson in the Diphoton Decay Channel | A Hamilton | Cape Town |
| Chimere Stanley Anabanti | M | Nigeria | Simple Linear Groups | J Moori | North West |
| Cocou Davis Ruben Aza-Gnandji | M | Benin | Modelling of the behaviour of a single stone column under specific loading conditions | D Kalumba | Cape Town |
| Collins Amburo Agyingi | M | Cameroon | Representation Theory of Finite Groups | J Moori | North West |
| Doaa Mostafa Ali Elsakout | F | Egypt | Computational algebra and enzyme kinetics | L Uys & B Green | AIMS |
| Emmanuel Amikiya | M | Ghana | Natural Convection in Porous Media | M Banda | Stellenbosch |
| Ermias Abebe Kassaye | M | Ethiopia | Continuum Observation of Potential Calibrators Using KAT-7 | N Oozeer & B Bassett | SKA/AIMS |
| Farainaina Rasolofson | F | Madagascar | Spectral/hp methods to solve reaction-diffusion equations with application to vascular transport of plant | S Chun & L Uys | AIMS |
| Georges Ferdinand Randriafanomezantsoa Radohery | M | Madagascar | Large Mathieu Groups | J Moori | North West |
| Guy Moise Dongho Nguimdo | M | Cameroon | Functional Derivative Discontinuity in Ensemble Density Functional Theory | D Joubert | Witwatersrand |
| Hassana Al-Hassan | F | Ghana | A Simple but Non-Standard Model for Option Pricing | R Becker | AIMS |
| Hola Kwame Adrakey | M | Togo | Linear Regression with Error in Measurement and Bayesian Approach | R Trotta & B Bassett | University College London/ AIMS |
| Huzifa Zain Alabdeen Abdarahman Hissen | M | Sudan | Terahertz (THz) Spectral Investigation | E G Rohwer | Stellenbosch |
| Ihechukwu Chinyere | M | Nigeria | Computer simulation of the modular fibration | B Bartlett | Stellenbosch |
| Isaac Mwangi Wangari | M | Kenya | Differential Susceptibility in Co-infection Models | M Kgosimore & F Nyabadza | Botswana/Stellenbosch |
| Joseph Mailizi | M | Uganda | Efficacy Analysis of Two Basic Control Measures in Malaria Prevention | R Ouitki | Stellenbosch |
| Justine Naseje | F | Uganda | Statistical Methods Used in Survival Analysis | H G Mwambi | KwaZulu-Natal |
| Kondwani John Kampenya | M | Malawi | An Introduction to the Theory and Practice of Forecasting Market Risk with Implementation | R Ghomrasi | AIMS |
| Lindifa Mbongeleni Ngwenya | M | Swaziland | Statistical analysis of ATLAS data in the search for the Higgs Boson in the Diphoton Decay Channel | A Hamilton | Cape Town |
| Mabintshi Tanya Shoma | F | DRC | Network Selection for Multiple Calls using Multi Criteria Group Decision Making | Olabisi Emmanuel Falowo | Cape Town |
| Mahmoud Yousif Ali Wahba Hashim | M | Egypt | Consistency Relations and Non-Gaussianities in Inflation | N Sivanandam | AIMS |
| Mamana Mbiyavanga | M | Angola | Subgraph searching for genome-wide association in protein-protein interactions | N Mulder & E Chimusa Rugamika | Cape Town/ AIMS |
| Marie Brilland Yann Ranorovelonalohotsy | M | Madagascar | Meromorphic functions and vector fields | F Breuer | Stellenbosch |
| Marvellous Onuma Kalu | F | Nigeria | Metrology: Redefining the Standards of Electrical Measurement | M Blumenthal | Cape Town |
| Mekonnen Yimam Legesse | M | Ethiopia | Dirichlet's Theorem on Arithmetic Progressions | S Wagner | Stellenbosch |
| Morenikeji Deborah Akinlotan | F | Nigeria | Understanding the Genomic Structure of African Populations | R S Ramesar & E Chimusa Rugamika | Cape Town/ AIMS |
| Mostafa El Metwally Ramadan Ahmed El Demery | M | Egypt | Non-Markovian Dynamics of Quantum Brownian Motion | F Petruccione | KwaZulu-Natal |
| Mpeli Alice Takane | F | Lesotho | Interaction of Radiation with Matter | S Allie & R Nchodu | Cape Town |
| Nancy Achieng Odihambo | F | Kenya | Linkage and Association Studies in Statistical Genetics | H G Mwambi & T N O Achia | KwaZulu-Natal |
| Nantsoina Cynthia Ramiharimanana | F | Madagascar | Inverse Galois Problem | B Green | AIMS |
| Nelson Christopher Dzipire | M | Malawi | Subtrees of Trees | S Wagner | Stellenbosch |
| Ninon Gildas Ondzibou | M | R.Congo | Propagation and Compression of an Ultrashort Pulse | E G Rohwer & P Neethling | Stellenbosch |
| Nirina Maurice Hasina Tahiriidimbisoa | M | Madagascar | Spacetime Curvature and its Singularity | B Bassett | AIMS/SAAO |
| Nouridine Slewe | M | Cameroon | The Tikhonov Theorem In Multiscale Modelling: An Application To The SIRS Epidemic Model | J Banasiak | KwaZulu-Natal |
| Omran Ahmed Mohamed Saïh | M | Sudan | Probabilistic Model Checking of a Web Server | J Sanders | AIMS |
| Samah Mohamed Osman Hassan Taha | F | Sudan | Investigating Minimum Cut Algorithms | J Sanders | AIMS |
| Shaimaa Mohamed Abdelmonem Abdelhatef | F | Egypt | Hausdorff Dimension of Cantor Sets | A Beardon | Cambridge |
| Testalem Abate Tegegn | M | Ethiopia | Riemann's Zeta function | F Breuer | Stellenbosch |
| Yasser Reda Ahmed Abd El Hamid El Mahalawy | M | Egypt | Homogeneous and Isotropic Universe Models | B Bassett | AIMS/SAAO |
| Zakaria Annour Mahamat | M | Chad | Prime generating polynomials | B Green | AIMS |

Graduation

All 52 students graduated with the Postgraduate Diploma in Mathematical Sciences at the AIMS graduation ceremony on 20 June 2012. The ceremony was officiated by Professor Julian Smith, Vice Rector Community Interaction and Personnel, Stellenbosch University, Professor Michael Davies-Coleman, Dean of Natural Sciences, University of the Western Cape, and Dr Max Price, Vice-Chancellor, University of Cape Town.

The main speaker was Mr Mduduzi Comfort Manana, Deputy Minister of Higher Education and Training.

The excellent academic achievements of five outstanding graduates were recognised with the following awards:

Martin Rees Scholarship
— Mr Assionvi Hove Kouevi
Stephen Hawking Scholarship
— Ms Doaa El-Sakout
Paul G. Allen Family Foundation Scholarship
— Ms Morenikeji Deborah Akinlotan
AIMS Victor Rothschild Scholarship
— Mr Collins Amburo Agyingi
AIMS Victor Rothschild Scholarship
— Mr Tesfalem Abate Tegegn



Extramural activities

During the course of the year, students attended various extramural Activities and outings. These included:

- On 24 September 2011, Heritage Day, there was free entry at all Iziko Museums and students made good use of the opportunity by visiting the Castle of Good Hope and the South African Museum in Cape Town.
- On 1 November 2011 the students went on a bus outing to Signal Hill and via Chapman's Peak to Cape Point.
- The students also went on various hikes, the first up Table Mountain from Camp's Bay on 12 November 2011, the second up to Silvermine Nature Reserve with a picnic held at Silvermine Lake on 19 November 2011, and the third a steep hike up Lion's Head on 26 November 2011. Students also hiked up Table Mountain on 22 January 2012 and 4 February 2012.
- On 28 December 2011 the PGD students were taken on an outing that included ice-skating in the morning and a trip to an indoor pool on Long Street in the afternoon.
- As some light relief after the essay phase a surfing lesson was organised for the students on 22 May 2012. Nine students took part in the hour-and-a-half long lesson, while a few others watched and took photos.



Progress of PGD students after AIMS

| Student | Gender | Origin | Programme | University/Institution | AIMS Bursary |
|---|--------|------------|-----------|------------------------------|--------------|
| Abdul-Karim Iddrisu | M | Ghana | MSc | KwaZulu-Natal | Yes |
| Ahmed Mohamed Ali Omer Hassan | M | Sudan | MSc | AIMS/Stellenbosch | Yes |
| Alice Ikuzwe | F | Rwanda | MSc | Stellenbosch | Yes |
| Alinune Musopole | M | Malawi | MSc | Cape Town | Yes |
| Alma Prell Bimbabou Maboulou | M | R.Congo | MSc | KwaZulu-Natal | Yes |
| Aminat Oyiza Suleiman | F | Nigeria | MSc | Stellenbosch | Yes |
| Armeline Dembo Mafuta | F | DRC | MSc | KwaZulu-Natal | Yes |
| Assionvi Hove Kouevi | M | Togo | PhD | Heriot-Watt | |
| Aurelie Mpoyi Mbula | F | DRC | | Pursuing other opportunities | |
| Babiker Yousif Babiker Ali | M | Sudan | | Pursuing other opportunities | |
| Balembo Tresor Matindi | M | DRC | MSc | Stellenbosch | Yes |
| Chama Bensmail | F | Morocco | MSc | Stellenbosch | Yes |
| Chilufya Mweva | F | Zambia | MSc | Cape Town | Yes |
| Chimere Chukwunye Stanley Anabanti | M | Nigeria | PhD | Warwick | |
| Cocou Davis Ruben Aza-Gnandji | M | Benin | MSc | Cape Town | Yes |
| Collins Amburo Agyingji | M | Cameroon | PhD | Cape Town | Yes |
| Doaa Mostafa Ali Elsakout | F | Egypt | PhD | Heriot-Watt | |
| Emmanuel Amikya | M | Ghana | MSc | Stellenbosch | Yes |
| Ermias Abebe Kassaye | M | Ethiopia | MSc | Cape Town | Yes |
| Faraniaina Rasolofson | F | Madagascar | MSc | AIMS/Stellenbosch | |
| Georges Ferdinand Randriafanomezantsoa Radohery | M | Madagascar | MSc | Stellenbosch | Yes |
| Guy Moise Dangho Nguimdo | M | Cameroon | PhD | Witwatersrand | Yes |
| Hassana Al-Hassan | F | Ghana | MSc | AIMS/Cape Town | Yes |
| Hola Kwame Adrakey | M | Togo | PhD | Heriot-Watt | |
| Huzifa Zain Alabdeen Abdarahman Hissen | M | Sudan | MSc | Stellenbosch | Yes |
| Ihechukwu Chinyere | M | Nigeria | PhD | Heriot-Watt | |
| Isaac Mwangi Wangari | M | Kenya | MSc | KwaZulu-Natal | Yes |
| Joseph Mainzi | M | Uganda | MSc | KwaZulu-Natal | Yes |
| Justine Nasejje | F | Uganda | MSc | KwaZulu-Natal | Yes |
| Kondwani John Kampenya | M | Malawi | MSc | KwaZulu-Natal | Yes |
| Lindifa Mbongeleni Ngwenya | M | Swaziland | MSc | Cape Town | Yes |
| Mabintshi Tanya Shoma | F | DRC | MSc | Cape Town | Yes |
| Mahmoud Yousif Ali Wahba Hashim | M | Egypt | MSc | Western Cape | Yes |
| Mamana Mbiyavanga | M | Angola | MSc | Cape Town | Yes |
| Marie Brilland Yann Ranorovelonalohotsy | M | Madagascar | MSc | Stellenbosch | Yes |
| Marvelous Onuma Kalu | F | Nigeria | MSc | Waterloo | |
| Mekonnen Yimam Legesse | M | Ethiopia | MSc | Stellenbosch | Yes |
| Morenikeji Deborah Akinlotan | F | Nigeria | MSc | Stellenbosch | Yes |
| Mostafa El Metwally Ramadan Ahmed El Demery | M | Egypt | MSc | KwaZulu-Natal | Yes |
| Mpeli Alice Takane | F | Lesotho | MSc | Cape Town | Yes |
| Nancy Achieng Othiambo | F | Kenya | MSc | KwaZulu-Natal | Yes |
| Nantsoina Cynthia Ramiharimanana | F | Madagascar | MSc | Stellenbosch/Tel-Aviv | Yes |
| Nelson Christopher Dzipie | M | Malawi | MSc | Witwatersrand | Yes |
| Ninon Gildas Ondzibou | M | R.Congo | MSc | Witwatersrand | Yes |
| Nirina Maurice Hasina Tahridimbisoa | M | Madagascar | MSc | Witwatersrand | Yes |
| Nouridine Siewe | M | Cameroon | PhD | KwaZulu-Natal | Yes |
| Omran Ahmed Mohamed Saalih | M | Sudan | MSc | KwaZulu-Natal | Yes |
| Samah Mohamed Osman Hassan Taha | F | Sudan | MSc | AIMS/Stellenbosch | Yes |
| Shaimaa Mohamed Abdelmonem Abdelhafez | F | Egypt | MSc | KwaZulu-Natal | Yes |
| Tesfalem Abata Tegegn | M | Ethiopia | PhD | Pretoria | Yes |
| Yasser Reda Ahmed Abd El Hamid El Mahalawy | M | Egypt | | Pursuing other opportunities | |
| Zakaria Annour Mahamat | M | Chad | | Pursuing other opportunities | |

Alumni

June 2012 marked the end of the 9th year of delivery of the Postgraduate Diploma in Mathematical Sciences. The table below summarises the progress of alumni for whom information is available.

| | Total | Male | Female |
|------------------------------------|-------|------|--------|
| AIMS graduates | 412 | 287 | 125 |
| Master's in progress | 127 | 86 | 41 |
| Completed Master's (Part III, MBA) | 172 | 118 | 54 |
| PhD in progress | 130 | 96 | 34 |
| Completed PhD | 36 | 32 | 4 |
| Postdoc/Researcher | 17 | 14 | 3 |
| Teacher/Lecturer | 66 | 49 | 17 |
| Industry | 21 | 15 | 6 |

In February 2012, Google launched a global conference dubbed "Solve for X" dedicated to tackling some of the world's greatest problems at the CordeValle Resort in San Martin, California. The meeting brought together top-thinkers, innovators, entrepreneurs and policy makers to come up with "technology moonshots" that are seemingly impossible solutions. AIMS Alumni Mercy N. Njima and Doriano-Boris Pougaza were sent as AIMS ambassadors to the conference. It was a great opportunity for them to network and have intense discussions about the rich presentations on topics ranging from low-cost water desalination, stretchable silicon biosensors, improving drug therapy delivery, taking images of the mind's eye, negative carbon liquid fuels, low power wireless everywhere and higher education impact.



Dr Emmanuel Osalusi

Dr Emmanuel Osalusi, from Nigeria, was one of the pioneer students for the AIMS programme in 2003/2004. After graduating in 2004, he acquired a PhD in Petroleum Engineering, specialising in Marine Renewable Energy, and is now registered as a Chartered Scientist and Chartered Marine Scientist with the United Kingdom Science Council.

Before he left Nigeria in 2003, his interest lay in doing research in alternative sources of energy. Nigeria is one of the world's top producing oil nations and this industry is viewed by many as the country's lifeblood. It was the dominance of – many would say dependence on – oil which first sparked his interest in alternative sources of energy – renewable energy. "Around 80% of Nigeria's budget comes from oil. But when I was living and studying there, not only were wells drying up but lives were also being lost due to spillage, fires and civil unrest. I began asking myself 'What happens when the wells dry up?' and started to nurse an interest in specialising in alternative energy sources which have a constant source of supply."

"Coincidentally, AIMS gave me the opportunity for the first foundation training in Mathematical Modelling, methods of solving complex engineering problems embedded in higher order differential equations, which is key in making any meaningful impact in engineering science. Not only that, AIMS sponsored me further for my Master's degree in Applied Mathematics (Fluid Mechanics) at the University of Limpopo, South Africa, and provided every support I needed even when I was in ICTP (Italy) and during my PhD studies in Petroleum Engineering in the United Kingdom. The excellent facilities at AIMS and the unparalleled quality of training with the seasoned teachers (not lecturers!), which is comparable with any other reputable research institution in the world, propelled me to be what I am today. AIMS, I am grateful!"



Hind Ahmed

Hind Ahmed, from Sudan, held an Honours Degree in Physics from the University of Khartoum, Sudan, before graduating from AIMS in 2006. She obtained her Master's degree in Material Physics from the University of Cape Town. She also has a Professional Master's in Micro/Nano Electromechanical Systems from the University of Trento in Italy and completed the prestigious Graduate Studies Program at the Singularity University at NASA AMES in California, USA.

"If I was not an AIMS student, I wouldn't have achieved all of this. Before I came to AIMS I only wished to pursue postgraduate studies in Physics and maybe do a Master's. After AIMS I got to know the person I want to be. My experience at AIMS developed not only my academic background but developed and changed my personal thoughts; I discovered my potential and what I am capable of. AIMS helped me to shape my purpose in life."

Hind is currently pursuing her PhD in solar energy at Dublin Institute of Technology in Ireland. She is aiming to develop new luminescent materials to enhance the performance of the solar cells and increase their efficiency.

"I'm passionate about Africa and I believe Africa's challenges require collective passion, vision and action. The AIMS environment is making that happen - it is where talented, like-minded Africans can share ideas, explore and scale them. I can't wait to finish my studies and go back to share my knowledge and thoughts about Africa, as I strongly believe the solution to Africa's challenges lies within Africans themselves."



Dr Charles Lebon Mberi Kimpolo

Dr Charles Lebon Mberi Kimpolo, from the Republic of Congo, has a passion for software development, recently joined ThoughtWorks where he works as a Consultant Developer. Thoughtworks is a global IT consultancy company which recently opened its first office in Johannesburg, South Africa. One of its core objectives is to build local capacity in the IT sector by training developers who have not had formal training before.

Charles graduated from AIMS in 2005. He completed his postgraduate studies at the University of the Witwatersrand and his doctoral studies in the school of Computational and Applied Mathematics in 2010.

After completing his postgraduate studies, he worked as a short-term postdoctoral fellow doing research with the support of the MRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt), and as a Business Analyst & Researcher in the Strategic Planning Division. "I believe that the training at AIMS provided me with excellent graduate-level mathematical modelling skills that are required as basic prerequisites to quickly learn software development."

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

For the past four years AIMS has offered courses towards Stellenbosch University's (SU) Honours in Mathematics with a focus in Biomathematics. Students spend the first half of the year at AIMS and the second half of the year at SU.

Five students graduated at the end of 2011 bringing the total number of graduates to 17. The five students currently enrolled on this programme are: Bafana Gweba, Mashudu Machaba, Rendani Malaudzi, Rendani Netshikweta and Tshepiso Tlhokabatho.

The Biomathematics courses taught at AIMS included the following:

| Time | Lecturer | Topic |
|-----------------|--|---|
| 23 Jan – 10 Feb | Gaston Mazandu, Cape Town | Numerical Computing using Python and Sage |
| 23 Jan – 10 Feb | Wilson Lamb, Strathclyde | Analytical Techniques in Mathematical Biology |
| 20 Feb – 9 Mar | Bharat Biswal, Paul Taylor, New Jersey | Biomedical Signal Processing |
| 12– 30 Mar | Dan Jacobson, Stellenbosch | Computational Biology |
| 10 – 27 Apr | Jacek Banasiak, KwaZulu-Natal | Structured Models of Population Dynamics |
| 30 Apr – 18 May | Jeff Orchard, Waterloo | Modelling Neural Systems |
| 21 May – 8 Jun | Juliet Pulliam, Fogarty | Introduction to Biomedical Sciences and MMED |



Courses towards a BSc Honours in Mathematical Finance

This honours degree programme offered by SU and the University of Cape Town (UCT) is designed to provide students with the skills necessary for solving realistic problems in finance.

The six students registered for the programme this year are: Brett Le Roux, S'thandiwe Vuyisile Mahlaba, Jeremia Manyisa, Faika Solomon, Michael Blyth Toms and Eve-lyn Mary van Schoor. Students attend lectures at UCT, SU and AIMS.

The Mathematical Finance courses taught at AIMS included the following:

| Lecturer | Topic |
|-------------------------------|--|
| Natasha Gray, Old Mutual | FIRM |
| Ronnie Becker, Cape Town/AIMS | Financial Computing |
| Ronnie Becker, Cape Town/AIMS | Interest rates, Local and Stochastic Volatility Models |
| Natasha Gray, Old Mutual | Value at Risk, Credit Derivatives |
| Peter Ouwehand, Stellenbosch | Measure Theory |
| Peter Ouwehand, Stellenbosch | Stochastic Calculus |
| Peter Ouwehand, Stellenbosch | Stochastic Optimisation |

AIMS Bursaries for study at South African Universities

Through the generous support of its donors, AIMS is able to offer half bursaries to its students each year to study at South African universities. This year AIMS awarded 32 such bursaries for Master's study and four bursaries for study towards PhDs. AIMS also awarded four full bursaries to students who are doing their Master's study in the AIMS Research Centre. (See the Progress of students after AIMS table on page 8, for the names of the bursary recipients.)



DAAD Scholarships for doctoral studies

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

New awards for 2012 were made to:

| Students | Gender | Country | University |
|-------------------------------|--------|------------|-----------------------------|
| Eyaya Birara | M | Ethiopia | Stellenbosch |
| Henintsoa Onivola Minoarivelo | F | Madagascar | Stellenbosch |
| Isaac Owino Okoth | M | Kenya | Stellenbosch |
| Olufemi Opeyemi Olaoye | M | Nigeria | Stellenbosch |
| Tahina Rakotoniana | M | Madagascar | Stellenbosch |
| David Sseviri | M | Uganda | Nelson Mandela Metropolitan |
| Sahba Yahya | F | Sudan | Stellenbosch |

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

A number of DAAD scholarship holders in previous years graduated. Tchilabalo Abozou Kpanzou, graduated in December 2011, Dimbinaina Ralaivosoaona in March 2012 and Dawit Worku in June 2012.

In December 2011, Dr Maurice Oduor (Kenya) completed his six-month visiting research fellowship as part of the DAAD Postdoctoral Fellowship Programme. He submitted two research articles.

Dr Dimbinaina Ralaivosoaona (Madagascar) has been accepted at AIMS for 6 months on a DAAD Postdoctoral Fellowship in sub-Saharan Africa starting 1 July 2012.

AIMS Research Centre

On behalf of the Department of Science and Technology, the National Research Foundation renewed its commitment to the AIMS Research Centre during this period.

Dr Sehun Chun joined the AIMS Research Centre in early January as a full-time resident researcher in Mathematical and Physical Biosciences. His research activities focus on the mathematical analysis of physical and biological phenomena and the development of computational schemes to simulate them. The appointment of Professor Bruce Bassett, leader of the AIMS Cosmology group was extended, and Professors Alan Beardon and Ronnie Becker and Dr Raouf Ghomrasni continue in their positions.

In February 2012, AIMS was awarded two joint Research Chair positions, the first in Mathematical and Physical Biosciences (AIMS 50% and SU 50%) and the second in Observational Cosmology (UWC 60%, SAAO 30% and AIMS 10%). The interview and selection processes for these positions are currently underway.



Profiles



Dr Raouf Ghomrasni, resident researcher

Dr Raouf Ghomrasni is a resident researcher at AIMS and an expert in stochastic analysis. He received his PhD in mathematics from Aarhus University, Denmark. His research focuses on the study of fine properties of Brownian motion and the local times of semimartingales. He also is interested in mathematical finance, specifically the stochastic portfolio theory and interest-rate modelling.

Prior to AIMS, he was a postdoctoral researcher at the Technical University of Berlin and a lecturer at the School of Computational and Applied Mathematics, Faculty of Science, University of the Witwatersrand, Johannesburg, South Africa. He has supervised five Master's theses and co-supervised one Doctoral thesis in mathematical finance. Dr Ghomrasni coordinates the weekly meetings of the Research Centre's Journal Club.



Dr Lafras Uys, postdoctoral fellow

Dr Lafras Uys, a postdoctoral fellow at AIMS, started his academic life as a biologist. He completed his undergraduate studies at the University of Pretoria, specialising in microbiology. He moved to Stellenbosch University where he completed postgraduate studies under Professors Johann Rohwer and Jannie Hofmeyr in the systems biology group at the Department of Biochemistry. For his Master's and doctoral studies he built mathematical models of sucrose accumulation in sugar cane. In 2009 he received his PhD in biochemistry.

In 2010 he started at AIMS, where he has pursued his own research interests, as well as co-supervising PGD and Master's students. His research focuses on the applications of algebra and computer science in modelling biological systems. He is particularly interested in using commutative algebra and algebraic geometry to model biochemical pathways. Together with Professor Jeff Sanders, he has also started using process algebras from theoretical computer science to model various abstraction hierarchies found in cells.



Fadoua El Moustaid, Master's student

Fadoua El Moustaid completed her Master's in the AIMS Research Centre with distinction in December 2011. Fadoua did her four-year degree at the University of Cadi Ayyad in Morocco in Mathematics. Her studies were in pure mathematics, but she was more excited about learning applied mathematics, which was her main motivation for applying to AIMS since the courses are more about using mathematics in real life. After completing the AIMS PGD she continued with a Master's degree in Mathematics applied to Biology, which she finished within 18 months. Her thesis was about bacterial behaviour within a biofilm. She was also appointed as a teaching assistant at AIMS for the 2011/2012 academic year. Currently she is pursuing her PhD with a scholarship at Cincinnati University in the United States and has been appointed as a teaching assistant.

"My experience at AIMS helped me a lot in my personal life as well as in my scientific career. While at AIMS, I had the opportunity to attend two conferences, one in Poland and the other one in Spain. This helped me to create a good network in the Biomathematics field of study, so for that I am really grateful to AIMS."



Dr Maurice Oduor, visiting researcher

Dr Maurice Oduor is a lecturer at Maseno University in Kenya and holds a PhD in Pure Mathematics. In December 2011, he completed a six-month visiting research fellowship at AIMS as part of the DAAD Postdoctoral Fellowship Programme.

He had this to say about his visit, "I wish to express my whole-hearted gratitude to DAAD for having sponsored my visit to AIMS-South Africa. I thank the AIMS community, led by the host, Professor Barry Green for having provided excellent research facilities and all the other logistics that made this research a success. I was privileged to interact with a number of scholars, including but not limited to both resident and visiting researchers."

He also attended various seminars and workshops run by AIMS including the Computational Algebra workshop. He submitted two research articles, one on the "automorphisms of a certain class of completely primary finite rings" and the other on "the structure of unit groups of certain classes of completely primary finite rings".



Professor Mamadou Sango, visiting researcher

Professor Mamadou Sango is a regular visitor to the AIMS Research Centre where he has assisted with the supervision and external examination of PGD students. He is a Professor of Mathematics in the Department of Mathematics and Applied Mathematics at the University of Pretoria where he also assumes the duties of research and postgraduate coordinator.

He graduated in 1993 with an MSc in Mathematics from Donetsk State University in Ukraine, and obtained his PhD in Applied Mathematics from the University of Valenciennes in France in 1998. Professor Sango's research interests are at the intersection of three major fields: Partial Differential Equations, Stochastic Processes and Differential Geometry. He has made outstanding contributions to several problems, notably in elliptic spectral problems with indefinite weights, in homogenization of non-linear partial differential equations and in some mathematical problems related to turbulent flows of fluids governed by stochastic partial differential equations. He leads a very successful research group at the University of Pretoria composed mainly of postgraduate students and postdoctoral fellows from several African countries.

He has received several awards, including the Vista University Vice Chancellor's Award for outstanding contributions to research and knowledge in 2001. He has held visiting positions in leading international research institutions, such as the Institut des Hautes Etudes Scientifiques in Paris, the Isaac Newton Institute for Mathematical Sciences at Cambridge and the Institute for Advanced Study at Princeton.

"For the last five years, AIMS has become the research institution that I visit most frequently. It offers an excellent environment to carry out my work efficiently. The interaction with students from all corners of the continent is very enriching in particular with regard to the challenges that Africa faces in her struggle to generate a lasting and sustained growth of highly-trained mathematicians. The blending of the diverse experiences brought by students, lecturers and visitors makes AIMS a unique intellectual delicacy and asset that speaks to the hope for a great scientific future on the African continent."

Master's and doctoral students who graduated under supervision of researchers at AIMS

| Student | Gender | Research field | Graduation | Supervisor/Host |
|-------------------------|--------|----------------------------|---------------|---|
| Doctoral Studies | | | | |
| Mhlanga, Farai | M | Mathematical Finance | June 2011 | Professor R I Becker |
| Okouma, Patrice Martin | M | Cosmology and Astrophysics | June 2012 | Professor B Bassett |
| Master's Studies | | | | |
| Ashforth, James | M | Mathematical Finance | June 2011 | Professor R I Becker |
| Bhyat, Aneez | M | Mathematical Finance | December 2011 | Professor R I Becker |
| El Moustaid, Fadoua | F | Biomathematics | December 2011 | Dr A Ouhinou |
| Holilal, Amiel | M | Mathematical Finance | December 2011 | Professor R I Becker |
| Jones, Christopher | M | Mathematical Finance | December 2011 | Professor R I Becker |
| Mancuveni, Conlias | M | Mathematical Finance | June 2011 | Professor R I Becker |
| Marks, Dean | M | Mathematical Finance | December 2011 | Professor R I Becker |
| Martin, Bryony | F | Cosmology and Astrophysics | February 2012 | Professor B Bassett/Dr K van der Heyden |
| Mathebula, Daphne | F | Biomathematics | March 2012 | Dr C Oukouomi Noutchie/ Dr R Ouifki |
| Mbofana, Stewart | M | Mathematical Finance | December 2011 | Professor R I Becker |
| Munhumwe, Blessing | F | Mathematical Finance | December 2011 | Professor R I Becker |
| Newling, James | M | Cosmology and Astrophysics | November 2011 | Professor B Bassett |
| Njau (Koimhuri), Mercy | F | Mathematical Finance | June 2012 | Professor R I Becker |
| Rahantamialisoa, Tahiri | M | Mathematical Finance | March 2012 | Dr R Ghomrasni |
| Raharinirina, Alexia | F | Biomathematics | March 2012 | Dr A Ouhinou |
| Savanhu, Richard | M | Mathematical Finance | December 2011 | Professor R I Becker |
| Tangpi, Ludovic | M | Mathematical Finance | December 2011 | Dr R Ghomrasni |

Postdoctoral fellows in the AIMS Research Centre

| Fellow | Gender | Research Field/Topic | Period | Supervisor/Host |
|-------------------|--------|---|---------------------------|---------------------|
| Marais, Magdaleen | F | Topics in Computational Algebra and Applications | 1 Jan 2011 – 31 Dec 2012 | Professor B W Green |
| Salmi, Petja Esko | M | Oscillons | 1 Jan 2010 – 1 Jan 2012 | Professor B Bassett |
| Smith, Mathew | M | Observational and Theoretical Cosmology | 1 Nov 2008 - 31 Dec 2011 | Professor B Bassett |
| Uys, Lafras | M | Coupling of Biochemical Reaction Networks with Advection-Diffusion Models | 1 Jan 2010 – 31 Dec 2012 | Professor B W Green |
| Khosravi, Nima | M | Cosmology | 15 Dec 2011- 14 Dec 2012 | Professor B Bassett |
| Sivanandam, Navin | M | Early Universe Cosmology and Inflation | 24 Oct 2011 – 23 Oct 2013 | Professor B Bassett |



Visiting Researchers

The researchers who visited AIMS during the period 1 August 2011 and 31 July 2012 are listed below:

| Researcher | Affiliation | Field of specialisation | Period of visit |
|---------------------------------------|--|--|--------------------------|
| Maurice Oduor | Maseno, Kenya | The Automorphism Groups of Finite Rings | 1 Jul - 31 Dec 2011 |
| Issa Zabsonre Ougadougou | Burkina Faso | Biomathematics | 8 Aug - 8 Nov 2011 |
| Gerard Razafimanantsoa | Antananarivo, Madagascar | Mathematics: Drinfeld Modules | 6 Sep 2011 - 6 Mar 2012 |
| Dennis Ikpe | UNISA, South Africa | Financial Mathematics | 18 Sep - 3 Dec 2011 |
| Mamadou Sango | University of Pretoria, South Africa | Applied Mathematics | 29 Sep - 7 Oct 2011 |
| Aderemi Adewumi | University of KwaZulu- Natal | Computer Science | 31 Oct - 4 Nov 2011 |
| Thomas Masiwa | Stellenbosch, South Africa | Extensions of Products of Totally Permutable Groups | 1 Nov - 31 Dec 2011 |
| Jamshid Moori | North-West, South Africa | Finite Simple Groups | 5 - 19 Nov 2011 |
| Yabebal Fantaye | International School for Advanced Studies, Italy | Cosmology: Astrophysics | 1 Dec 2011 - 28 Jan 2012 |
| Ragunath Arnab | KwaZulu-Natal, South Africa | Statistics: Sample Survey | 11 to 16 Dec 2011 |
| Jacek Banasiak | KwaZulu-Natal, South Africa | Biomathematics | Dec 2011 - Jan 2012 |
| Teko Motsumi | Gaberone, Botswana | Numerical Analysis | 13 Jan - 12 July 2012 |
| Benard Nyaare | Maseno, Kenya | Operator Theory and Elementary Operations | 1 Feb - 1 May 2012 |
| Gerhard Pfister | Kaizerslautern, Germany | Computational Algebra | 20 Feb - 3 Apr 2012 |
| Adou, Kablan Jerome | University of Cocody, Abidjan Cote d'Ivoire | Fluid Mechanics | 7 May - 6 Jul 2012 |
| Adewumi, Aderemi | University of KwaZulu-Natal | Computer Science | 20 - 27 Jun 2012 |
| Obgbogbo, Chisara Peace (PhD Student) | University of Ghana | Financial Mathematics, Levi Processes, Modeling Crude Oil Prices | 10 - 30 May 2012 |
| Sango, Mamadou | University of Pretoria | Applied Mathematics | 1 May - 8 Jun 2012 |

Resident researcher Dr Raouf Ghomrasni continued to organise weekly journal club meetings. Highlights of the club this year included the presentation by Professor Bengt Fornberg (University of Colorado at Boulder, USA) on recent advances in the topic of radial-basis functions which recently have gained enormous popularity in mesh-free methods for partial differential equations (PDEs), and the enlightening talk by Professor Mamadou Sango (Department of Mathematics and Applied Mathematics, University of Pretoria) on the measure of theoretical applications to dynamical systems, which was thoroughly enjoyed by the students.

The Cosmology Seminar Series continued throughout the period under review and included the First Cape Town Astronomy and Cosmology Colloquium on the 13 April 2012, where Professor Tarun Souradeep Ghosh from the Inter-University Centre for Astronomy and Astrophysics (IUCAA) spoke on challenging the Isotropic Cosmos.



Honours and Achievements

During the review period AIMS researchers and postgraduate students were recognised as follows:

- **Professor Bruce Bassett** was Chair of the “Future Probes of Fundamental Physics” session at the international COSMO11 conference in Porto, Portugal during August 2011. He also visited the Institute of Cosmology and Gravitation at the University of Portsmouth during where he was an invited speaker at the theory meeting associated with the UK COSMO meeting.
- **Dr Carolina Odman-Govender** was awarded the Science Prize for Online Resources in Education (SPORE).
- **Dr Raouf Ghomrasni** was invited to visit the Centre of Mathematics for Applications, CMA, a Norwegian Centre of Excellence funded by the Research Council of Norway from 9 to 19 December.
- The TED@Johannesburg event was held on 3 May in Soweto where **Professor Bruce Bassett** gave a talk entitled “Are We Special: the Search for our Place in the Cosmos”. This event, one of 14 across the globe, is part of the TED2013 theme, “The Wise. The Young. The Undiscovered”.
- **Professor Ronnie Barker** was invited to the University of Rome La Sapienza from 20 June to 3 July 2012, at which he gave two Colloquium talks and did research.
- **Professor Jeff Sanders** was invited to spend three weeks at the Technical University of Berlin in July 2012, where he presented a seminar titled “Formal Methods for Self-* Systems” and worked generally in the area of Formal Methods of Software Development.



Publications

Several publications have resulted from work at AIMS. The list of published outputs below includes all 2011 and 2012 research articles where AIMS is given as the affiliation of at least one of the authors.

2011

- T Akrid, L Maniar and A Ouhinou. Spectral criteria and almost periodic solutions for a class of non autonomous semilinear boundary Cauchy problems. *International Journal of Evolution Equations*, 5(2) (2011), 177 – 195.
- BA Bassett, Y Fantaye, R Hlozek and J Kotze. *Fisher matrix preloaded – Fisher4Cast*. *International Journal of Modern Physics D*, 20 (13) (2011), 2559-2598.
- AF Beardon. *The Theorems of Stieltjes and Favard*. *Computational Methods and Function Theory*, 11 (2011) 247-262.
- AF Beardon. *Cyclic absolute differences of integers*. *American Mathematical Monthly*, 118 (2011), 650 – 652.
- AF Beardon. *Integral inequalities in probability theory* *Mathematical Gazette*. 95 (2011), 119 – 123.
- AF Beardon. *On 94.20 (cutting corners), Feedback*. *Mathematical Gazette*, 95 (2011), 1322.
- AF Beardon, K Driver and K Jordaan. *Zeros of polynomials embedded in an orthogonal sequence*. *Numerical Algorithms*, 57 (3) (2011), 399-403.
- M Cortès, AR Liddle and D Parkinson. *On the prior dependence of constraints on the tensor-to-scalar ratio*. *Journal of Cosmology and Astroparticle Physics*, (9) (2011), art. no. 027.
- TM Davis, L Hui, JA Frieman, T Haugbølle, R Kessler, B Sinclair, J Sollerman, B Bassett, J Marriner, E Mörtzell, RC Nichol, MW Richmond, M Sako, DP Schneider and M Smith. *The effect of peculiar velocities on supernova cosmology*. *Astrophysical Journal*, 741 (1) (2011), art. no. 67.
- HB Ekobena Fouda, CB Tabi, A Mohamadou and TC Kofané. *Intramolecular vibrations and noise effects on pattern formation in a molecular helix*. *Journal of Physics Condensed Matter*, 23 (37) (2011), art. no. 375104.
- A Elazouzi and A Ouhinou. *Optimal Regularity and stability analysis in the alpha-norm for a class of partial functional differential equations with infinite delay*. *Discrete and Continuous Dynamical Systems – A*, 30(1) (2011), 115 – 135.
- R Ghomrasni. *Comment on “On a stopped functional for a bidimensional process” by C. Makasu*. *Chaos, Solitons and Fractals*, 44 (12) (2011), 1117-1118.

- RR Gupta, CB D'Andrea, M Sako, C Conroy, M Smith, B Bassett, JA Frieman, PM Garnavich, SW Jha, R Kessler, H Lampeitl, J Marriner, RC Nichol and DP Schneider. *Improved constraints on type Ia supernova host galaxy properties using multi-wavelength photometry and their correlations with supernova properties.* *Astrophysical Journal*, 740 (2) (2011), art. no. 92.
- SD Hove-Musekwa, F Nyabadza and H Mambili-Mamboundou. *Modelling Hospitalization, Home-Based Care, and Individual Withdrawal for People Living with HIV/AIDS in High Prevalence Settings.* *Bulletin of Mathematical Biology*, 73 (12) (2011), 2888-2915.
- MNO Ikhile. *The root and Bell's disk iteration methods are of the same error propagation characteristics in the simultaneous determination of the zeros of a polynomial, Part II: Round-off error analysis by use of interval arithmetic.* *Computers and Mathematics with Applications*, 61 (11) (2011), 3191-3217.
- SM Kassa and A Ouhinou. *Epidemiological models with prevalence dependent endogenous self-protection measure.* *Mathematical Biosciences*, 229(1) (2011), 41 – 49.
- CA Kitio Kwuimy and BA Nana Nbandjo. *Active Control of horseshoe chaos in a driven Raleigh oscillator with fractional order deflection.* *Physics Letters A*, 375 (2011), 3442 – 3449.
- I Lari, F Ricca, A Scozzari and RI Becker. *Locating Median paths on Connected Outerplanar Graphs.* *Networks*, 57(3) (2011), 294-307.
- MC March, R Trotta, P Berkes, GD Starkman and PM Vaudrevange. *Improved constraints on cosmological parameters from Type Ia supernova data.* *Monthly Notices of the Royal Astronomical Society*, 418 (4) (2011), 2308-2329.
- J Newling et al (including BA Bassett, B Martin, M Smith and M Varughese from AIMS), *Statistical Classification Techniques for Photometric Supernova Typing.* *Monthly Notices of the Royal Astronomical Society*, 414 (2011), 1987-2004.
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AIMS Library Series

Manuscripts for the fourth and fifth books of the AIMS Library Series, respectively, "A first Course in Computational Algebraic Geometry" by W Dekker and G Pfister and "Difference and Differential Equations in Mathematical Modelling" by J Banasiak, are currently being refereed.

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.

AIMS Schools Enrichment Centre (AIMSSEC)



Established in 2003, AIMSSEC seeks to extend educational opportunities to disadvantaged communities in South Africa, to introduce new skills for the teaching of mathematics and to raise standards of attainment.

For the period under review, AIMSSEC trained 379 teachers and subject advisers from all parts of South Africa. The teachers attended residential courses in the school holidays and then engaged in distance learning once they were back at work in their schools. This enables teachers based in rural areas far from other universities to get the training they need.

Commissioned by the Eastern Cape Department of Education, AIMSSEC is currently training 23 teams of 12 teachers to be mathematics subject leaders in each Eastern Cape School District. To reach as many learners as possible, AIMSSEC trains teachers to run workshops for other teachers and provides the learning materials for these workshops. Over 800 teacher-led workshops have now been conducted providing field trials for the series of 16 books being written by the 50-strong AIMSSEC International team.

We are delighted to report that on 24 April 2012, AIMSSEC, together with the Rato Bangala Foundation (Nepal) and the Banco del Libro (Venezuela), was awarded the UNESCO-Hamdan bin Rashid al-Maktoum Prize for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers.

The prize is awarded every two years, and was set up to recognise organisations working with teachers in developing countries within marginalised or disadvantaged communities. Projects from 33 countries were nominated for the prize. The US\$270,000 prize money was divided equally between the three organisations. This prize money will help AIMSSEC to extend its staff team. AIMSSEC has more than 400 teachers on its waiting list. The small AIMSSEC team must build capacity in order to meet the pressing demand from teachers for professional development and to give more young learners in South Africa their entitlement to a good mathematical education.

The AIMSSEC Mathematical Thinking (MT) course has now been run eighteen times for a total of 995 teachers and subject advisors from all parts of South Africa. A ten-day residential course was held in April 2012, and another one in June/July, for a total of 131 teachers, with 65 hours of face-to-face mathematics workshops. The course promotes a learner-centred, activity-based approach to teaching, while consolidating educators' subject knowledge, with a particular focus on content that is newer to the curriculum. It emphasises understanding and encourages a shift away from 'chalk and talk' and rote-learning. Daily IT sessions develop computer skills and familiarise the teachers with free software and online resources. The teachers submit two assignments in the following three months reporting on how they have implemented lesson plans that put the AIMSSEC teaching philosophy into practice.

Former AIMSSEC and AIMS graduates, Sagree Pillay, Mondli Mkhwanazi and Doaa Mostafa, were teaching assistants on the MT course.

The MT course is a prerequisite for the two-year Advanced Certificate in Education (ACE) to train Mathematics Subject Leaders that AIMSSEC runs in partnership with Stellenbosch and Fort Hare universities. ACE was designed by AIMSSEC and it is an innovative, blended-learning, technology-enriched programme. The students attend residential units in January and July each year. They are committed to ten hours a week home study guided by the lecturers who answer their questions through the course management system (<http://moodle.aimssec.org>). Students submit regular assignments, attend workshops in their own areas broadcast from Stellenbosch on the Interactive Telematic Education TV system, and write examinations every year.

Forty-one students graduated in December 2011 from the ACE course that AIMSSEC teaches with the Institute for Mathematics, Science and Technology at the University of Stellenbosch (IMSTUS). There are 25 students registered for their second year of study on this course in 2012.



The AIMSSEC/University of Fort Hare ACE programme is the subject of a three-year research and evaluation study by Kellelo Consulting and Professor Jill Adler funded by the Zenex Foundation.

Through the AIMING HIGH online community www.aiminghigh.aimssec.org, AIMSSEC supports current students and alumni and provides an online forum to discuss a problem-solving approach to teaching mathematics. Now that teachers have cellphone access to the internet they are able to read to share ideas and support each other. AIMSSEC has also built capacity for the teacher network by setting up two new Interactive Telematic Education (ITE) Learning Centres in Mthatha and Queenstown in the Eastern Cape. Two more new centres are planned so that no teacher has to travel more than 100 kilometres to a centre and all teachers can benefit from mathematics professional development workshops.

Mobile learning is becoming increasingly accessible and important. AIMSSEC has developed 70 applications for learning mathematics on basic cellphones using MXiT software, targeted at developing countries: (MXiT-BSMRT-SMRTUP-Mathematical Investigations). AIMSSEC also takes part in a project with Nokia called MoMaths that enables learners and teachers from grades 10 to 12 to use cellphones for learning maths. In addition, AIMSSEC is involved in research in partnership with Cambridge University Millennium Mathematics Project on developing maths apps for smartphones.

South Africa is ranked 139th out of 142 countries for the quality of its school mathematics and science education (Global Competitiveness Report, World Economic Forum 2011/2012), and the country urgently needs professional development for mathematics teachers. AIMSSEC plans to offer the new Advanced Certificate in teaching (Level 6), the Advanced Diploma in Education (Level 7) and the Postgraduate Diploma in Education (Level 8) as a 6-year part-time blended learning professional development programme to train subject leaders in mathematics. Applicants would first need to qualify through the three-month AIMSSEC MT course. The objective is to empower experienced mathematics teachers of grades 4 to 12 to develop their subject knowledge, and teaching and leadership skills.

AIMSSEC plans to offer a new course: **AIMING HIGHER 'Maths with Wings'** to be part of a research project on teacher transformation. The course objectives are to inspire teachers to learn more university-level mathematics relevant for school teaching, to develop their teaching skills and to help them foster learners'

skills of mathematical reasoning, problem-solving, independent learning, collaborative learning and communication. The initial intake will be 27 teachers - three per province, with bursaries for the teachers selected by their respective Provincial Education Departments. Selection criteria will require mathematical and teaching qualifications with at least three years experience, proven competence in teaching at Grades ten to twelve and obtaining good results with their matric learners. Two two-week residential units in the school holidays in January and July are planned with blended learning and assignments between the residential units.

AIMSSEC will continue to foster its global links, its community involvement with local schools and the tutoring and mentoring involving AIMS students and graduates. AIMSSEC plans to expand distribution of free interactive resources to promote activity-based learning to support the South African school mathematics curriculum and to support similar programmes based in AIMS-Sénégal, AIMS-Ghana and AIMS-Ethiopia.



Workshops and Conferences

The following workshops and conferences were held during the period under review:

A Computational Algebra Workshop: **Towards the classification of real singularities using SINGULAR** was held at AIMS from 26 to 30 September 2011. Attended by 14 participants, the workshop was a joint activity between AIMS and the University of Kaiserslautern. The goal was to understand the results of the Russian mathematician VI Arnold in the real case by the systematic classification of functions (respectively hypersurface singularities) by equivalence and modality. One of the goals of the workshop was to provide a SINGULAR library which computes the type of a polynomial over the complex numbers in the sense of Arnold's classifications, extending what was done previously over the reals. Speakers included the Director of the Mathematisches Forschungsinstitut Oberwolfach in Germany, Professor Gerd-Martin Greuel (Kaiserslautern), Professor Ignacio Luengo (Madrid), Dr Magdaleen Marais (AIMS) and Mr Andreas Steenpass (Kaiserslautern).

The **5th JEDI workshop** co-organised by the cosmology group at AIMS, took place from 28 October to 2 November 2011 in the south of Mauritius. It was the first time a JEDI school has been held outside South Africa. The JEDI format, first developed in 2008 by Professor Bruce Bassett, provides a highly innovative and successful approach to teaching research. There are few talks, and participants are provided with a list of research projects to choose from and work on instead. The resulting research groups, which consist of a mix of students, postdocs and faculty members, work on each project intensively during the workshop and continue to collaborate on the project after the workshop has ended, leading to powerful and natural networking and collaboration building, as well as papers published in top journals.

A four day workshop on **Mathematical Methods in Systems Biology and Population Dynamics** held at AIMS from 4 to 7 January 2012, brought together 62 mathematicians and researchers working in various biological and medical fields to exchange ideas, promote collaboration and further research in this area. This workshop was funded by Southern Illinois University, Edwardsville.

Leading mathematicians in the application of mathematics in industry participated in the **9th Mathematics in Industry Study Group** held at AIMS from 9 to 13 January 2012. During this workshop 58 academic researchers and graduate students worked collaboratively on eight problems submitted by local industry. Among the foreign researchers attending the workshop were Dr Hilary Ockendon, Oxford University, who initiated the first such study group in the 1960s; Professor Colin Please, University of Southampton, an expert in the modelling of industrial problems in continuum mechanics; and Dr Neville Fowkes from the University of Western Australia who, subsequently, also lectured a course on industrial modelling for the AIMS postgraduate diploma course.



As a precursor to the International Cosmology School, an informal workshop was held at AIMS on 11 and 12 January 2012. Speakers included Andreas Faltenbacher, Western Cape (Anisotropy in the matter distribution at very large scales), Peter Dunsby, Cape Town (Is the Concordance Model the only game in town?), Paolo Creminelli, ICTP, (the CMB bispectrum in the squeezed limit), Ue-li Pen, CITA (21 cm intensity mapping), Heather Campbell, ICG (Cosmology with SDSS-II Photometrically-Classified Type-Ia Supernova) and Rahman Amanullah, Stockholm (Searching for distant supernovae behind massive-galaxy clusters).

The AIMS Cosmology group hosted the **Cape Town International Cosmology School** which was held from 15 to 28 January 2012 at STIAS, Stellenbosch. Co-organised by the International Centre for Theoretical Physics (ICTP), the Perimeter Institute for Theoretical Physics (PI) and the University of the Western Cape, the School received 215 applications for the 58 available places. Selected participants comprised a mixture of Master's and PhD students, as well as postdoctoral fellows from 31 countries. Formal feedback from participants indicated that a large number of the participants rated the School as the best one they had ever attended. Sponsors included the Centre for High Performance Computing, ICTP, the National Institute for Theoretical Physics, the National Research Foundation, PI, SKA and the Royal Society.

The **Complex Analysis and Hyperbolic Geometry Workshop** was organised by Alan Beardon and hosted at AIMS from 30 January to 3 February 2012 with financial support from the School of Mathematics, University of the Witwatersrand. There were 13 participants including several South African postgraduate students. All participants gave at least one lecture or presentation.

The **5th Summer School in Mathematical Finance** was held at AIMS from 16 to 18 February 2012 bringing together practitioners, academics and students in the fast-growing field of mathematical finance. Forty-seven participants were able to benefit from the lectures of invited speakers Professor Matheus Grasselli (McMaster University, Canada) on Agent-based models and banking network, Dr Andrea Macrina (Kings College, London, United Kingdom) on Utility Theory and Functions and Professor Cornelis Oosterlee (Delft University of Technology, Netherlands) on Efficient Computation and Hybrid Modelling in Finance and Insurance. Sponsors included 27 four Investment Managers, Riskworx and Standard Bank.

The **Meaningful Modelling of Epidemiological Data Workshop**, co-sponsored by SACEMA and AIMS, was held at AIMS from 28 May to 8 June 2012. It was attended by 50 participants, including tutors, speakers and participating AIMS students.

The **2012 Quantum Information and Computing School and Workshop** was held at AIMS from 11 to 16 June. The main organiser and speaker was Professor Edward Farhi of the Department of Physics and Director of the Centre for Theoretical Physics. Other speakers included Gilles Brassard (University of Montreal), Matthias Christandl (Institute for Theoretical Physics, Zurich), Aram Harrow (University of Washington), Patrick Hayden (McGill University), Francesco Petruccione (University of KwaZulu-Natal), and Simone Severini (University College of London). The meeting was attended by seven international speakers and 25 participants (AIMS students, as well as students and academic staff from a number of South African universities).

The **Applications of Mathematics in Biology and Medicine Workshop**, co-sponsored by SACEMA and AIMS, was held at AIMS from 2 to 6 July 2012. There were 40 participants, three tutors and ten speakers, including Sehun Chun and Lafras Uys from AIMS. The course was fully funded for South African students, who were all third-year and Honours students in mathematics, physics, or computer science at South African universities.



Special Seminars

21 October is celebrated as the birthday of the mathematician Martin Gardner (1914-2010). This academic year, a lecture in his honour was delivered at AIMS by Professor Dirk Laurie (Stellenbosch University) who was teaching the Experimental Mathematics course. The lecture was designed as a "Gathering for Gardner Celebration of Mind" event and was the only such event on the African continent.

Esther Dyson, an expert in tech start-ups and daughter of Freeman Dyson the famous physicist, gave a talk to the students at AIMS on 1 October 2011 about entrepreneurship and starting businesses.

On 3 October 2011, Professor Ivan Gutman (University of Kragujevac, Serbia) gave a general colloquium on the History of the Interplay between Mathematics and Chemistry. The talk covered the first (erroneous) result of mathematical chemistry (Plato); Jabir ibn Hayyan's magic number 17 (VIII century); Alchemical geometry; the first theorem of "mathematical chemistry" (1741); the mathematical background of the XIX-century structural chemistry; chemical origin of graphs; the over-optimism of the 1930s; and the present status of mathematical chemistry.

On 2 November 2011, Charles Maisel, a social entrepreneur and innovation coach, gave a two-hour innovation and entrepreneur workshop to the PGD students.

On 19 November 2011, AIMS hosted an Africa@Home hackfest with participation of the Department of Computer Science at the University of Cape Town, the Citizen Cyberscience Centre, Connexions, the Open Knowledge Foundation, P2PU, Siyavula and SACEMA, through the support of the Shuttleworth Foundation. AIMS Alumni based at Cape Town and Stellenbosch universities worked on a Malaria Mapping project. Other projects included Epicollect mobile phone data collection, Geotagging Libya, Radio-Astronomy image analysis, and digitisation projects.

Associate Professor Lincoln D. Carr, Humboldt Fellow Physikalisches Institut, Universität Heidelberg, and Department of Physics, Colorado School of Mines gave a talk on 14 November 2011 to students and researchers on "Understanding Quantum Phase Transitions".

Awards

The African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC), together with the Rato Bangala Foundation (Nepal) and the Banco del Libro (Venezuela) was awarded the UNESCO-Hamdan Bin Rashid Al-Maktoum Prize for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers. The ceremony took place in Dubai on 24 April 2012, in the presence of the UNESCO Director-General. The US\$270,000 prize money was divided between the three organisations. The prize was set up with funding from Sheikh Hamdan Bin Rashid Al-Maktoum of Dubai in 2009, and is awarded every two years to candidates who have shown outstanding achievement in enhancing the performance and effectiveness of teachers in developing countries within marginalized or disadvantaged communities.

Professors Barry Green and Alan Beardon, Jan Groenewald, Igsaan Kamalie, Lynne Teixeira and Deborah Wilsnagh, received awards from the AIMS-NEI Secretariat in recognition and appreciation for the noteworthy contributions they have made to the organisation. Mrs Toni Beardon also received an award recognising her contribution through AIMSSEC.

Professor Garth Dales (Leeds) gave a talk at AIMS about the Continuum Hypothesis and its independence from the axioms of set theory on 25 November 2011. The talk was titled "How many real numbers are there?"

In December 2011, AIMS alumnus Faniry Harijaona Razafindrazaka, who is registered for a PhD at the Berlin Mathematical School, Freie Universität Berlin, Germany, presented a talk to the students on his research. He also gave a talk entitled "Physical Based Smoothing Scheme on Polygons and Applications" at the Journal Club.

Professor John Webb (Department of Mathematics and Applied Mathematics at UCT) gave a talk on 8 December to AIMS students on the International Mathematics Olympiad competition and plans for it to be hosted in South Africa in 2014.

The Cape Town Science Hack Day took place at AIMS from 28 to 29 January 2012, and brought together scientists, designers and educators who wish for science and its benefits to be within the reach of the general population.

A Skills for Entrepreneurship, Employment and Development workshop was held at AIMS during the reading week 13 to 15 February. Presentations were made by David Casey and Varkey George of the University of Cape Town; Arun Sharma, AIMS-NEI; and Christoff Oosthuysen, business improvement consultant at Flowfinder.

Professor Raju Venugopalan, Brookhaven National Laboratory and Stony Brook University, USA gave a talk on 16 February entitled "The hottest stuff on earth: how it's formed, what its made of, and how it flows".



Outreach

Visits to local universities

Professor Barry Green visited the Universities of Limpopo, Venda and Mafikeng in August 2011, to give presentations to prospective South African students encouraging them to apply for the new AIMS programmes starting in January 2012. He noted that these institutions are doing excellent work with limited resources and was struck by the enthusiasm of the students as well as their eagerness to find out more about AIMS programmes. Colleagues at these universities were also keen to build a relationship with AIMS, and they would like to see AIMS play a supporting role in their own growth.

Following on from his visit, a **Workshop on Statistical Modelling with R** was held at the Department of Statistics at the University of Venda from 5 to 16 March 2012. It was sponsored by AIMS as part of its outreach to local universities. The workshop, which was facilitated by Dr Edgar Otumba, head tutor at AIMS, introduced the 17 participants to the usage of R package for Statistical Modelling. This is open source software as opposed to other statistical packages and is easy to use, since it is built on S and S plus platforms. R is also compatible with UNIX and Windows operating systems, and has excellent graphing capabilities. The mode of instruction was via a participatory approach, with all participants getting involved in several tasks allocated by the instructor. A number of data sets were also analysed so as to enable the participants to get used to data analysis techniques and exploration.

Public Lecture Series

During the period under review, AIMS presented a series of public lectures which are listed below:

- **Dr Nadeem Oozeer, Operations and Commissioning Scientist** at the Square Kilometre Array (SKA) South Africa, spoke about the Meerkat, a precursor to the SKA, on 20 September 2011
- **Professor Jannie Hofmeyr, Centre for Studies in Complexity and Department of Biochemistry**, University of Stellenbosch, gave a talk titled "Self-fabrication as a key to life" on 4 October 2011
- **Professor Robert de Mello Koch, Research Chair in Theoretical Physics** at the University of the Witwatersrand gave a talk titled "From Spacetime and Quantum Mechanics to String Theory"
- **Professor Eugene Cloete, Dean: Faculty of Science**, Stellenbosch University gave a talk on 13 December 2011 titled, "Achieving the extraordinary with ordinary people. Does a high IQ equal success?"
- **Professor Tadashi Tokieda**, Cambridge University, gave a talk titled "Science from a piece of paper" on 17 January 2012
- **Dr Simukai Utete, Research Leader, Mobile Intelligent Autonomous Systems Group**, CSIR, gave a talk titled "Real-world field robotics" on 21 February 2012
- **Nicola Mulder, Associate Professor, Computational Biology Group**, University of Cape Town, gave a talk on the application of bioinformatics to the study of human disease, on 13 March 2012
- **Dr Roberto Trotta, an astrophysicist at Imperial College London** and a communicator of science, freelance science journalist and broadcaster gave a talk on 3 April 2012 titled, "One day, Sir, you may tax it: How Faraday's famous reply to the Chancellor of the Exchequer, encapsulates the need for blue sky research even and especially at times of financial hardship."
- **Professor Ben Turok, Trustee of AIMS and a Member of Parliament** spoke about Africa's economic renewal on 22 May 2012



Joint Initiatives

In 2010, AIMS signed a memorandum of understanding with the Council for Scientific and Industrial Research (CSIR). During the period under review, three CSIR students attended courses at AIMS; Dr Simukai Utete, Dr Jonathan Clarkson and Natasha Govender lectured a course on Robotics as part of the Postgraduate Diploma programme; and Dr Utete supervised the work of an AIMS postgraduate diploma student. The essay was entitled "Spatial placement methods for robots and sensors".

An MOU between AIMS-South Africa, AIMS-NEI and the University of British Columbia (UBC) was signed in January 2012. Through this agreement UBC commits funding to AIMS-South Africa under the One for Many Scholarship Programme. Parties also agreed to work collaboratively to facilitate visits of UBC faculty to AIMS-South Africa and the entrance of AIMS graduates into the UBC's graduate programmes.

Professor Green participated in regular planning meetings of the umbrella organising committee for the Mathematics of Planet Earth 2013 over the past year. The committee has decided that one of 10 special international public lectures will be held at AIMS with partial funding from the Simons Foundation.

In fulfillment of the MOU signed between AIMS-South Africa and the University of Montreal in 2010, which called for the creation of joint workshops, a Quantum Information and Computing School and Workshop was held at AIMS in June 2012.

Plans are in progress for the biennial CIMPA School on Evolutionary Equations with applications in Natural Science, to be held at AIMS in July 2013.

AIMS-South Africa is one of the participants in the German-South African Year of Science programme of activities and has been awarded funding for research or teaching visits by members of the Singular Group at Kaiserslautern, a workshop with the Berlin Mathematical School and the travel costs of German lecturers participating in AIMSSEC courses.

Federal Minister Dr Annette Schavan, together with other delegates from Germany including Dr Horst Freitag, Ambassador of the Federal Republic of Germany, Professor Helmut Schwarz, President: Alexander von Humboldt Foundation, Professor Margret Wintermantel, President: German Academic Exchange Service and Professor Jörg Hacker, President: German National Academy of Science, Leopoldina, visited AIMS on Tuesday 17 April 2012. The visit formed part of the activities that took place in Cape Town for the opening of the German-South African Year of Science (2012/2013).



Meetings Attended

The 54th annual congress of the South African Mathematical Society was held at the Nelson Mandela Metropolitan University from 29 November to 3 December 2011. This was the second joint international conference of the South African and American Mathematical Societies.

Plenary speakers included Professor Daya Reddy (from UCT and an AIMS Council Member and Trustee) and Professor Peter Sarnak (from the Institute for Advanced Study, Princeton, who is also an AIMS distinguished Research Fellow). About 350 delegates attended the meeting, among them 16 AIMS Alumni who presented talks. AIMS donated prizes for the top two Master's and PhD presentations.

In the week commencing 5 March 2011, Professor Green attended a workshop and meetings all involving AIMS activities. The workshop was held at the American Institute for Mathematics, in Palo Alto near San Francisco, and involved planning for the 2013 Mathematics of Planet Earth special year (www.mpe2013.org). AIMS-South Africa is one of the participating institutes. He also visited the Perimeter Institute for Theoretical Physics, for discussions with Professor Neil Turok and to learn more about this institute, which is a close partner of AIMS. Following this he spent a day in Vancouver, where he visited the University of British Columbia, who have shown great interest in and support for AIMS.

Professor Green visited AIMS-Sénégal in November 2011 and again in April 2012 to attend their annual Academic Council meeting and

for discussion related to their academic programme and student intake for 2012-2013 academic year.

Professor Green also attended the Global Young General Assembly which was held in Johannesburg in May 2012 and included 80 young scientists from 40 countries, distinguished senior scientists and science administrators from around the world. The conference focused on concrete actions young scientists can take to advance a sustainable future.

Professor Green attended the Euroscience Open Forum 2012, which took place in Dublin, Ireland from 11 to 15 July. As part of the programme in the section titled "An Educational Revolution to reveal Scientific Talent in Africa", Professor Green gave a presentation on AIMS and the NEI network. He was joined by Hind Ahmed, a 2005 PGD graduate who gave a presentation about her home life in Sudan, her time at AIMS and all that she has achieved since leaving AIMS.

The Strathmore International Mathematics Research Meeting was held in Kenya from 23 to 27 July 2012. The theme of the meeting was "Enhancing Mathematics research in African universities through international collaboration". Professor Green gave the keynote address and a presentation in Pure Mathematics.

AIMS Evaluation

During the period under review, AIMS-South Africa underwent an independent external evaluation as part of the Monitoring and Evaluation plan submitted by AIMS-NEI to the International Development Research Centre in July 2011. The evaluation was commissioned by AIMS-NEI and sought to address both learning and accountability as the AIMS-NEI rolls out its growth plan to replicate centres of excellence for mathematical sciences, similar to AIMS-South Africa across Africa.

The evaluation sought to identify the results achieved to date, to contribute to lesson learning for enhanced performance of AIMS-South Africa and to inform the development of future centre-specific strategies for AIMS-South Africa and other new centres within the AIMS network. The evaluation was carried out by a team of independent evaluators from Canada and South Africa led by Dr Dorothy Nyambi. The final report will be available soon.

The AIMS-NEI Network



AIMS-Sénégal, the second centre in the AIMS network was officially opened on 6 September 2011. Jan Groenewald, IT Manager travelled to Sénégal to assist with preparations for the opening by setting up the IT network and training the local IT staff. Igsaan Kamalie, Facilities Manager, also travelled to Sénégal to help establish the facilities for the students. In October 2011, Frances Aron visited AIM-Sénégal to assist the language lecturer in developing language and communication classes.

AIMS-South Africa staff also assist the AIMS-NEI Secretariat in a senior advisory support capacity. Professor Barry Green is the Director of Academic Development and a member of the AIMS-NEI Board. Deborah Wilsnagh is the Senior Advisor, HR and Financial Operations and Linda Camara, is the Strategic Communications Advisor and oversees communications and branding for AIMS-NEI.

From 23 to 25 May 2012, AIMS-South Africa staff participated in the first ever AIMS-NEI Network Strategy Planning Meeting. The workshop was hosted by the AIMS-NEI Secretariat and attended by representatives from each of the AIMS Centres as well as the Perimeter Institute for Theoretical Physics in Canada. The objective of the workshop was to answer the three questions: Where is AIMS now and how did we get here? Where do we go from here and how do we get there? What is the roadmap for future success? The outcomes of this meeting will help support and guide the development and launch of future AIMS Centres, ensuring their seamless integration into a network designed to build a critical mass of highly skilled maths and science graduates across Africa.

AIMS-Ghana, the third centre in the AIMS Network, is set to open in August 2012. Some staff from AIMS-South Africa will also travel to Ghana to assist with these preparations.



Visitors

August 2011

German delegation: Dr Helga Braun, Deputy Minister of Education and Research of the Federal Republic of Germany. Mrs Susanne Madders, Head of the African Department in the Germany Ministry of Education and Research, Mrs Maja Clausen, Head of Department for Research, Science and Technology at the German Embassy in Pretoria and Mrs Sandra Röttgen.

September 2011

Ethiopian delegation composed of scientists setting up the Entoto Astronomical Observatory and Space Science Centre:

Dr Baylie Dامتie, Bahir Dar University President
Professor Gezahegn Yirgu, Ethiopian Space Science Society (ESSS) Manager and, Dean School of Earth and Planetary Science, AAU representative
Tese gaye Kassa, Bahir Dar University representative
Dr Solomon Belay, Chair, Research, Education and Public Outreach Program and EAOSS, Technical Committee Chairman, ESSS representative

October 2011

Professor Giorgio Israel, a distinguished scholar from Università di Roma "La Sapienza"
Esther Dyson, expert in startups and daughter of Freeman Dyson the famous physicist
Professor Ivan Gutman, University of Kragujevac, Serbia
Charles Maisel, social entrepreneur and innovation coach

November 2011

Dr Matodi Maserumule, Dr Thulani Dlamini, Ms Pinda Situnda, Mr Kagiso Keatimilwe (CSIR)
Associate Professor Lincoln D. Carr, Humboldt Fellow Physikalisches and Department of Physics, Colorado School of Mines.
Professor Garth Dales (Leeds) and Professor Donna Strauss (Leeds)
Tshepo Molema, DST

December 2011

Professor Therese Tchombe and Professor Khalifa Alsuwaidi, jury members for the UNESCO-Hamdani Bin Rashid Al Maktoum Prize for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers
Mr Faniry Harijoana Razafindrazaka, AIMS Alumnus, currently a PhD student at the Berlin Mathematical School at the Freie Universität, Berlin
Professor Malik Maaza, iThemba labs
Professor John Webb, Department of Maths and Applied Maths, University of Cape Town
Professor Paul Vanderlin, University of Stockholm, Sweden
Associate Professor Vishnu Jejalla, Research Chair, University of the Witwatersrand

January 2012

Dr Adam Kirrander, Harvard University
Rahman Amanulla, Postdoc in observational astrophysics and cosmology at the Oskar Klein Centre at Stockholm University
Professor Ravi Sheth, Professor and Associate Chair for Graduate Affairs in the Department of Physics and Astronomy at Penn
Dr Paolo Creminelli, Research Scientist at ICTP
Professor Robert Nichol, Professor of Astrophysics, Director of Institute of ICG
Professor Ariel Goobar, Experimental Particle Astrophysics in the Department of Physics at Stockholm University

Professor Ue-li Pen, Associate Director, Canadian Institute for Theoretical Astrophysics
Heather Campbell, PhD student at ICG
Professor Lennart Ohlsson, Lund University, Sweden
Professor Lars Kjeseth, El Camino College in Torrance, California, USA
Hilmar Schmudt, Der Spiegel

February 2011

Professor Hua Wang, Southern University, Georgia
Professor Frikkie Scholz and Rene Kotze, NITHEP
Professor Raju Venugopalan, Brookhaven National Laboratory and Stony Brook University, USA
Mr Geoff White, Councillor, High Commission of Canada
Professor Abdul-Aziz Yakubu, Howard University, Washington,
Professor Avner Friedman, Ohio State University and Professor Urszula Ledzewics, Southern Illinois University
Dr Hugo Touchette, Queen Mary University, London

March 2012

Mr Okendo Lewis Gayle, The Harambe Entrepreneur Alliance
Professor Sergej Rjasanow, Universität des Saarlandes, Saarbrücken, Germany and his wife Professor Kerstin Rjasanowa, also a mathematician at Fachhochschule Kaiserslautern, University of Applied Sciences
Dr Makoto Fujiwara, TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics and the University of Calgary

April 2012

Opening of the German-South African Year of Science 2012/2013, Dr Annette Schavan, Federal German Education and Research Minister, Dr Horst Freitag, Ambassador of the Federal Republic of Germany, Professor Helmut Schwarz, President: Alexander von Humboldt Foundation, Professor Margret Wintermantel, Presidedent: German Academic Exchange Service and Professor Jörg Hacker, President: German National Academy of Science Leopoldina

May 2012

Kirsten Poppendieck, German Freelance Radio Journalist

June 2012

Professor Bengt Fornberg, Colorado at Boulder, USA



Governance and Administration

AIMS Trust

Members of the AIMS Trust met on 23 January 2012. The AIMS Trust is a registered charitable trust with tax exemption with the following appointed trustees: Professor Russel Botman, Professor Fritz Hahne, Professor Keith Moffatt, Professor Daya Reddy, Professor Ben Turok, and Professor Neil Turok. Professor Jan van Bever Donker retired from the Trust in early 2012, and Professor Brian O'Connell has accepted an invitation to join the Trust.

AIMS Council

AIMS is governed by a Council which includes representatives of each of the six-partner universities. The AIMS Council met on 23 January 2012. Its current members are Professor Ramesh Bharuthrum (University of the Western Cape) who was appointed in March 2012, Professor Hendrik Geyer (Stellenbosch University), Professor Daya Reddy (University of Cape Town), Professor Grae Worster (University of Cambridge) Professor Graham Richards (Oxford University), Dr Tsou Sheung Tsun (Oxford University), Professor Stephane Ouvry (Université de Paris Sud XI), Dr Philippe Mawoko (NEPAD Office of Science and Technology) with Professor Neil Turok (Perimeter Institute) as Founder and Chair, and Professor Barry Green (Director of AIMS) as an ex officio member. Professors Keith Moffatt and Jan van Bever Donker resigned from the Council during the period under review.

AIMS 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. Members of the Board during the period under review were: Professor Edward Lungu (University of Botswana) as Chair, Professor Jacek Banasiak (University of KwaZulu-Natal), Professor David Fisher (University of the Western Cape), Professor Barry Green (AIMS), Dr Sizwe Mabizela (Rhodes University), Dr Peter Martinez (South African Institute of Physics), Dr Thandi Mgwebi (NRF), Professor David Sherwell (University of the Witwatersrand), Dr Sibusiso Sibisi (Council for Scientific and Industrial Research), Professor Arnold van Zyl (Stellenbosch University) and Professor Hlangani Siweya (South African Mathematical Society).



AIMS Executive Team

Members of the Executive Team during the period under review were Professor Francis Benyah and Dr Rafiq Omar from the University of the Western Cape, Dr Hannes Kriel and Professor Ingrid Rewitzky from Stellenbosch University, and Dr Mark Berman and Professor Nicola Mulder from the University of Cape Town. During the reporting period Dr Jesse Ratzkin stood in for Dr Mark Berman who was on research leave. Members of the Executive Team assist the Director with the selection of students for the PGD and DAAD scholarships, as well as with other tasks related to the academic programme and the partnership with the three local universities.



Staff

In August 2011, Rene January was appointed full-time at AIMS-South Africa, continuing as Administrative Officer in the Cosmology Research Group and becoming an Administrator in the Research Centre to assist Lynne Teixeira, Manager: Administration and Research, along with A'eeda Rhodes. Linda Camara joined as Communications Officer. Liesl Jones was appointed full-time as Finance Officer to assist Deborah Wilsnagh, Manager: Finance and Human Resources. In February 2011 Waseem Elliot joined IT manager Jan Groenewald and Tom Bamford in the IT section as a Systems Administrator. Manager Igsaan Kamalie, Fazley Jattiem and Emmanuel Kongolo continued providing support in the Logistics and Facilities division.

For AIMSSEC, Barrie Barnard and Toni Beardon are responsible for managing the distance-learning with the help of two temporary lecturers Elizabeth Turok and Sari Smit. Chris Clarke made a remarkable impact as teaching associate by developing AIMSSEC's course management system. Virginia Davidson was appointed on 1 July 2012 as Office manager/IT coordinator to share the administrative work with Najwa Chellan. There are plans to appoint an academic lecturer with the UNESCO-Hamdan prize money.



Lecturers and Tutors

Visiting lecturers are invited to teach courses on the AIMS academic programmes a number of teaching assistants are appointed to assist them and the AIMS Directors. During the year under review, the following teaching assistants were appointed: Gordon Nana Kwesi Amoako (Ghana), Emma Coutts (UK), Laila El Ghandour (Morocco), Fadoua El Moustaid (Morocco), Jai Grover (Canada), Markus Kruger (South Africa), Gaston Mazandu (Congo), Felix Oghenekohwo (Nigeria), Patrice Okouma (Gabon), Edgar Alfred Ouko Otumba (Kenya), Dimbinaina Ralaivosoaona (Madagascar), Tahirivonizaka Rahantamialisoa (Madagascar), Emile Chimusa Rugamika (Democratic Republic of Congo), and Maitagorry Helene Schade (Germany)

Frances Aron continued as English and Communications Lecturer while Jan Groenewald also taught a number of IT-related courses.



Information Technology

In 2011-12 the IT department's focus was on team-building, service upgrades, and creating a desktop science software distribution to cater for all AIMS centres.

Gordon Amoako, a tutor helping in the IT department, left AIMS to start his PhD at UCT. He was replaced by an AIMS alumnus, Emile Chimusa, from the UCT Computational Biology group. Thabo Ntitsane returned to his post as Network Manager at the National University of Lesotho, and was replaced by a new system administrator, Waseem Elliot in February 2012.

Tom Bamford attended industry conferences: Google South Africa 2.0, the Africa@Home Hackfest, Scaleconf, Science Hack Day, Free Software Geographic Information Systems, and IPv6 training. IT Manager Jan Groenewald attended wireless training, tutored at the Advanced School on Scientific Software Development at ICTP in Trieste, Italy, and accompanied students on visits to Muizenberg-based Earth Sciences Consultancy Umvoto, and Google Incubator Umbono.

The AIMS wireless network was extended to the upper floors of the main AIMS building and to the tutor and researcher accommodation 500 metres from AIMS. New servers and improved services include a firewall and web cache with bandwidth management, a weekly backup system, upgrading to the new Virtual Private Network connection to Stellenbosch University, an Interactive Voice Menu system for the phones, and a monitoring system for desktops and servers. Additional equipment include data projectors, printers, and staff laptops. A website for the AIMS/UCT/UWC Honours in Mathematical Finance was implemented. Nine workshops were supported throughout the year, with Ubuntu installations for visitors now a standard offering.

AIMS signed a Memorandum of Understanding with TENET for a shared-access circuit. Via this agreement the monthly internet bill will reduce by 55%, at a once-off cost of 50% of the current annual internet cost. This will increase AIMS' national connectivity by a factor of 21! While this will alleviate pressure and increase AIMS' capability to collaborate nationally, AIMS will continue to pursue direct SANReN connectivity to truly benefit from international cloud services and from high performance computing opportunities available at CHPC and SA-GRID.

The courses Computing and LaTeX and Ubuntu for Science were taught to both the PGD and Honours in Mathematical Biology students. Parallel computations were performed using all the AIMS desktops as a 130-node cluster.

Academic staff and students were assisted with specialist Free Software for application development frameworks, data visualization, finite element solvers, genome association analysis, geodesy, geographic information systems, graph theory, mathematical finance modelling, model checkers, network simulation, neural systems, operational research, particle physics, phylogenetic inference, radio astronomy, regression analysis, robotics, statistical data interpretation, and symbolic computation.

The Free Software mathematics application Sage was packaged for easy installation on Ubuntu. AIMS-desktop (<https://launchpad.net/aims-desktop>) was created to be used as a science desktop distribution at all AIMS centres and on visitor laptops.

The IT manager travelled to AIMS-Sénégal to deploy scientific software, and to teach Computing and LaTeX including translation technologies available in Ubuntu and Google Apps; which is crucial at this dual language institute. The AIMS student application database has been made available for applications and proposals at all AIMS centres, until NEI adapts it into a multi-lingual system able to cater for multiple centres, monitoring and evaluation, and alumni tracking. Liaison with AIMS-Ghana to consult on IT Infrastructure and scientific computing is ongoing. A vision for future IT infrastructure and shared services was presented at the NEI Strategy and Planning meeting which was held in May 2012.

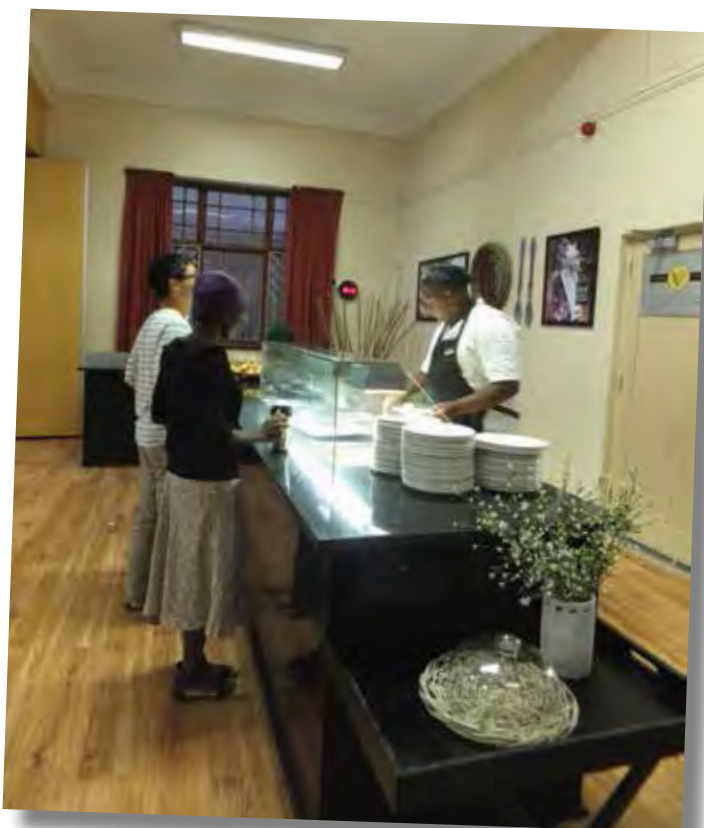


Facilities

Two new vehicles were purchased, a Quantum 14 seater and an Avanza 7 seater for student transport.

From April to August 2011, the tutor and visiting lecturer accommodation in Watson Street and St Claire's was painted and new decorative items, including curtains, bed lamps, etc. were added. The kitchens were repainted and new counters and cupboards fitted. In the main AIMS building two new offices and a new cloakroom were constructed.

In December 2011, three storage areas were converted into rooms for students, and a new storage area was built. The downstairs computer lab was painted and refitted with new counters, new carpets and sliding boards. The seminar room was also repainted and new sliding boards installed. A roller board was also installed in the Research Centre and security was improved with a security-access control gate.



AIMS-South Africa Financial Reports



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
104 Lebesevenende oor kennis potter

STELLENBOSCH UNIVERSITY AIMS R028

Audited Financial Statement for the year ended 31 December 2011

| | TOTAL | GENERAL OVERHEAD COSTS | PGD PROGRAMME BURSARIES | ACADEMIC PROGRAMME COSTS | POST AIMS BURSARIES | HONOURS PROGRAMME BURSARIES | RESEARCH PROGRAMME COSTS | ENDOWED SCHOLARSHIPS | MOXTERSTEIN INITIATIVE & AMFET | PRIOR YEAR 31/12/2010 |
|--|----------------------|------------------------|-------------------------|--------------------------|---------------------|-----------------------------|--------------------------|----------------------|--------------------------------|-----------------------|
| TOTAL INCOME | 17 881 314.02 | 5 886 936.81 | 4 307 154.97 | 4 490 000.00 | 2 722 742.14 | 132 500.00 | 280 000.00 | 272 676.00 | 0.00 | 16 995 049.96 |
| Anonymous | 0.00 | | | | | | | | | 120 681.20 |
| Cambridge University Press | 213 147.90 | | 313 147.50 | | | | | | | 279 490.00 |
| Canon Collins | 0.00 | | | | | | | | | 44 000.00 |
| DAAD | 1 686 340.00 | | | | 1 685 340.00 | | | | | 1 182 750.00 |
| Department of Higher Education (DHE) (1/11/11) | 4 000 000.00 | | | 4 000 000.00 | | | | | | 4 000 000.00 |
| Department of Science and Technology | 1 600 000.00 | 740 000.00 | | 480 000.00 | | | 280 000.00 | | | 1 600 000.00 |
| Friends of AIMS | 40 510.00 | | 49 610.00 | | | | | | | 96 000.00 |
| Foreign Exchange Profit | 1 041.48 | 1 341.48 | | | | | | | | 3 487.04 |
| Foundation Prisenroep | -429 134.62 | | 429 134.62 | | | | | | | 77 000.00 |
| Google (Trust Foundation) | 0.00 | | | | | | | | | 8 823 628.91 |
| Gifts and Gains | 17 380.50 | | 17 380.50 | | | | | | | 0.00 |
| ORC | 2 946 222.18 | | 2 475 222.18 | | 471 000.00 | | | | | 0.00 |
| London Mathematical Society | 166 281.00 | | 166 281.00 | | | | | | | 91 474.39 |
| Martin Fees (Endowed Scholarship) | 92 000.00 | | 92 000.00 | | | | | | | 92 000.00 |
| Nel Tunoi | 6 407.62 | | 6 407.62 | | | | | | | 7 042.00 |
| One for Many | 1 016 696.51 | | 458 264.40 | | 558 432.12 | | | | | 0.00 |
| Royalties | 0.00 | | | | | | | | | 44.84 |
| SACBMA | 192 900.00 | | | | | 132 000.00 | | | | 90 000.00 |
| Stellenbosch University | 0.00 | | | | | | | | | 420 000.00 |
| Stephen Hawking (Endowed Scholarship) | 92 000.00 | | 92 000.00 | | | | | | | 92 000.00 |
| Sundry Income | 44 911.80 | 44 911.80 | | | | | | | | 30 321.96 |
| The Paul G. Allen Family Foundation (Endowed Scholarship) | 80 000.00 | | 80 000.00 | | | | | | | 80 000.00 |
| The Victor Kobach Memorial Fund | 156 827.20 | | 156 827.20 | | | | | | | 153 640.00 |
| Unilever Rite Aid | 178 482.37 | 178 482.37 | | | | | | | | 0.00 |
| Workshops and Conferences | 1 224 366.89 | 1 224 366.89 | | | | | | | | 384 448.51 |
| Other income: Contributor by Projects (Accom & Admin Fees) | 2 820 492.26 | 2 820 492.26 | | | | | | | | 2 451 682.00 |
| Other income: Contribution by AIMS-NEI | 1 14 916.75 | 114 916.75 | | | | | | | | 0.00 |
| Other income: Contribution by Cost Centre: HRP | 759 200.00 | 844 000.00 | | | | | | 226 000.00 | | 480 000.00 |
| Other income: Interest Received | 356 707.51 | 316 326.51 | | | | | | -47 679.00 | | -42 896.75 |
| TOTAL EXPENSES | 16 695 946.47 | 9 071 154.79 | 4 059 057.24 | 4 499 833.23 | 2 815 000.00 | 191 680.00 | 206 805.86 | 222 137.89 | 372 357.40 | 20 490 544.85 |
| Accountation (General Overhead Lev) | 1 530 492.26 | | 1 160 491.34 | 28 142.00 | | | 64 400.00 | | | 1 511 620.00 |
| Administration Fees (General Overhead Lev) | 591 000.00 | | 480 000.00 | 440 000.00 | | | | | | 920 000.00 |
| Advertising | 0.00 | | | 25 000.00 | | | | | | 52 133.00 |
| Acad Fee | 28 090.00 | | | | | | | | | 18 893.00 |
| Affiliation, Memberships and Subscription Fees | 124 601.00 | 2 700.00 | 121 901.00 | | | | | | 1 418.00 | 98 664.89 |
| Book and periodicals | 9 348.98 | 7 824.98 | | | | | | | | 6 873.31 |
| Building, Building Refurbish Costs, Equipment & Furniture | 620 988.83 | 581 489.67 | | | | | | 38 499.86 | | 682 306.84 |
| Bursaries | 2 979 000.00 | | | | 2 815 000.00 | | | 164 000.00 | | 2 370 670.00 |
| Catering | 2 637 230.96 | 826 967.66 | 1 419 676.80 | 305 678.00 | | 86 211.86 | | | | 2 722 980.63 |
| Cleaning and Sanitation | 29 202.72 | 29 202.72 | | | | | | | | 40 606.16 |
| Computer Materials | 118 640.67 | 86 340.62 | | | | | | 27 100.16 | | 182 941.64 |
| Consultation Fees and Services | 419 828.63 | | | 419 828.63 | | | | | | 381 236.01 |
| Consumable Materials | 254 297.96 | 226 994.24 | | | | | | | 799.95 | 207 718.01 |
| Copying and Printing | 46 402.88 | 46 402.88 | | | | | | | | 72 388.28 |
| Courses | 26 400.00 | 11 400.00 | | 15 000.00 | | | | | | 0.00 |
| Flowers and Gifts | 7 348.50 | 7 348.50 | | | | | | | | 4 526.91 |
| Foreign Exchange Loss | 5 297.83 | 5 297.83 | | | | | | | | 2 026.88 |
| General Office Expenses | 6 414.65 | 4 980.16 | | | | | | | 1 934.00 | 28 140.92 |
| General Vehicle Expenditure | 193 326.74 | 193 326.74 | | | | | | | | 0.00 |
| Insurance | 80 427.80 | 80 427.80 | | | | | | | | 59 701.09 |
| Internal Transfer of Funds | 311 884.40 | | | | | | | | 311 884.40 | 3 352 086.01 |
| Internal Expenses | 293 905.41 | 30 336.06 | 59 210.34 | 131 759.01 | | | 19 204.30 | | | 211 926.25 |
| Medical Expenses | 243 637.36 | | 218 392.00 | 34 245.36 | | | | | | 260 382.50 |
| Miscellaneous Expenses (Security Fees, Refuse, Poles) | 1 056 147.26 | 1 038 509.26 | | | | | | 18 638.00 | | 800 626.41 |
| Photographic Materials | 5 164.48 | 5 164.48 | | | | | | | | 8 591.48 |
| Postage | 7 354.80 | 7 354.80 | | | | | | | | 3 886.74 |
| Reimbursement | 4 238 494.28 | 2 059 862.76 | | 3 388 631.52 | | | | | 258.79 | 3 438 590.54 |
| Repairs & Maintenance | 183 240.36 | 192 240.36 | | | | | | | | 147 616.33 |
| Reparation costs (Students) | 0.00 | 0.00 | | | | | | | | 626 100.00 |
| Security Services | 12 824.16 | 12 824.16 | | | | | | | | 10 868.60 |
| Stationery | 64 281.79 | 53 334.82 | | | | | | | 1 216.67 | 48 183.88 |
| Student Stipends | 634 780.66 | | 607 780.66 | | | | 26 000.00 | | | 635 283.00 |
| Telephone and Cell Phone Costs | 86 892.71 | 86 892.71 | | | | | | | | 74 666.85 |
| Travel Expenses | 1 716 948.93 | 496 732.66 | 579 712.90 | 624 537.62 | | | | 63 217.84 | | 1 624 193.30 |
| Capital Expenses - Furniture and Equipment | 0.00 | | | | | | | | | 48 278.83 |
| Building Maintenance Reserve Fund | 0.00 | | | | | | | | | 150 000.00 |
| Computer / Equipment Replacement Reserve Fund | 0.00 | | | | | | | | | 230 030.00 |
| NET INCOME OVER EXPENDITURE | -1 104 630.56 | -386 116.97 | -310 602.37 | -8 832.23 | -80 257.86 | -59 180.00 | 78 174.14 | 50 741.14 | -302 257.40 | -1 436 494.89 |
| ACCUMULATED FUNDS AT 1 JANUARY 2011 | 6 136 241.69 | 295 344.97 | 2 689 773.27 | 3 263 139.77 | 822 411.23 | -295 457.81 | 19 163.86 | 523 680.74 | 491 267.64 | 3 643 676.59 |
| FUNDS AVAILABLE AT 31 December 2011 | 7 003 711.14 | -86 771.00 | 2 347 870.90 | 3 254 307.54 | 736 153.38 | -348 638.81 | 92 337.80 | 580 401.88 | 119 000.44 | 6 196 311.60 |

SIGNED
MS F Malles
Deputy Director Financial Services

Malles

Boer

Notes to the financial statements for AIMS (Cost Centre R028) for the year ended 31 December 2011

These financial statements are official documents of Stellenbosch University who provide financial administration services to AIMS.

Income

1. Fund received via AIMS-NEI from the IDRC and One for Many, for 50 diploma student bursaries for the 2010/2012 academic year and for 45 diploma student bursaries for the 2012/2013 academic year.
2. The donation from Cambridge University Press contributes towards 4 diploma student bursaries.
3. Grant received from the Department of Higher Education and Training is for the Academic Programme.
4. The funds received from the Department of Science and Technology cover:
 - 4.1. A grant for African tutors and researchers
 - 4.2. A contribution to core funding.
5. Funds received from Friends of AIMS are donations received from visiting lecturers at AIMS who have opted to donate their honoraria.
6. The donation received from Fondation Philanthropia covers 5 student bursaries
7. Funds received from the Tides Foundation (Google) cover general support, diploma student bursaries and half-bursaries for post-AIMS studies.
8. Grant received from London Mathematical Society contributed towards travel costs for African students who attended the AIMS diploma programme in 2008-09 and 2009-10.
9. 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, provides AIMS with 2 diploma student bursaries per annum.
10. An endowed scholarship received from The Paul G Allen Foundation provides AIMS with 1 diploma student bursary per annum.
11. The donation received from the Victor Rothschild Foundation is for 2 diploma student bursaries.
12. Funds received from Université Paris Sud towards project expenses including certain capital expenses.

Expenses

1. All expenses shown for 2011 refer to actual costs directly attributable to the relevant AIMS Projects, as detailed on the financial statement.
2. Accommodation costs refer to costs for students, lecturers, 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 includes general administration and other general expenses of the institution, departmental administration, sponsored projects administration, student administration and services which includes affiliation costs, computer materials costs, consumables, general office costs, staff costs, telephone costs etc.
4. Bursaries and stipendia, staff remuneration, 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 2011, accumulated funds include earmarked funds as listed. Any project shortfalls are taken from existing funds available.

Events after year-end

Funding for a further three year cycle was approved by the Department of Science and Technology.



AIMS RESEARCH CENTRE (27798)

Financial Statement for the year ended 31 December 2011

| | 31/12/2011 | 31/12/2010 |
|--|----------------------|---------------------|
| | R | R |
| Income | 782,803.59 | 4,395,532.17 |
| NRF | 500,000.00 | 4,000,000.00 |
| Interest received | 282,154.56 | 394,238.00 |
| Foreign Exchange Profit | 649.03 | 1,294.17 |
| Expenses | 3,887,174.90 | 3,621,521.33 |
| Accommodation and catering | 57,225.21 | 330,354.25 |
| Administrative Fees | 132,000.00 | - |
| Affiliation and Registration Expenses | 6,359.96 | 6,829.00 |
| Audio Visual Expenditure | - | 600.00 |
| Bursaries | 489,645.00 | 554,256.60 |
| Consultation Fees | 314,230.71 | 363,967.50 |
| Consumables | 94,660.09 | 28,559.48 |
| Foreign Exchange Loss | 985.67 | - |
| Furniture & equipment | 31,713.25 | 132,415.86 |
| General Office Expenses | 126,376.30 | 1,295.00 |
| Internet | 92,304.00 | 83,100.00 |
| Medical Expenses | 46,901.00 | 39,194.00 |
| Printing and Stationery | 68,491.94 | 23,790.81 |
| Remuneration | 1,539,767.76 | 1,461,015.81 |
| Rent of premises | 132,000.00 | 120,000.00 |
| Travel Expenses | 754,514.01 | 476,143.02 |
| NET INCOME OVER EXPENDITURE | -3,104,371.31 | 774,010.84 |
| ACCUMULATED FUNDS AT 1 JANUARY 2011 | 6,660,586.69 | 5,886,575.85 |
| FUNDS AVAILABLE AT 31 DECEMBER 2011 | 3,556,215.38 | 6,660,586.69 |

SIGNED:

Ms F Majiel

Deputy Director: Financial Services

Notes to the financial statement for the AIMS RESEARCH CENTRE (Cost Centre 27798) for the year ended 31 December 2011

1. Accommodation and catering costs refer to costs for visiting researchers, postdoctoral fellows, doctoral and Master's students residing at 14 Watson Street, Muizenberg, during the year under review.
2. Bursary costs include bursaries paid to postdoctoral fellows, doctoral and Master's students.
3. Furniture and equipment includes the further acquisition of computers and furniture in order to accommodate an increase in researchers, visiting researchers and students at the Research Centre.
4. Medical expenses refer to medical costs for visiting researchers, doctoral and Master's students for the duration of their stay at AIMS.
5. Remuneration costs and consultation fees include salaries for resident and senior researchers, Administrative Officer, part costs for Administrative and Research Manager, and honorarium stipends to visiting researchers not covered by grant received from the Department of Science and Technology.

Events after year-end

Funding for a further three year cycle was approved by the National Research Fund (NRF).



AIMSSEC – R268

Financial Statement for the year ended 31 December 2011

| | <u>31/12/2011</u> | <u>31/12/2010</u> |
|--|---------------------|---------------------|
| | R | R |
| INCOME | 3,416,790.60 | 1,445,955.06 |
| Donations | | |
| Aga Khan Education Services | - | 8,000.00 |
| Anonymous | - | 11,922.21 |
| Christ Church, Oxford | - | 2,715.81 |
| Churchill College, Cambridge | - | 1,086.33 |
| Claire Hall, Cambridge | - | 9,994.19 |
| Datatec Education and Technology Trust | 284,171.00 | 200,000.00 |
| Emmanuel College, Cambridge | - | 1,086.33 |
| Girton College, Cambridge | - | 2,178.94 |
| Give and Gain | 5,885.58 | - |
| Kings College, Cambridge | - | 2,581.98 |
| Magdalene College, Cambridge | - | 2,065.57 |
| May and Stanley Smith Charitable Trust | - | 172,917.60 |
| Michaelhouse | - | 4,300.00 |
| Nuffield College, Oxford | - | 3,088.37 |
| Nuffield Foundation | 181,222.50 | - |
| Old Mutual Foundation | 200,270.00 | - |
| Oriol College, Cambridge | - | 516.40 |
| Rand Merchant Bank Fund | 500,000.00 | - |
| Sankhya Ltd | 29,965.07 | 29,679.22 |
| Sidney Sussex College, Cambridge | - | 1,194.96 |
| St Catherine's College, Cambridge | - | 2,191.40 |
| St John's College, Cambridge | 10,903.00 | 10,768.00 |
| St John's College, Oxford | - | 2,715.81 |
| Trinity Hall, Cambridge | - | 2,581.98 |
| University of Cambridge (Mobile Maths) | 11,127.70 | - |
| Victor Rothschild Memorial Fund | - | 133,440.00 |
| Zenex Foundation | 614,654.00 | 283,280.00 |
| Other income: Sundry | 109,340.33 | 3,177.45 |
| Other income: Sundry cash back | 19,770.00 | - |
| Department of Education: Eastern Cape | 1,349,275.00 | 290,475.00 |
| Department of Education: Kwazulu Natal | - | 120,700.00 |
| IMSTUS | 79,456.00 | 128,440.00 |
| Foreign Exchange Profit | 5.60 | 52.76 |
| Interest Received | 20,744.82 | 16,794.75 |
| EXPENDITURE | 2,785,880.66 | 1,304,747.41 |
| Advertising | 0.00 | 1,363.77 |
| Accommodation and Catering | 653,917.80 | 366,197.05 |
| Affiliation and Registration Fees | - | 280.00 |
| Books | - | 3,479.10 |
| Bursaries | 519,225.00 | 21,072.00 |
| Consultation Fees and Services | 29,468.68 | 9,076.00 |
| Consumable Materials | 4,353.45 | - |
| Foreign Exchange Loss | 534.57 | 746.13 |
| General Office Expenses | 14,138.97 | 14,939.66 |
| IT Services | 66,912.55 | 64,550.00 |
| Postage | 13,089.15 | - |
| Remuneration | 755,424.31 | 437,919.59 |
| Rent of Rooms | 64,262.10 | - |
| Services | 102,976.18 | - |
| Smaller Furniture and Equipment | 11,808.05 | - |
| Printing and Stationery | 25,317.05 | 33,190.34 |
| Travel Expenses | 525,453.00 | 351,933.75 |
| NET INCOME OVER EXPENDITURE | 630,909.94 | 141,207.65 |
| ACCUMULATED FUNDS AT 1 JANUARY 2011 | 334,742.58 | 193,534.93 |
| FUNDS AVAILABLE AT 31 DECEMBER 2011 | 965,652.52 | 334,742.58 |

SIGNED: 
 Ms F Majiet
 Deputy Director: Financial Services

SUPPORTERS

AIMS-South Africa continues to receive support from a wide range of donors. The Departments of Higher Education and Training and Science and Technology renewed their three-year grants in support of the AIMS academic programme and the Research Centre and in addition to the larger donors listed below, many lecturers and individuals provide support in the form of smaller online donations, and contributions of books, expertise and time. We are extremely grateful to all.

Current Donors

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- Stellenbosch University
- Professor Neil Turok
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- One for Many Scholarship Programme

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- Seardel Investment Corporation Limited, South Africa
- Cheryl Grunbock and Martin King
- The University of Cambridge Local Examinations Syndicate
- The Daniel Iagolnitzer Foundation (Fondation De France)
- The Go Open Source Campaign
- SUN Microsystems
- Hyper-Interactive Teaching Technology
- The Ellison Medical Foundation
- Fred Turok
- Hand Drum Rhythms, Victoria BC
- Professor Jonathan Webb, University of Cape Town (book donation)
- Professor Brian Abrahamson, Flinders University, Australia (book donation)
- Friends of AIMS including donations from lecturers
- Stella Innes, for the donation of the remarkable mathematical research library of her late husband, Evan Innes
- British Airways, South Africa Office
- Chicago State University
- European Mathematical Society Committee for Developing Countries
- Jonathan Leake, Sunday Times

AIMSSEC is grateful to its sponsors for supporting its programmes. The following sponsors donated more than R30 000:

- Datatec Educational and Technology Trust
- Department of Education: Eastern Cape
- Nuffield Foundation
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- Zenex Foundation



Future Plans

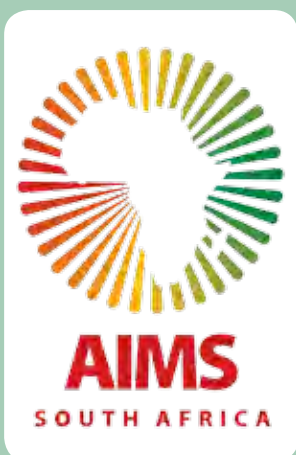
This year we plan an important change and two exciting additions to the AIMS-South Africa programme. The first is the conversion of our postgraduate diploma to a Master's degree and the second, a plan to film selected special courses at AIMS-South Africa, with the view to establishing an engaged online presence. This will enable us to interact more broadly with universities and other centres and institutions promoting the mathematical sciences in Africa. The third is to increase our involvement in the training of school teachers in South Africa by strengthening the capacity building activities of our Schools Enrichment Centre and highlighting a stream for prospective teachers within our core academic programme.

Following discussion with our council we decided to initiate the process of upgrading our postgraduate diploma and realigning it to be offered as a structured coursework Master's degree in the mathematical sciences. The three local universities, who award our qualification, have supported and assisted us with this process and so at the end of this academic year, our tenth anniversary, students will graduate with a Master's degree. This has also been an opportunity to reaffirm the positive partnership we enjoy and benefit from with our local partners. While AIMS will maintain the unique innovative character of its programme, this positive change will give greater recognition and value to our course and also bring it in line with the qualifications now being awarded at the new AIMS centres in Sénégal and Ghana.

The growth of all aspects of the programme at AIMS-South Africa makes the expansion of our facilities an essential part of our long-term plan for the future and we hope to initiate this process in the coming year.







African Institute for Mathematical Sciences

6 MELROSE ROAD | MUIZENBURG | CAPE TOWN 7945 | SOUTH AFRICA
TEL: +27 (0)21 787 9320 | FAX: + 27 (0)21 787 9321
EMAIL: info@aims.ac.za | WEB: www.aims.ac.za