

ANNUAL REPORT

2020



AIMS

African Institute for
Mathematical Sciences
SOUTH AFRICA

ABOUT US

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

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

This is the annual report of AIMS South Africa for the period 1 August 2019 to 31 July 2020. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2019 calendar year.

Since AIMS South Africa opened in 2003, 870 students, of which 35% are women, from 41 different African countries have graduated from its core academic programme.

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

AIMS South Africa offers:

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

* AIMS Next Einstein Initiative,
Kigali, Rwanda,
Email: info@nexteinstein.org.

For further information, see
www.nexteinstein.org





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FOREWORD

The 2019 - 2020 year at AIMS South Africa tested us in a way we could never have imagined beforehand. The first seven months were full of onsite activity, involving our Master's and PhD students, Postdoctoral fellows, researchers and visitors. For the months from March 2020 onwards AIMS was a different place, still achieving its key objectives, but under lockdown.

At the end of February, the International Mathematical Union (IMU) Executive Committee Meeting was held at AIMS and included the Fields Medallists Prof. Shigofumi Mori and Prof. Andrei Okounkov as visitors. From South Africa Prof. Loyiso Nongxa, who is presently serving as one of the Vice Presidents of the IMU, coordinated the arrangements for this meeting. It was a very special occasion and together with the South African Mathematical Society (SAMS), AIMS hosted a special day of engagement with local mathematicians and students. During that meeting the COVID-19 Pandemic was beginning to have a grave effect in Italy and participants wondered if flights would be operating as normal. Shortly after this in mid-March we were in a very strict lockdown situation, and AIMS South Africa changed to a closed environment, to maintain the health and safety of our students.

Since then almost all activities were offered virtually. Lectures, special courses, workshop activities and even the final examination process was conducted in this way. We adapted quickly and are very pleased to report that the academic programme was offered successfully online. Although lecturers weren't present at AIMS, their sessions and interaction with students generated the same enthusiasm and accomplished the learning experience we hoped for. Under lockdown, like a large family, all students at AIMS observed the national health regulations in a safe, monitored environment with good internet connectivity. This was essential to maintaining the AIMS programme. Our staff adapted to the new situation, mostly working from home, or at the AIMS residences where they are based. Our Academic Director, Dr Simukai Utete, and the Tutors, our IT Manager, Mr Jan Groenewald and the IT group, our Facilities Manager, Mr Igsaan Kamalie and his team took care of the academic programme and the residential needs of our students with care and understanding. There were a number of unexpected challenges, for example finding flights for our students to return home. Students who would normally leave at the end of June, have had to stay on at the centre until October when international flights again became possible. It is a pleasure to acknowledge our Administration and Finance teams led by Ms Deborah Wilsnagh, who have managed each situation with care and urgency. They have been on call till late at night and on weekends as needed.



In June this year for the first time the AIMS-ESMT (European School of Management Technology) Industry Immersion Programme was offered simultaneously at three centres: at AIMS South Africa, Ghana and Rwanda. Benefitting from the situation the course was presented online by our ESMT partners simultaneously to selected alumni and students at the three AIMS campuses. The programme was a great success and a very positive signal for the future. The course was co-ordinated by Mr David Attipoe and Mr Mark Heerden, who were based at the Muizenbeg centre throughout and Mr Nick Barniville, ESMT Director of Degree Programs, with support from Prof. Wulf Plinke, the ESMT Founding Dean.

Considering the lockdown situation our School Enrichment Centre, AIMSSEC, have also had to adapt and so planned to host their very successful Mathematical Thinking course online for teachers. Led by Dr Barrie Barnard this course replaced the residential course in 2020 and began in August. This may also open up new possibilities for the future.

During the year we said goodbye to Ms Rene January, who decided to pursue other work opportunities and to Dr Michelle Lochner, who was appointed to a joint position with the South African Radio Astronomy Observatory and UWC. Both colleagues have contributed to AIMS very significantly for many years. Rene has been an excellent Senior Research Centre Administrator, coordinating our workshop and Research Centre postgraduate support activities, and Michelle an excellent talented young researcher, who joined AIMS, while a PhD student of Prof. Bruce Basset and continued as a postdoctoral fellow and researcher, associated with the SKA project as well.

In December 2019 we were all saddened by the passing of Prof. Ben Turok, an AIMS Trustee, who contributed significantly to the establishment of AIMS in Muizenberg and was an active and inspirational supporter of AIMS since its founding.

This year has taught us all a great deal, and at AIMS, we are confident that we are better equipped now to offer our programme in the new global situation, adapting our model so that talented young African students in the Mathematical Sciences are taught by among the best international experts, learning from and interacting with them to obtain the unique AIMS qualification we are all proud of.

Barry Green
Director

ACADEMIC

PROGRAMMES

The AIMS Structured Master's is a structured degree in the mathematical sciences with three phases: foundational skills courses, elective (review) courses and a research project phase. AIMS South Africa has two intakes: an August intake and a January intake that aligns with the academic year in South Africa. This report covers the January 2019 intake, the 2019-20 August intake and the January 2020 group.

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2019 INTAKE)

Oral defences for the 19 students in the January 2019 intake took place in November 2019, and 16 students completed their programme the same month and participated in an on-site recognition of achievement event at AIMS in November. By December 2019, all of the intake had successfully completed project requirements and the programme. Graduation sessions for the January intake students take place, after their completion of the AIMS programme, at the universities where they are registered.

For the January 2019 intake, 32% of projects achieved a Distinction.

RESEARCH PROJECTS OF THE JANUARY 2019 INTAKE

Full name	Gender	Origin	Research Project Title	Supervisors
Saumu Athman Abdallah	F	Kenya	Symmetry Analysis of a Nonlinear System of Coupled Burgers Equations	CM Khaliq, North-West
Tshenolo Thato Daumas	F	South Africa	Convolutional Neural Network Model for Prediction of MHC-II Peptides Interactions	AM Degoot & W Ndifon, AIMS Rwanda
Ghislaine Flore Kabadiang Ngon	F	Cameroon	Fractional states of light	A Forbes, Witwatersrand
Precious Blessing Khumalo	F	South Africa	A Galois connection in the quasi-metrization of an ordered metric space	Y Gaba, Institut de Mathématiques et de Sciences Physiques, Bénin
Kiprono Elijah Koech	M	Kenya	Segmentation Refinement by Region Growing - A Post-processing Module for Convolutional Neural Network	B Bah, AIMS, S Reid & M Mweene, Aerobics Cape Town
Katlego Lentswe	M	South Africa	Forecasting Low Frequency Volatility using a Combination of Econometrics Models and Random Forests	M Kateregga, Impact Radius
Andani Alex Madula	M	South Africa	Towards improving inter-robot knowledge transfer for developmental robots using non-stationary model.	Dr N Makondo, IBM Research Africa
Zizipho Maqokolo	F	South Africa	Portfolio Optimisation in a Stable Regime Switching Market Framework	M Kateregga, Impact Radius - Forensiq,
Karabo Vincent Mogotsi	M	South Africa	Pricing credit default swaps using finite volume methods	P Mashele, North West
Willie Mohlongo	M	South Africa	A State Space Framework for Models with Uncertainty	D Ikpe & R Becker, AIMS
Ramatsimela Lebogang Mphahlele	F	South Africa	Crank-Nicolson method for real option valuation of risks related to climate change	P Mashele, North-West
Mzwakhe Mandlakhe Mthethwa	M	South Africa	Dynamic Parking Pricing	SL Tilahun, Zululand
Kibidi Alexander David Neocosmos	M	South Africa	Image Segmentation Using Convolutional Graph Neural Networks	B Bah, AIMS
Menzi Meerfact Ngcamphalala	M	South Africa	Machine Learning Methods in Long-Term Bond Price Prediction	D Ikpe & R Becker, AIMS
Yannick Harisson Nkocko Awountsa	M	Cameroon	Comparative Study of Semi-analytical and Numerical Methods for Solving Falkner-Skan Equations	P Sibanda & S Goqoa, KwaZulu-Natal
Star Aduratomí Oje	F	Nigeria	Breast Cancer Prediction using Machine Learning Algorithms - A Deep Learning Approach	Z Mungloo- Dilmohamud, Mauritius, M Mbiyavanga & N Tiffins, Cape Town
Zainab Olufunke Olukoga	F	Nigeria	Towards an Arbitrage Theorem in an Infinite Horizon	D Ikpe, AIMS & Y Gaba, Mathématiques et de Sciences Physiques, Bénin
Letladi William Rathaga	M	South Africa	Approximating European options using Artificial Neural Network and Finite Difference Method	P Mashele, North-West
Alungile Sukwana	M	South Africa	Comparing the Forecasting of Financial Data Using 1D Convolutional Neural Networks and LSTM	R Becker, AIMS

COMBINED COURSES TABLE

Period	Lecturer	Course	MSc Jan 2019	MSc Aug 2019	MSc Jan 2020	Hons Biomaths 2020
2019						
26 Aug – 22 Nov	Jan Groenewald, AIMS South Africa	Computing and LaTeX		x		
26 Aug – 22 Nov	Noluvuyo Hobana, AIMS South Africa	English and Communication Skills		x		
2 – 20 Sept	Stephan Wagner & Dimbinaina Ralaivaosoana, Stellenbosch	Mathematical Problem Solving		x		
2 – 20 Sept	Jeff Sanders & Lebeko Poulo, AIMS South Africa	Python		x		
23 Sept – 11 Oct	Yae Gaba, African Centre for Advanced Studies	Experimental Mathematics with Sage		x		
23 Sept – 11 Oct	Siaka Lougue, Institut de Recherche en Science de la Santé	Statistics		x		
14 – 25 Oct	David Aschman, Cape Town	Concepts and Problem Solving in Physics		x		
14 – 25 Oct	Magdaleen Marais, Pretoria	Algebra		x		
28 Oct – 1 Nov	Jonathan Marks, GIBS	Entrepreneurship Skills	x	x		
11 – 29 Nov	Kinvi Kangni, University Felix Houphouet Boigny	Harmonic Analysis		x		
11 – 29 Nov	Fernando Pestana da Costa, Aberta	Differential Equations		x		
11 – 29 Nov	Rafael Nepomechie, Miami	Quantum Mechanics		x		
2 – 20 Dec	Paul Taylor, National Institutes of Health, Bethesda	Signal Processing with Python		x		
2 – 20 Dec	Bruce Bartlett, Stellenbosch	Knot Theory		x		
2 – 20 Dec	Pete Grindrod, Oxford, Emmanuel Dufourq & Bubacarr Bah, AIMS	Data Science		x		
2020						
6 Jan –	Jan Groenewald, AIMS South Africa	Computing & LaTeX			x	x
6 – 24 Jan	Jeff Sanders, Lebeko Poulo & Martha Kamkuemah, AIMS South Africa	Python			x	
6 – 24 Jan	Mathematics in Industry Study Group, Zululand	Workshop		x		
6 – 24 Jan	Charlotte Kestner, Imperial College London	Model Theory		x	x	
6 – 24 Jan	Grae Worster, Cambridge & Richard Katz, Oxford	Fluid Dynamics		x	x	x
6 – 24 Jan	Ronnie Becker, AIMS South Africa	Financial Mathematics		x	x	
27 Jan – 14 Feb	Eric Andriantiana, Rhodes	Experimental Mathematics with Sage			x	
27 Jan – 14 Feb	Neville Fowkes, Western Australia	Industrial Modelling		x	x	x
27 Jan – 14 Feb	Stéphane Ouvry, Paris Sud XI	Introduction to Random Systems, Information Theory, and related topics		x	x	
27 Jan – 14 Feb	Phil Knight, Strathclyde	Networks		x	x	
24 – 13 Mar	Stefan Jaehnichen, TU Berlin	Entrepreneurship case studies		x	x	
24 Feb – 13 Mar	Wilson Lamb, Strathclyde	Analytical Techniques in Mathematical Biology		x	x	x
24 Feb – 13 Mar	Wolfram Decker & Gerhard Pfister, TU Kaiserslautern	Computational Algebra		x	x	
24 Feb – 13 Mar	Douw Steyn, University of British Columbia & Stefano Galmarini, Institute for Environment and Sustainability	Atmospheric Modelling		x	x	x
24 Feb – 13 Mar	David Spiegelhalter, Cambridge (video) & Daniel Nickelsen, AIMS	Statistics		x	x	x
16 Mar – 3 Apr	Matt Macauley, Clemson University	Algebraic Biology		x	x	x
16 Mar – 3 Apr	Nancy Neudauer, Pacific University	Mathematical Problem Solving			x	
6 – 24 Apr	Juerg Weber, Western Australia	Insurance Economics			x	
6 – 24 Apr	Jeff Sanders, AIMS	Designing Algorithms			x	
4 – 22 May	Simukai Utete, AIMS	Distributed Coordination			x	
4 – 22 May	Bubacarr Bah & Emmanuel Dufourq, AIMS South Africa	Data Science			x	
25 May – 12 June	Henri Laurie, Cape Town	Programming with Julia			x	
25 May – 12 June	Surafel Tilahun, Zululand	Multiobjective Optimization			x	
15 June – 3 July	Masood Khaliq, North West	Symmetry Analysis of Differential Equations			x	
15 June – 3 July	Justin Munyakazi, Western Cape	Numerical Mathematics			x	
23-25 September	Shiela Yabo and Mikael Samuelsson, UCT Graduate School of Business	Entrepreneurship			x	

MASTER'S IN MATHEMATICAL SCIENCES (AUGUST 2019 INTAKE)

Forty students arrived to join the 2019 August intake at AIMS South Africa. They began their programme with skills courses, including Mathematical Problem Solving, given in 2019 by Prof. Stephan Wagner and Dr Dimbinaina Ranaivosoaona (SU), Concepts and Problem-Solving in Physics with Prof. David Aschman (UCT) and Statistics with Dr Siaka Lougue, from the Institut de Recherche en Science de la Santé (IRSS) in Burkina Faso. The skills courses set a common foundation for the programme for students coming from a range of disciplines. Amongst other courses in the skills phase are modules on entrepreneurship. Review courses included Differential Equations with Prof. Fernando Pestana da Costa (Aberta University) and Quantum Computing with Prof. Rafael Nepomechie (University of Miami). Prof. Kinvi Kangni from Université Félix Houphouët-Boigny gave a course on Harmonic Analysis. Dr Magdaleen Marais (University of Pretoria) gave an Algebra course. Prof. Phil Knight from the University of Strathclyde lectured a review course on Networks. The subject proved very popular, attracting almost all of the students in both the August and January groups. The annual Mathematics in Industry Study Group was held at the University of Zululand in 2020. Students can take a MISG-themed course as an elective and three students opted to do this. They subsequently prepared reports and presentations on Study Group problems. These were assessed by Prof. Neville Fowkes (University of Western Australia) who also gave the Industrial Modelling review course. More information on MISG appears in the Workshops part of the report. A full list of the skills and review courses and lecturers can be seen on page 4.

Every year, visits to partner universities are organised, so that the students meet staff from the universities at which they are registered and hear about ongoing research and programmes. The university visits took place at the start of November. The visits also led some students to begin to think about project areas, and possible supervisors, for the research phase. During the year, students were offered several workshop and research opportunities. Prof. Pete Grindrod, from the University of Oxford, was one of the lecturers for the Data Science course (with Dr Bubacarr Bah and Dr Emmanuel Dufourq from the AIMS Research Centre). Prof. Grindrod offered an opportunity for two students from the Data Science class to attend a science policy workshop to be held at Oxford. The Fluid Dynamics course was given by Prof. Grae Worster from the University of Cambridge and Prof. Richard Katz from Oxford. Prof. Katz offered an internship place for a student to spend the UK summer conducting research in his group at Oxford. (Circumstances have necessitated some re-planning, given travel current travel issues.)

Research phase

In the research phase, the August group of students worked on a range of topics set by supervisors, including topics in computational algebra, topology, machine learning, financial mathematics, quantum information processing, statistics and cryptology.

Examinations

With lockdown being implemented as the August students were completing courses, many changes were necessary. The examination process was held by recording, with examiners and supervisors submitting questions in advance. The recording system was to allow for the possibility that panel members' connectivity might be an issue. In the event, a number of panel members were able to attend recordings and for those who could not, the recording was available. Each recording session was hosted by a teaching assistant. With the switch to online lectures and examinations, the programme relied significantly on the IT department for the setup throughout the process of courses, projects and examinations going online, and the Facilities department, catering department and others for the continuity of support for the students in residence. The students also demonstrated adaptability in the circumstances.

The AIMS programme is highly interactive and tutorial-based and teaching assistants help to support this form of learning. Teaching assistants during the reporting period were: Mr Rock Stéphane Koffi (head tutor), Ms Alice Nanyanzi, Ms Emilia Magnani, Dr Faraniaina Rasolofoson, Mr Lebeko Poulo (IT tutor), Dr Prudence Djangba, Ms Rahinatou Njah, Ms Reem Omer, Ms Samar Elsheikh and Mr Timothy Carolus.

The August intake students successfully defended their projects in June. The fact that the students were able to complete despite the changes necessitated by lockdowns speaks to a team effort, including AIMS staff from all departments, lecturers, supervisors, examiners, the partner universities, the AIMS Network, and many others. The efforts of lecturers and supervisors in re-planning at short notice and continuing to support the student groups as the programme went online are notable.

For the August intake, 33% of projects achieved a Distinction.

GRADUATE PROFILES



Ms Tshenolo Thato Daumas
AIMS South Africa 2019

Tshenolo graduated in 2019 and is currently doing a Research Master's in the AIMS South Africa Research Centre and is a member of the AIMS South Africa Data Science Group. Her research focuses on Bioinformatics - Deep Learning Applications in Immunology.

Before coming to AIMS, she completed a BSc Mathematical Sciences, double majored in Pure and Applied Mathematics and minored in Mathematical Statistics and Computer Sciences at the University of Johannesburg. She then spent three and a half years working at the SKA. She started out as a Telescope Operator where she got involved with the technical side of Radio Astronomy, primarily gaining insights into the intricacies of the instrument, the Radio Interferometer itself. She was trained to monitor and maintain its health (functionality) and carry out observations at the request of Astronomers.

Her final AIMS research project was titled: 'Convolutional Neural Network Model for Prediction of MHC-II Peptides Interactions' and she graduated with distinction and received the Ben and Mary Turok Scholarship Award.

"Going to AIMS was the best decision I made for my life at the time. I had come back from 4 years in industry and I got to retouch my mathematical skill set. I was also afforded the chance to collaborate with colleagues on group projects. The pressure being off by having everything provided in terms of non-academic support was amazing. I loved my time at AIMS and I flourished beyond what I had imagined I could."



Mr Hobihassina Patrick Rakotoarisoa

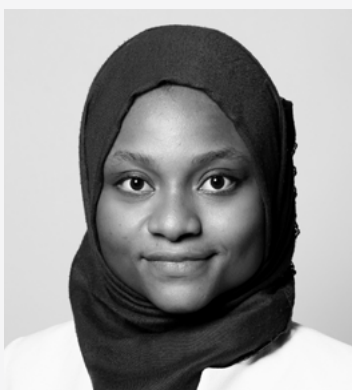
Patrick completed his undergraduate studies in mathematics at Ankatso University in Antananarivo, Madagascar. In his last year of high school, he was fascinated by the beauty and the power of mathematics to solve problems especially dividing a segment into several equal parts in geometry using Thales's theorem.

Urged on by his curiosity in mathematics he decided to pursue a mathematics degree at university. "Mathematics is such a broad topic and I'm particularly interested in algebraic-geometry."

At AIMS, the courses showed him another face of mathematics, one which uses computation on computers. "Learning mathematics in another language helped me to understand it more". He also participated in the AIMS Giveback Programme during which he tutored high school students.

For his final AIMS research project he chose a topic in computational algebra and algebraic geometry, 'Modular algorithms for the geometry of rational maps'. This topic is closely related to birational geometry which is a very topical issue in mathematics at the moment. At graduation he was awarded the Paul G. Allen Scholarship for exceptional performance.

He hopes to complete a PhD in mathematics and continue to actively engage in research.



Ms Sahadatu Larabu
AIMS South Africa 2020

Before joining AIMS, Sahadatu, completed her undergraduate studies at the University of Ghana where she obtained a Bachelor's Degree in Mathematics and Economics.

"Growing up, I have always loved working with numbers and figures. My journey at AIMS has been amazing, exciting and the experience was worthwhile. AIMS has built on my love for Mathematics and has taught me to be an innovative problem solver and an independent thinker. I got to meet brilliant colleagues from diverse background and cultures all over Africa. AIMS has instilled in me the love for Africa and the need to solve Africa's problem. I learnt a lot academically, socially and professionally at AIMS. Amidst the COVID-19 pandemic, AIMS still ensured we completed our academic term with a sound and healthy peace of mind."

Her final research project focused on predicting stock returns by comparing the Capital Asset Pricing Model and an Artificial Neural Network Approach. She also participated in the AIMS-ESMT Industry Immersion Program.

"I am an enthusiastic learner, strongly passionate about creating change, giving back to my community and making a positive impact wherever possible. I therefore co-founded YooKama Foundation in May 2019, an NGO that seeks to groom, teach and empower teenage girls in some areas in Ghana to strive hard for success." Her research interest lies in the intersection of Data Science, Economics and Finance and she hopes to secure a role in industry where she can apply data science to understanding and solving macro and micro economic issues.

MASTER'S IN MATHEMATICAL SCIENCES (JANUARY 2020 INTAKE)

The 2020 students began their programme in early January, taking one skills course per block initially, and joining the August students for some of the review courses. There are 18 students in the January intake group (one August student having joined this group subsequently). The January intake students are at time of writing completing their research projects.

During the year, a number of talks and other activities are organised for students as part of the scientific environment around their programme. Amongst highlights were a January 2020 talk by Prof. Alan Beardon (Cambridge and AIMS), entitled "What makes a mathematician?", and a November 2019 talk given by Dr Nichol Furey (Trinity Hall, Cambridge), "Towards a more efficient algebraic model of particle physics".

During the programme, the students received support in language and communication skills from Ms Noluvuyo Hobana, the Language and Communications Teacher. Mr Jan Groenewald, the IT Manager, runs Computing and Latex sessions for each student group.

Many other activities make up the programme and the learning environment for students at AIMS, and so the above is necessarily a summary.

STUDENTS ON THE JANUARY 2020 INTAKE

Full name	Gender	Country	Previous institution
Sincedile Buzani	Male	South Africa	Fort Hare
Kerol Roussin Djoumessi Donte	Male	Cameroon	Dschang
Arinze Lawrence Folarin	Male	Nigeria	Ibadan
Grace Airenghe Ikhizama	Female	Nigeria	Ajayi Crowther
Siphamandla Khumalo	Male	South Africa	Zululand
Oratile Legae	Male	South Africa	North-West
Gladstone Thabo Madito	Male	South Africa	North-West
Kentse Maefo	Male	South Africa	North-West
Tshepo Bafana Maila	Male	South Africa	Sefako Makgatho Health Sciences
Thabang Wilson Malapane	Male	South Africa	Limpopo
Tintswalo Kissey Mhelembe	Female	South Africa	Sefako Makgatho Health Sciences
Nontokozo Mkhawamubi	Female	South Africa	Zululand
Richard Mwale	Male	Zambia	The Copperbelt
Cebolenkosi Lohengrin Ngema	Male	South Africa	Zululand
Gulfornia Thakana Phahlane	Female	South Africa	North-West
Tumelo Donald Sereo	Male	South Africa	North-West

BSC (HONOURS) IN MATHEMATICS WITH A FOCUS IN BIOMATHEMATICS

Each year, a number of students on the BSc (Honours) in Mathematics with a focus in Biomathematics at SU take courses from the AIMS programme, from January to June. Three Honours students took AIMS courses in 2020. Courses taken by the Honours students included Introduction to Random Systems, Information Theory, and related topics, given by Prof. Stéphane Ouvry (Université Paris Sud XI) and Analytical Techniques in Mathematical Biology, given by Prof. Wilson Lamb (University of Strathclyde). When classes for Honours students moved online, the programme continued, as was the case for the August and January intake students. Again, the adaptability of lecturers and others in supporting this change, at short notice, is much appreciated. As in previous years, the January intake Statistics skills course was run using video lectures by Prof. David Spiegelhalter, with an on-site lecturer also presenting material for the course. This year, the on-site lecturer was Dr Daniel Nickelsen from the Research Centre and the course was taken also by the Biomathematics students. With lockdowns coming into effect, the MMED workshop which would have formed one of their courses, was not held, so Dr Nickelsen set work for the Honours students to complete for credit, including individual statistics projects, tailored to each of their Honours research project areas.



Above: January intake and BSc Honours Students

GRADUATIONS

January 2019 Intake

AIMS South Africa celebrated the success of its eighth group of January intake students at a special Recognition of Achievement Ceremony held at its centre in Muizenberg on 14 November 2019.

Sixteen students (including 10 South Africans) received their AIMS Master's Recognition of Achievement Certificates.

The invited speakers were AIMS Alumni, Ms Lindsay Blows, Senior Technical Analyst at Broadreach (2014) and Mr Ndivhuwo Mphephu, Quantitative Risk Analyst at the South African Reserve Bank (2013). Both shared what an important role AIMS played in their current success.

In the student address Ms Tshenolo Thato Daumas noted, "I have gained brothers and sisters from all over Africa, in fact from all over the world and this is the most prized possession that I have obtained during my time at AIMS." Mr Kibidi Alexander David Neocosmos had this message for his fellow students, "Don't squander the opportunity we have been given here as we are the Einsteins of tomorrow."

In the ceremony, Prof. Thandi Mgwebi, Deputy Vice-Chancellor: Postgraduate Studies, Research, Innovation and Engagement, Tshwane University of Technology and AIMS South Africa Council Member, presented two awards. The Ben and Mary Turok Award

for Excellent Achievement was awarded to South African student Ms Tshenolo Tathu Daumas. An Award for Academic Excellence also went to Kenyan student, Mr Kiprono Elijah Keoch.

Students subsequently graduated at their respective university graduation ceremonies.



Above: Prof. Green, Ms Daumas, Mr Keoch, Prof. Mgwebi and Dr Utete



Above: Recognition of Achievement Ceremony 2019

August 2019 Intake

This year due to lockdown instead of holding a special graduation ceremony celebrating the success of our 2019-20 Structured Master's Students, we produced a short Recognition of Achievement Video highlighting the achievement of this group of students. This video can be viewed at <https://youtu.be/oivllir5tyE>.

We are very pleased that all our students completed the Master's in Mathematical Sciences Programme successfully. This year we had 39 students, all completing the programme, among them 18 women. There were 7 students who obtained distinctions and their research projects were most interesting and of a high standard. These included topics from Mathematics, Physics and areas of application. Of particular interest at this time were projects relating to the COVID-19 pandemic, which included data science analytic modelling.

Local and international lecturers spent many hours online, supervising students and it was encouraging to see how well this and the oral examination defence sessions worked.

The video contains messages by senior members of our partner universities, who would normally have been present at the ceremony, as well as a student address.

We congratulate the following students who were awarded AIMS Endowed Scholarships. These are awarded to students who have performed exceptionally well during the course of the year:

- The Stephen Hawking Scholarship was awarded to Mr Ali Traore from Mali.
- The Martin Rees Scholarship, was awarded to Ms Fezile Sibongile Mhlabane from eSwatini
- The Paul G. Allen Scholarship was awarded to Mr Hobihassina Patrick Rakotoarisoa from Madagascar

"It is a pleasure to congratulate our 2019-20 Master's group on their excellent achievement and to wish them all the best for the future," Prof. Barry Green.



Above: Graduates of the August 2019 Intake

POST AIMS: SUPPORT, OPPORTUNITIES AND ALUMNI

AIMS Bursaries for study at South African Universities

Through the generous support of the South African Department of Science and Technology (DST), and the ForExcellence partners, AIMS South Africa is able to offer matching half bursaries to its students who are accepted for Master's or PhD study at South African universities. This year AIMS South Africa awarded **three** such bursaries for Master's study. **Two** bursaries was also awarded for a Master's in the AIMS Research Centre. Recipients are asterisked in the table below.

RESEARCH PROJECTS OF THE AUGUST 2019 INTAKE

Full name	Gender	Origin	Institution	Programme/ Position
Graduates from January 2019 intake				
Saumun Athman Abdallah	F	Kenya	Still exploring opportunities	
Tshenolo Thato Daumas*	F	South Africa	AIMS South Africa	Research Master's
Ghislaine Flore Kabadiang Ngon	F	Cameroon	University of Yaounde I of Cameroon	PhD
Precious Blessing Khumalo	F	South Africa	Cape Town	Research Master's
Kiprono Elijah Koech*	M	Kenya	AIMS South Africa	Research Master's
Katlego Lentswe	M	South Africa	Research Assistant	
Andani Alex Madula	M	South Africa	AIMS-ESMT IIP (2019)/ Psybergate (Pty) Ltd.	Junior Java Developer
Zizipho Maqokolo	F	South Africa	Buhle Waste Pty Ltd	Data Administrator
Karabo Vincent Mogotsi	M	South Africa	AIMS-ESMT IIP (2019)/Discovery Ltd.	Data Analyst Intern
Willie Mohlongo	M	South Africa	ABSA	Analyst in Model Risk Validation.
Ramatsimela Lebogang Mphahlele	F	South Africa	Still exploring opportunities	
Mzwakhe Mandlakhe Mthethwa	M	South Africa	Still exploring opportunities	
Kibidi Alexander David Neocosmos	M	South Africa	AIMS South Africa	Research Master's
Menzi Meerfact Ngcamphalala	M	South Africa	PriceWaterhouseCoopers	Senior Associate
Yannick Harisson Nkocko Awountsa	M	Cameroon	Stellenbosch	PhD
Star Aduratomu Oje	F	Nigeria	Washington State University	PhD
Zainab Olufunke Olukoga	F	Nigeria	Manobi Africa	Research Intern
Letladi William Rathaga	M	South Africa	Quantitative Analyst	
Alungile Sukwana	M	South Africa	Telesure Investment Holdings	Frontend Developer
Graduates from August 2019 intake				
Marwa Musa Babiker Adam	F	Sudan	Still exploring research opportunities	
Serge Raphael Adonsou	M	Togo	Still exploring research opportunities	
Mustafa Mahmoud Bakheet Gasm Alseed	M	Sudan	Still exploring research opportunities	
Dorcas Asare	F	Ghana	Still exploring research opportunities	
Jeremie Bakambana Ngumba	M	Democratic Republic of the Congo	Still exploring research opportunities	
Boka Fikadu Banti*	M	Ethiopia	Still exploring research opportunities	
Roger Jeasy Bavididila	M	Republic of the Congo	University of Pretoria	
Ahmed Osama Mohamed Sayed Elmwafy	M	Egypt	Still exploring research opportunities	
Bouchra Er-Rabbany	F	Morocco	Still exploring research opportunities	
Maluti Kgarose	M	South Africa	Great Learning	Postgraduate certificate in Data Science and Business Analytics
Guy Franck Konan	M	Cote d'Ivoire	North-West	PhD
Sahadatu Larabu	F	Ghana	Still exploring opportunities	
Faith Lembemo	F	Malawi	Still exploring research opportunities	
Carolyne Njoki Macharia	F	Kenya	Still exploring research opportunities	
Rayan Hussien Alsedig Madany	F	Sudan	Still exploring research opportunities	
Mcolisi Shadrack Madonsela	M	Swaziland	Still exploring research opportunities	
Tanaka Makuvaza	M	Zimbabwe	Stellenbosch	PhD
Gerald Gabriel Mathiya	M	Malawi	Old Mutual Malawi	Junior Actuarial Specialist
Tatenda Emma Matika	F	Zimbabwe	Still exploring opportunities	
Fezile Sibongile Mhlabane*	F	Swaziland	Still exploring opportunities	
Finhai Mupfuti	M	Zimbabwe	Hasselt University	Research Master's
Geoffrey Gacemi Ngeru	M	Kenya	AIMS South Africa	Research Master's

Mouhamed Lamine Ngom	M	Senegal	Still exploring research opportunities	Research Master's
Ghislain Niyongabo	M	Burundi	Still exploring opportunities	
Bijoue Meslye Schailde Obanda	F	Republic of the Congo	Still exploring opportunities	
Abraham Orinda*	M	Kenya	UNISA	
Linda Agyapomah Osei - Agyare	F	Ghana	Still exploring opportunities	
Joseph Owuor Owino	M	Kenya	Still exploring research opportunities	Research Master's Auditor
Hobihassina Patrick Rakotoarisoa	M	Madagascar	Still exploring opportunities	
Antsa Tantely Fandresena Rakotondrafara	F	Madagascar	Still exploring opportunities	
Fameno Rakotoniaina	F	Madagascar	Still exploring opportunities	
Refiloe Sarah Shabe	F	Lesotho	Stellenbosch University	
Alieu Sowe	M	Gambia	Industry	PhD Sales Officer
Hirmans Tabaharizato	M	Madagascar	Still exploring opportunities	
Nedjla Tazdait	F	Algeria	KwaZulu-Natal	
Tamara Tembo	F	Zambia	Plant a Million, Zambia	
Sitraka Nandrianina Tolojanahary	F	Madagascar	Still exploring opportunities	
Ali Traore	M	Mali	Still exploring research opportunities	
Aulan Lucrèce Zahoundo	F	Benin	Still exploring opportunities	

THE AIMS-ESMT INDUSTRY IMMERSION PROGRAMME

The AIMS-ESMT Industry Immersion Program (IIP) is a partnership between AIMS and the European School of Management and Technology (ESMT) in Berlin, with funding support from the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD). The IIP seeks to provide mathematically trained AIMS Graduates with business skills and internships to enhance their ability to take up careers in business and industry. The program launched in 2017 is currently in its fourth and final year of the pilot term.

The joint founders of the program were Prof. Wulff Plinke and Mr Nick Barniville, and Mr Mark Heerden and Mr David Attipoe, an AIMS Alumnus, both at AIMS.

With the onset of the COVID-19 pandemic, 2020 proved to be a challenging year. Nevertheless, with support of all the partners, the delivery of the program was successfully converted into an "Online Blended Program". The Business Skills modules were

drawn from the ESMT Online MBA, comprising notes, streamed lectures and Zoom Q&A sessions with the relevant professors. The focus was increasingly towards data analytics in the workplace this year, complementing the general business skills, with modules such as data and decisions and data analytics for business introduced. The Work Readiness and Personal Development Skills component, again led by the SU Careers' Office, was improved with Zoom contributions from industry leaders from across the continent.

Another first for the IIP was the 2020 cohort, comprising 45 AIMS graduate students from 26 countries, were hosted with 15 each at AIMS South Africa, Ghana and Rwanda, to take account of social distancing requirements. The IIP was run for five weeks from 8 June to 10 July. Mr Heerden and Mr Attipoe led the Online Blended Program from the AIMS campus in Muizenberg assisted by part-time MBA tutors present in the other AIMS Centres. The first virtual graduation took place on 10 July 2020 via Zoom.



Above: AIMS-ESMT South Africa participants



Above: AIMS-ESMT Ghana participants

Guests included a number of important international dignitaries, in particular, Prof. Dr Grosse, Chairman of The Sub-Saharan Africa Initiative of German Business (SAFRI) and Ms Dzigbordi Kwaku-Dosoo the Founder and CEO of Dzigbordi Consulting Group. The German Partners of the program also confirmed that they are seeking to scale the IIP and raise further funding for another five years.

The importance of internships continues to be key to the success of the program. Results of the previous three years attests to this success with over 80% of students successfully being placed into internships or employment. This year's cohort are currently being placed into internships, although this will be a more challenging year given the impact of the COVID-19 pandemic on industry and country lockdowns.

With the conclusion of the pilot program this year, the IIP team is actively working with their partners to scale the program into a further five-year term.

The program continues to be one of the several industry initiatives across the AIMS Network and benefits from the links and synergy with the work of the AIMS Industry Initiative, led by Dr Charles Mberi-Kimpolo, the Director in charge, and other key stakeholders across the AIMS Network.

DAAD BURSARIES FOR DOCTORAL STUDY

The German Academic Exchange Service (DAAD) generously awards scholarships within the DAAD/AIMS agreement which was signed in 2018. 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. This year due to COVID-19 there has been a delay in the awarding of new scholarships, however scholarships of 10 DAAD scholars in their second and third year of study were renewed. Four DAAD scholarship holders graduated in 2019.



In December, Mr Prudence Djabga, a 2017 AIMS South Africa alumnus, and a tutor at AIMS South Africa, graduated from SU with a PhD. His thesis was titled: 'Contributions to the Theory of Beidleman Near-Vector Spaces'. His studies were funded through the DAAD bursaries for doctoral studies.



In July 2020, Mr Elimboto Mwiki Yohana, a 2009 AIMS South Africa alumnus was awarded a PhD from the University of KwaZulu-Natal for his thesis titled: 'Probing the Nature of Dark Energy with 21-cm Intensity Mapping.' "I would like to extend my thanks to DAAD and AIMS South Africa for the financial support towards my PhD studies." He is currently an assistant lecturer in the Faculty of Science at the University of Dar Es Salam.

ALUMNI PROFILES



Mr Ndivhuwo Mphephu
AIMS South Africa 2013

Ndivhuwo graduated from AIMS South Africa in 2013 and is currently a Quantitative Risk Analyst at the South African Reserve Bank (SARB). Before joining SARB, he was a Junior Lecturer in the Mathematics Department at the University of Venda. He grew up in Budeli village in the Limpopo Province where he did his primary and secondary school.

He also holds a Master's in Financial Engineering from WorldQuant University; a Postgraduate Diploma in Risk Management from the University of South Africa; and BSc Honours degree in Applied Mathematics from the University of Venda.

His interest is in the development and validation of credit risk models for regulatory capital calculations under the Advanced Internal Rating Based (AIRB) approach. Ndivhuwo is also involved in studies to investigate the viability of machine learning techniques for estimating the Basel risk parameters where the focus is assisting with the development of new policies and regulations relating to credit risk. Apart from his professional duties, he provides mentorship and career guidance to junior students mainly from the University of Venda where he has over ten candidates who progressed through to Master's level and are now working in reputable financial institutions in South Africa.

"AIMS equipped me with unique problem solving and programming skills, presentation and communications skills and exposed me to a diverse network."



Mrs Oluwakemi Imole Adewumi
AIMS South Africa 2016

Oluwakemi, originally from Nigeria, is currently a doctoral candidate of Economics at the University of Kent where her research interests cut across topics at the intersection of Macroeconomics and Finance, particularly macro-finance linkages, financial economics, and international finance. Prior to joining Kent, she was a Commonwealth scholar at Heriot-Watt University where she topped her class of MSc Quantitative Finance and Mathematics, graduating with distinction.

She is an alumna of AIMS South Africa, where she completed a Master's degree in Mathematical Sciences in 2016. Her degree was awarded by the University of Cape Town. She was also selected as a Mastercard Scholar.

She graduated with a first class (honours) degree in Mathematics from Ekiti State University. During her undergraduate education, she participated in the National Mathematics Olympiad for Universities and emerged as the best student in the female category and second highest ranked student in combined category, winning a silver medal from among the 70 high-achieving contestants. She has worked as a member of the Finance Research Group at AIMS where she co-organized symposiums on the rudiments and evolution of the application of mathematics to finance. While at Heriot-Watt University, she undertook her MSc dissertation with Genpact under the Scottish Financial Risk Academy (SFRA) where she worked on the Model Risk Challenges of the Fundamental Review of Trading Book (FRTB). Throughout her education, Oluwakemi has been active in volunteer work, and hopes to be a "great resource to the universe," using science and technology to impact not just her home country but society at large.



Dr Richard J Munthali
AIMS South Africa 2013

Richard, from Malawi, graduated from AIMS South Africa in 2013 and went on to complete his PhD in Bioinformatics specialising in statistical genetics at Wits in 2017. He is currently a Research Statistician and Data Lead at The Wits Reproductive Health and HIV Institute.

His responsibilities include clinical research design and organisation. He did his Postdoctoral research at the University of British Columbia (UBC) Centre for Heart Lung Innovation from September 2017 to September 2018. He is concentrating on Bioinformatics and Statistical Genetics.

He joined the University of the Witwatersrand in 2017, prior to which, he had attended the University of Cambridge as a visiting PhD Researcher in 2016. He had a short working stint at the Communitech as an Application Design and Developer from July to December 2013. He has authored 26 publications which have earned 164 citations, h-index 7 and i10-index of 5.

RESEARCH

The Research Centre is supported by the Department of Science and Innovation and the National Research Foundation, South Africa; the German Government (through the BMBF) and the Alexander von Humboldt Foundation. The Research Centre is now 12 years old and hosts researchers working in several focus areas under the theme Mathematical Modelling in a Multidisciplinary Context. Regular conferences and workshops are held in collaboration with other national and international institutions.

In September 2019, AIMS South Africa welcomed Dr Marc Sedjro, appointed as the German Research Chair for Applied Mathematics, who has relocated from AIMS Tanzania. This position is in conjunction with SU and UCT.

In January 2020, AIMS South Africa appointed Prof. Phillip Mashele, as part-time Senior Resident Researcher in Mathematical Finance in the Research Centre.

RESIDENT RESEARCHERS



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



Prof. Barry Green,
Senior Resident Researcher
Pure mathematics



Dr Michelle Lochner,
Resident Researcher
(until 13 April 2020)
Statistics and machine
learning applied to
astronomy and cosmology



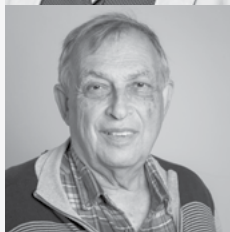
Prof. Bruce Bassett,
Senior Resident Researcher
Cosmology and astrophysics



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



Prof. Jeff Sanders,
Senior Resident Researcher
Theoretical computer science



Prof. Ronnie Becker,
Senior Resident Researcher
Mathematical finance



Dr Dennis Ikpe,
Research Associate
Mathematical finance



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



Prof. Johan De Villiers,
Senior Resident Researcher
(until 31 January 2020)
Analysis and approximation
theory



Prof. Phillip Mashele,
Part-time Senior Resident
Researcher
Mathematical finance



Dr Marc Sedjro,
German Research Chair
Applied mathematics with
specialization in Partial
Differential Equations and
Calculus of Variations



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



Dr Gaston Mazandu,
Part-time Researcher
AIMS-H3ABioNet

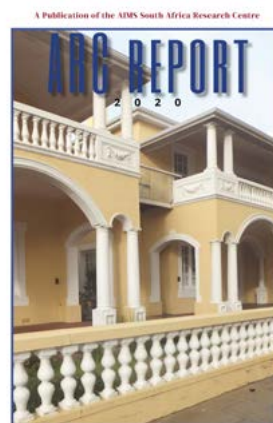


Dr Simukai Utete,
Senior Resident Researcher
Robotics

ARC REPORT

In August 2020, the latest edition of the ARC Report was distributed to various stakeholders. The report contains interesting contributions by members of our Research Centre. Researchers at AIMS are working on and have contributed to a number of interesting problems, some very relevant to the situation we find ourselves in due COVID-19. This report presents some of their work, which gives a picture of what has been done in the Research Centre recently, especially since lockdown. It is a pleasure to thank all who contributed.

The report can be viewed online at <https://aims.ac.za/research/research-activities/>.



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POSTDOCTORAL FELLOWS

Five new postdoctoral fellowships were awarded during the period under review.

Name	Citizenship	Gender	Start date to end date	Research Field	Supervisor/Host
Shankar Agarwal	India	M	1 April 2018 – 31 December 2020	Data Science	Dr B Bah
Erick Almaraz Avina	Mexico	M	1 November 2019 – 31 October 2020	Cosmology	Prof. B Bassett
Emmanuel Dufourq	Mauritius	M	1 August 2019 – 31 July 2021	Evolutionary deep learning	Prof. I Durbach
MPA Espinaze-Pedro	Mexico	F	1 January 2019 – 30 June 2020	Parasitology	Prof. C Hui
Sthembiso Reuben Gumede	South Africa	M	1 September 2019 – 31 August 2020	Dynamic modelling of species distributions in response to climate change	Prof. C Hui
Daniel Nickelson	Germany	M	1 October 2019 – 30 September 2020	Estimation of Marginal Likelihood for Complex Models	Dr B Bah
MJ Marial Pisa	Italy	M	1 January 2019 – 30 June 2020	Molecular Ecology	Prof. C Hui
Olugbenga Oluseun Oluwagbemi	Nigeria	M	1 March 2018 – 28 February 2020	The development of mathematical and compartmental models for the control of HIV and for malaria elimination	Prof. C Hui
Dinna Ranirina	Madagascar	F	1 January 2019 – 31 August 2021	Data Science	Dr B Bah
Milaine Tchamga	Cameroon	F	1 July 2018 – 30 June 2020	Biomathematics	Dr G Mazandu

POSTGRADUATE STUDENTS IN THE RESEARCH CENTRE

The number of students hosted by the AIMS Research Centre and supervised by AIMS resident researchers totalled 39 during the period under review. Eighteen of these are doctoral students. The students who have graduated are indicated with an * in the tables below.

PhD Students

No.	Name of student	Citizenship	Gender	Study duration	Supervisor/Host	Based at
1	David Attipoe	Ghana	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
2	Lesiba Charles Galane*	South Africa	M	1 January 2016 – 31 December 2019	Prof. R Lochowski	Limpopo
3	Buri Gershom	Uganda	M	6 September 2016 (ongoing)	Dr W Ndifon	AIMS/SU
4	Eberechi Georgina Chris-Kalu	Nigeria	F	2019 (ongoing)	Dr D Ikpe	UNISA
5	Bejamin David Du Toit	South Africa	M	1 January 2017 (ongoing)	Prof. C Hui	SU
6	Ephifania Geza	Zimbabwe	F	24 August 2015 (ongoing)	Dr G Mazandu	AIMS/SU
7	Martha Ndeyapeuomogano Kamkuemah	South Africa	F	1 July 2016 (ongoing)	Prof. J Sanders	AIMS/SU
8	Dieudonne Kabongo Kantu	Congo	M	1 November 2015 (ongoing)	Prof. I Durbach	AIMS/UCT
9	Rock Stephane Koffi	Ivory Coast	M	1 February 2015 (ongoing)	Dr A Tambue	AIMS/UCT
10	Irene Kyomugisha	Uganda	F	1 March 2018 (ongoing)	Dr B Bah & Dr G Mazandu	AIMS/SU
11	Vitalis Kimutai Lagat	Kenya	M	1 May 2017 (ongoing)	Prof. C Hui	SU
12	Funmilayo Makinde	Nigeria	F	1 January 2019 (ongoing)	Dr G Mazandu	UCT
13	Jordan Masakuna	Democratic Republic of Congo	M	7 February 2016 (ongoing)	Dr S Utete	AIMS/SU
14	Samuel Ofori Mensah	Ghana	M	1 February 2019 (ongoing)	Dr B Bah	AIMS/SU
15	Chinenye Assumpta Nnyakeni	Nigeria	F	1 Jul 2017 (ongoing)	Prof. C Hui	SU
16	Ethan Roberts	South Africa	M	1 March 2018 (ongoing)	Dr N Oozeer and Prof. B Bassett	AIMS/UCT
17	Abdulrahman Lawal Suleiman	Nigeria	M	1 January 2018 (ongoing)	Prof. C Hui	SU
18	Neil Watson	South Africa	M	1 January 2016 (ongoing)	Prof. I Durbach	UCT

Master's Students

No.	Name of student	Citizenship	Gender	Study duration	Supervisor/Host	Based at
1	Asheligh Megan Basel	South Africa	F	1 January 2019 (ongoing)	Prof. C Hui	SU
2	Curtly Blows*	South Africa	M	1 January 2018 – 31 December 2019	Prof. B Bassett	AIMS/UCT
3	Gloria Burengengwa*	Burundi	F	1 August 2018 – 31 March 2020	Prof. C Hui	SU
4	Tshenolo Thato Daumas	South Africa	F	1 February 2020 (ongoing)	Dr B Bah	AIMS
5	Evander El-Tabonah Nyoni	Zimbabwe	M	25 August 2019 (ongoing)	Prof. B Bassett	AIMS
6	Richard Gibbs	South Africa	M	1 January 2020 (ongoing)	Prof. C Hui	SU
7	Emmanuel Kabuga*	Burundi	M	25 August 2017 – 31 December 2019	Prof. I Durbach & Dr B Bah	AIMS
8	Precious Blessing Khumalo	South Africa	F	1 February 2020 (ongoing)	Dr Y Gaba and Prof. HP Kunzi	UCT
9	Kiprono Elijah Koech	Kenya	M	1 February 2020 (ongoing)	Dr B Bah	AIMS
10	Mmatlou Kubyana*	South Africa	M	1 January 2018 – 31 March 2020	Prof. C Hui	SU
11	Juliana Thomasia Chakirath Marcos	Benin	F	1 October 2018 (ongoing)	Dr S Utete	AIMS/SU
12	Oarabile Hope Moloko*	South Africa	M	1 January 2018 – 31 December 2019	Dr M Lochner & Prof. B Bassett	AIMS/UCT
13	Kibidi Neocosmos	South Africa	M	1 February 2020 (ongoing)	Dr B Bah	AIMS
14	Thabani Ngcobo	South Africa	M	1 July 2019 (ongoing)	Dr N Hale & Dr M Sedjro	SU
15	Max Nieuwoudt	South Africa	M	1 February 2020 (ongoing)	Prof. B Bassett	AIMS/UCT
16	Rojo Fanamperana Randrianomentsoa	Madagascar	F	1 October 2018 (ongoing)	Prof. J Sanders	AIMS
18	Emmanuel Sekyi	Ghana	M	1 February 2020 (ongoing)	Prof. B Bassett	AIMS/UCT
19	Yethu Sithole	South Africa	M	1 May 2019 (ongoing)	Dr D Ikpe	UNISA
20	Asmaa Tbaen*	Sudan	F	1 October 2017 - 31 December 2019	Prof. C Hui	SU

Honours Student

1	Simon Mokhanda	South Africa	M	1 May 2019 (ongoing)	Dr D Ikpe	UNISA
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Above: Mr Emmanuel Kabuga, Research Master's student



Above: Ms Rojo Fanamperana, Research Master's student



Above: Mr Evander Nyoni, Research Master's student



Above: Ms Juliana Marcos, Research Master's student

RESEARCH PROFILES



Dr Marc Sedjro,
German Research Chair

Dr Sedjro is the German Research Chair for Applied Mathematics with specialization in Partial Differential Equations and Calculus of Variations at AIMS South Africa.

Prior to moving to AIMS South Africa, Dr Sedjro was the German Research Chair at AIMS Tanzania. He completed his PhD in Mathematics at the Georgia Institute of Technology in 2012 under the supervision of Prof. Wilfrid Gangbo. After that, he spent a few years as a Postdoctoral fellow at RWTH-Aachen and at King Abdullah University of Science.

Dr Sedjro's research interests lie in the fields of Partial Differential Equations and the Calculus of Variations. He is interested in problems arising in Fluid Mechanics such as the multi-dimensional compressible Euler Equations, Gas dynamics, and the almost axisymmetric flows. He has also been interested in Mean Field Games and Elasticity.

While at AIMS South Africa, Dr Sedjro intends to build a research group around his research interests and to develop research cooperation with researchers at SU, the UCT and Technische Universität Berlin.



Prof. Phillip Mashele,
**Part-time Senior Resident
Researcher**

Prof. Mashele, was appointed as a part-time Senior Resident Researcher in Mathematical Finance at AIMS South Africa.

Prof. Mashele's main interest was initially in the field of pure mathematics but his focus has since moved to the field of mathematical finance, in particular, financial model development and financial risk analysis.

Starting with a Bachelor's degree at Vista University, South Africa, in 1991, Prof. Mashele continued on to the University of the Free State to complete both his Honours and MA in Pure Mathematics and thereafter, completed his PhD in Pure Mathematics at the University of the Witwatersrand. In 2002, he spent some time abroad as a Postdoctoral Fellow at the Hungarian Academy of Sciences, Hungary and returned to South Africa to take up the position as Senior Lecturer in the Department of Mathematics at SU. Since then, Prof. Mashele has held various positions in both the academic and business sectors, with his most recent position being that of Professor and Consultant for the Centre for Business Mathematics and Informatics at North-West University, which he currently holds.



Dr Daniel Nickelsen,
Postdoctoral Fellow

Dr Nickelsen is currently a postdoctoral research fellow in the Data Science Group at AIMS South Africa. His current research focus at AIMS together with Dr Bubacarr Bah is on Bayesian model selection for complex systems with many parameters, as well as combining laws of physics with machine learning. His other research interests include asymptotic methods used in fluctuating thermodynamics, statistical analysis of equilibration in many-body quantum systems, and stochastic description of developed turbulent flows.

He started his academic career studying physics in Germany, where in 2014 he also obtained his PhD in theoretical physics on stochastic thermodynamics and developed turbulence. After a short postdoc in Germany, he joined the National Institute for Theoretical Physics (NITheP) at SU in 2016, as a postdoctoral researcher, where he deepened his knowledge on stochastic processes with Prof. Hugo Touchette, and worked with Prof. Michael Kastner on equilibration in quantum systems. During his time at SU, he helped in 2017 to organise a fully-funded winter school on computational methods for disadvantaged students in South Africa, he was the lead organiser of the first postdoctoral conference of southern Africa in 2018, and during his time at NITheP he was actively involved with the Postdoctoral Society for which he served as the chairperson in 2019. Since 2019, he has also been visiting AIMS regularly as a visiting researcher and in August he took over the organisation of the AIMS research colloquium (the "Journal Club").

In April 2020, Dr Nickelsen received a postdoctoral scholarship from the Oppenheimer Memorial Trust to conduct research and teach at AIMS South Africa. Since then, he has lectured a skills course, devised and supervised three mini-projects for biomathematics students as replacement for cancelled courses due to the COVID-19 pandemic, and has supervised one Structured Master's student. "At AIMS I enjoy the diversity in mathematical field and culture, as well as working closely with so highly motivated students."

PRESENTATIONS AT WORKSHOPS AND CONFERENCES

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

- Ms Funmilayo Lydia Makinde, a PhD student attended the **9th DAAD South Africa Conference Science Communication** held in Johannesburg from 5 to 8 September 2019. The conference brought together South African scholarships holders as well as scholarships holders from other African countries who are currently studying in South Africa.
- Prof. Bruce Bassett gave the opening address at the **2019 Big Data Africa School** which was hosted by the South African Radio Astronomy Observatory (SARAO), from 6 to 16 October 2019, at the Lagoon Beach Hotel in Cape Town. Dr Michelle Lochner and Dr Nadeem Oozeer, AIMS Associate Research Fellow, both presented projects for the students to work on during the workshop.
- Ms Samar Elsheikh, who graduated from AIMS Ghana in 2014 and is currently a tutor at AIMS South Africa, presented a poster at the **ISCB-Africa ASBCB 2019 Conference** in Kumasi, Ghana. She also took the opportunity to visit AIMS Ghana, on a PhD research visit from 15 to 17 November 2019 and gave a talk about part of her PhD work.



Above: Ms Samar Elsheikh

- Mr Bernard Lebeko Poulo, AIMS tutor and Mr Buri Gershom, a PhD student in the AIMS Research Centre, attended the **WitsQ Summer School on Quantum Computing** organised by the University of the Witwatersrand and IBM. The summer school ran from 2 to 10 December 2019. It was followed by the Qiskit Camp Africa Hackathon which was entirely sponsored by IBM. It took place at Kwa Maritane Bush Lodge in the Pilanesberg National Park from 11 to 14 December. Their attendance at the school was sponsored Prof. Rafael Nepomechie, University of Miami.



Above: Mr Bernard Lebeko Poulo

- On 25 May 2020, Prof. Bassett, gave a talk at a **NITheP Colloquium** via Zoom titled: 'How hard will COVID-19 hit South Africa? A story in three parts'. This talk can be viewed at <https://youtu.be/fpQl9nIK5m8>



Above: Prof. Bruce Bassett NITheP Colloquium

- On 29 May 2020, Dr Emmanuel Dufourq, gave a talk as part of **CoEMaSS Seminar Series**. The talk was titled: 'The world's rarest primate – a deep learning journey'.
- On 11 June 2020, Prof. Bassett gave a seminar titled: 'COVID-19: Models and Mysteries'. This seminar was hosted by the **South African Astronomical Observatory**.
- On 1 July 2020 Prof. Bassett gave a talk as part of a **COVID-19 Modelling Webinar Series**. This talk was titled: 'COVID-19: ensemble national models and testing the BCG, Blood and Climate as drivers of spread'. This webinar series is coordinated by the CSIR and is used to enhance collaboration among the various researchers in South Africa on the modelling of COVID-19.

- Prof. Bassett also participated in a virtual online discussion on 25 July 2020 titled: 'The mathematics of the pandemic.' The title of his talk was 'A tool that provides a visualisation of the number of COVID-19 cases.' In which he spoke about modelling the progression of COVID-19 in South Africa and factors that may influence the spread.
- The **Fusion 2020 conference**, an international conference on data fusion, took place 6 to 9 July 2020, as a virtual conference.

Various members of the Research centre took part in the conference: Mr Jordan Masakuna, PhD student presented on a paper, 'Performance-Agnostic Fusion of Probabilistic Classifier Outputs'; Dr Simukai Utete was a session chair for one of the conference sessions, Machine Learning Methods 2 – Environmental Sensing; and Dr Bubacarr Bah, gave a talk titled: 'On Error Correction Neural Networks for Economic Forecasting'.

SEMINARS

The Journal Club is the colloquium of the Research Centre. It differs from usual colloquia in that it also invites research students to present. Apart from the research students, also internal and external researchers are invited to present their work, in particular visiting researchers. The idea of the Journal Club is to give insights into work-in-progress, rather than presenting published work. The benefit for the research students is to receive valuable input and practice discussing their research as they advance with their projects, and to gain insights from established researchers.

The Journal Club series 2019/20 was opened in September 2019 by resident researcher Prof. Jeff Sanders, who first talked about the history and the idea of the Journal Club, and then about his work on Zero-Knowledge Protocols. Other presentations by AIMS researchers have been given by postdoctoral researcher Dr Dufourq in October 2019 on using deep learning to identify the call of the critically endangered Hainan gibbon, as well as a talk in February 2020 by the German research chair Dr Marc Sedjro on axisymmetric flows in a free boundary domain as observed in cyclones. In October 2019, Mr Jonathan Carter, systems architect at AIMS and one of very few active Debian developers in Africa, spoke about the history of Linux, and the Debian derivative known as AIMS Desktop developed and maintained at AIMS.

A number of visiting researchers participated in the Journal Club during the reporting period. In September, Dr Hassan Bakri from the Sudan University of Science and Technology spoke about exact solutions of start-up Couette flows of a non-Newtonian fluid. Visiting from the University of Dschang, Cameroon, Dr Alain Fotue presented his work on polarons and decoherence in quantum dot nanostructures and its significance for quantum computing. Advances and future applications of quantum computing was the topic of a presentation given by Mr Christian Plitz from the Technical University of Munich in November. A presentation for a broader audience including all students at AIMS was given by Dr Nichol Furey visiting from University of Cambridge, she spoke about her work on more efficient algebraic models of particle physics. The first presentation of the new year was given by Dr Jan Sürmeli from Technical University Berlin, Germany, the topic of his talk was decentralizing identity. His talk was followed by Mr Muhammad Sirajo Abdullahi from the University of Technology Thonburi, Thailand, on digital image topology and fixed points, and a presentation about discrete optimization methods for group model selection in compressed sensing by Dr Jannis Kurtz from the RWTH Aachen University in Germany. The last two presentations of the semester were given by Dr Mokhwetha Mabula from the University of Pretoria, who spoke about the role of Archimedean in normal and generating cones, and Prof. Alan Beardon from the University of Cambridge on The Lambert function.



Above: *Dr Mokhwetha Mabula*

Presentations given by research students at AIMS during the reporting year include Mr Emmanuel Kabuga on identification of individual animal from images with a siamese network, Ms Rojo Randrianomentsoa about the fundamental theorem of auction theory, Ms Ephifania Geza on population relationships and natural selection in admixed individual genomes, Mr Evander Nyoni on neural machine translation for African languages, Mr Samuel Mensah about the REINFORCE algorithm, and Ms Juliana Marcos on data fusion and formation control in wildlife monitoring.

From 17 March 2020, the Journal Club had to be suspended temporarily as part of the COVID-19 prevention measures.

On 16 January 2020, a special seminar for all students and researchers at AIMS was given by Prof. Werner Varnhorn from the Kassel University in Germany. His presentation was on the challenges of the Navier-Stokes equation on an introductory level, covering historic aspects, as well as the physics and mathematics behind the Navier-Stokes equation, and concluded with some recent results of research.



Above: *Prof. Werner Varnhorn*

VISITING RESEARCHERS

In 2019/20 the Research Centre hosted 23 visiting researchers. During their stay, visiting researchers collaborate with the AIMS resident researchers, interact with AIMS students and give talks in the AIMS Journal Club. Some of the visiting researchers are participants in the conferences or workshops held at AIMS.

	Full name	Country of origin	Gender	Affiliation	Research area	Dates of visit
1	Nooralhoda Abdalrazeg Ahmed Mohamd	Sudan	F	University of Khartoum	Mathematics	12 March – 9 August 2020
2	Muhammad Sirajo Abdullahi	Nigeria	M	King Mongkut's University of Technology	Digital Topology, Algebraic Topology	1 December 2019 – 7 March 2020
3	Collins Amburo Agyingi	Cameroon	M	Nelson Mandela University	Asymetric Topology	23 September – 5 October 2019
4	Jacek Banasiak		M	University of Pretoria	Functional Analysis	10 – 12 March 2020
5	Prudence Djaqba	Benin	M	Stellenbosch University	Mathematics	1 July – 30 September 2020
6	Jean-Daniel Djida	Cameroon	M	AIMS Cameroon	Mathematics	20 – 26 February 2020
7	Audace Dossou-Olory	Benin	M	University of Johannesburg	Discrete Mathematics	9 December 2019 – 8 January 2020
8	Reem Elmadi	Sudan	F	Stellenbosch University	Machine Learning	1 July – 30 September 2020
9	Alain Fotue	Cameroon	M	University of Dschang	Physics	1 September – 31 October 2019
10	Lei Fu	China	F	Shandong University of Science and Technology	Applied Mathematics	22 September – 21 December 2019
11	Nichole Furey	Canada	F	University of Cambridge	Theoretical Physics	5 November 2019 – 20 January 2020
12	Liu Jiahui	China	F	Shandong University of Science and Technology	Applied Mathematics	22 September – 21 December 2019
13	Rock Koffi	Ivory Coast	M	University of Cape Town	Financial Mathematics	1 July – 30 September 2020
14	Jannis Kurtz	Germany	M	RWTH Aachen University	Applied Mathematics	17 – 27 February 2020
15	Meixuan Li	China	F	Shandong University of Science and Technology	Applied Mathematics	22 September – 21 December 2019
16	Mokhwetha Mabula	South Africa	M	University of Pretoria	Functional Analysis	3 February – 4 April 2020
17	Setareh Maghsudi	Germany	F	Technical University of Berlin	Multi-Armed Bandit Theory and Online Decision Making under Uncertainty	2 – 6 December 2019
18	Hassan Mohamed	Sudan	M	Sudan University of Science & Technology	Non-Newtonian Fluid Dynamics	29 July – 20 September 2019
19	Sinenhlanhla Mtshali	South Africa	F	University of the Witwatersrand	Applied Mathematics	11 – 23 November 2019
20	Christian Plitz	Germany	M	Technical University of Munich	Electrical Engineering and Computer Science	22 October 2019 – 20 January 2020
21	Lebeko Poulo	Lesotho	M	University of KwaZulu-Natal	Mathematics	1 July – 31 August 2020
22	Jan Suermeli	Germany	M	Technical University of Berlin	Modelling and Analysis of Distributed Systems	2 – 6 February 2020
23	Lijun Zhang	China	F	Shandong University of Science and Technology	Differential Equations	2 October – 3 November 2019



Above: Visiting researchers, Ms Liu, Ms Fu, Prof. Zhang and Ms Li from Shandong University of Science and Technology.



Above: Visiting researcher, Mr Plitz from the Technical University of Munich

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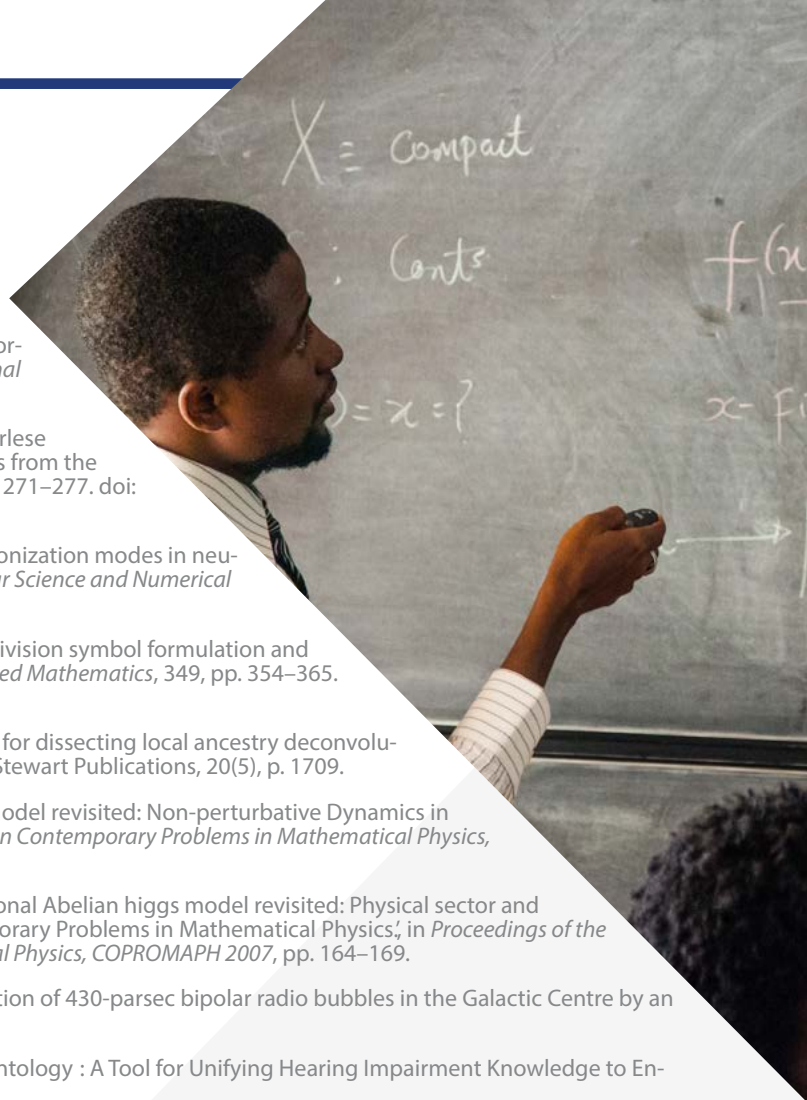
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WORKSHOPS AND CONFERENCES

During the period under review AIMS researchers hosted **four** workshops and conferences which were held at AIMS. Many of these were held in collaboration with other organisations including: Wits; SACEMA and SU. Due to the COVID-19 regulations several planned workshops were postponed to 2021.

Spring School on Mathematics of Data Science

This school was held at AIMS South Africa from 23 to 27 September 2019 and was preceded by a pre-school held from 16 to 20 September. The school was organised by Dr Bubacarr Bah and Prof. Dr Holger Rauhut, RWTH Aachen University. There were 42 participants including the speakers: Prof. Stephen Becker (University of Colorado, Boulder); Prof. Massimo Fornasier (Technical University of Munich); Prof. Felix Krahmer (Technical University of Munich); Prof. Nathan Srebro (University of Chicago); and Prof. Clayton Webster (University of Tennessee, and Oak Ridge National Laboratory).

Data Science Focused Group Workshop

From 30 September to 4 October, the Data Science Group organised a Focused Group Workshop for students. Participants from AIMS included Dr Bubacarr Bah, Dr Franck K. Mutombo, Mr Elhadji Moustapha Seck, Mr Rockefeller and Mr Jean Claude Utazirubanda. From TU Berlin participants included Dr Peter Jung, Dr Osman Musa and Dr Hendrik Peterson. Mr Nathaniel Agwu from RWTH Aachen also participated. The purpose of the workshop was to have a one-week intensive session on two problems from the collaboration project that Dr Bah has with the Communication and Information Theory Group at TU Berlin. The general theme of the project is the application of deep learning methods to communications and data science problems.

Practical Introduction to Deep Learning Workshop

AIMS South Africa hosted this three-day workshop from 4 to 6 November 2019. The 24 participants were introduced to the theory of deep learning and implemented a number of solutions to problems such as text/data classification, regression, time-series prediction etc. The workshop was organised by two Post-doctoral Fellows Dr Emmanuel Dufourq and Dr Shankar Agarwal.



Above: Spring School on Mathematics of Data Science



Above: Data Science Focused Group Workshop



Above: Practical Introduction to Deep Learning Workshop

Mathematics in Industry Study Group (MISGSA) 2020

A Mathematics in Industry Study Group is a five-day workshop at which academic researchers and graduate students work collaboratively with representatives from industry on research problems submitted by local industry. This year the workshop took place at the University of Zululand, from 13 to 17 January 2020. Amongst the attendees were three structured Master's students, four research Master's students and two tutors from AIMS South Africa. Prof. Jeff Sanders, Senior Resident Researcher AIMS South Africa, was one of the presenters at the camp.

IMU Executive Committee engagement with mathematicians and graduate academics at SA universities

From 21 to 24 February 2020, the International Mathematics Union (IMU) Executive Committee visited AIMS, where they held their annual meeting and participated in a special day of engagement with local mathematicians and AIMS students. The day of engagement included plenary talks, panel discussions, informal conversations and face-to-face interaction. This was a unique opportunity for attendees to meet the IMU leadership, including the Fields Medallists Prof. Shigofumi Mori and Prof. Andrei Okounkov and gain insight into current mathematical developments. The event was arranged by the Council of the South African Mathematical Society (SAMS) and was hosted at AIMS South Africa. During the day Prof. Carlos Kenig, IMU President, University of Chicago gave a survey lecture titled: 'Simplification in partial and differential equations.' This was followed by an inter-view with Prof. Nalini Joshi, IMU Vice-President, University of Sydney. Prof. Andrei Okounkov, Fields Medalist, IMU Executive Committee member-at-Large, Columbia University then gave a survey lecture titled: 'Lie theory without groups.' A panel discussion titled: 'Internationalisation versus Geographical Isolation' was hosted with the following panellists: Prof. Loyiso Nongxa, IMU Vice-President, South Africa; Prof. Nalini Joshi, IMU Vice-President; Prof. Paolo Piccione, IMU ExCo Member-at-Large, Brazil and Prof. RT Ramadas, IMU ExCo Member-at-Large, India. The Chair was Prof. Precious Sibanda, SAMS President. Further interviews took place after lunch with Prof. Helge Holden, IMU Secretary General, Norwegian University of Science and Technology; Prof. Daya Reddy, ISC President, UCT; Prof. Jill Adler, ICMI President, University of the Witwatersrand and Prof. Barry Green, AIMS Director and CIMPA President. The Chair was Prof. Loyiso Nongxa. There was also an opportunity for participants to network with the entire IMU executive later in the day.



Above: Mathematics in Industry Study Group (MISGSA) 2020



Above: IMU Executive Committee members



Above: IMU Executive Committee engagement with mathematicians and graduate academics

AIMSSEC

AIMS SCHOOLS ENRICHMENT CENTRE

ACTIVITIES

AIMSSEC is proud to report on the following activities:

Courses

AIMSSEC presented its 32nd Mathematical Thinking (MT) Course to 55 in-service mathematics teachers from 2 to 11 January 2020 at Stellenbosch High School. The teachers came from three provinces Eastern Cape (31), KZN (5) and Limpopo (19). Three overseas lecturers and two local lecturers (one an AIMSSEC alumna) assisted the local team to present the course to three phase groups. Three AIMSSEC alumni assisted as teaching assistants, while one AIMSSEC alumnus assisted in the computer labs. The total number of teachers trained on the MT course over the last sixteen years now stands at 2094.

The National Skills Fund (NSF) visited the AIMSSEC residential part of the MT32 course on Friday 10 January 2020 to do student verification and gave AIMSSEC excellent feedback from the teachers attending the course. The teachers were all very impressed by all the presentations of the lecturers and by their teaching strategies and pedagogy which emphasised active engagement by the learners, a growth mindset and planning for learning. AIMSSEC supports the DBE strategy of Teaching Mathematics for Understanding which calls for a transformation leading to teaching

methods that enable learners in all mathematics classrooms in South Africa to make sense of what they learn.

The MT32 course took a while to complete as Assignment 2 which was due in April 2020, could not be submitted due to the lockdown level 5 restrictions. To be able to do Assignment 2 as originally planned, teachers and their learners would have had to be back in the classroom. With the phasing in of only grades 7 and 12 to return to school from 8 June, AIMSSEC decided that instead of submitting Assignment 2 each student had to submit a short report assignment to finalise the marks for the MT32 course. The students had to write this short report about their experiences during the AIMSSEC MT32 course and how the course influenced them, their learners and other teachers in their school or circuit or district.

The MT33 course could not take place as the lockdown in South Africa has made it impossible to run residential courses as planned. AIMSSEC then designed a new version of the Mathematical Thinking course which it offered online from August to November 2020. The Old Mutual Foundation sponsored this MT Online course.

Course	Course Date	# attended	% passed	Average mark
MT 28	Jan 2018	61	90%	63%
MT 29	July 2018	60	98%	64%
MT 30	March 2019	76	96%	69%
MT 31	June 2019	68	94%	65%
MT 32	Jan 2020	55	100%	73%
MT Online	Aug 2020	110	In progress	In progress
3 Year Total		430	478/5 = 95,6%	334/5 = 66,8%

Summary of results of the MT courses over the last three years



Above: Teachers and staff on the MT32 course.

AIMSSEC developed the **Mathematical Thinking Online Course** for mathematics teachers from schools who have entered their learners to take part in the Old Mutual South African Mathematics Olympiad (SAMO) organised by the South African Mathematics Foundation (SAMF). AIMSSEC will present the professional development course which will involve thirteen weeks of online learning (17 August to 20 November 2020). Each participant is expected to complete five assignments during this period. The format will be a virtual course, where AIMSSEC has invited international and local lecturers to share course materials and record their sessions to be shared with the students via WhatsApp, and Google Classroom. Lecturers will also facilitate live sessions with the teachers (live broadcasts) using the Google Meet platform.

Outreach activities

AIMSSEC contributed towards the public engagement arm of AIMS South Africa, by its involvement with National Science Week, International Women's Week and Africa Code Week.

Every year for the past five years AIMSSEC has organised a Global Maths Lesson for schools around the world. The lesson about fractals on 10 October 2019 involved over 10,000 learners from seventeen countries.

AIMSSEC HAPPY MATHS has a worldwide following of more than twelve thousand teachers, parents and home-schoolers every day (see the table below).

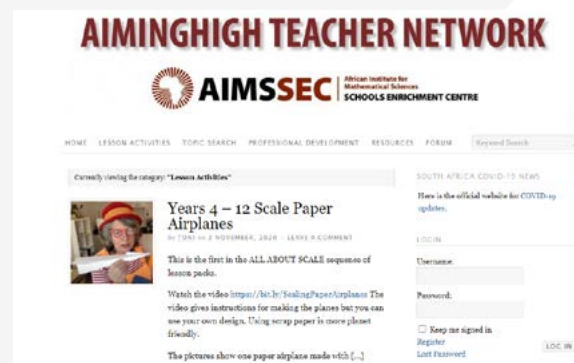
Ms Toni Beardon and Ms Caroline Ainslie provide a daily Inclusion and Home Learning Guide, and a live webinar, with a lesson starter for a class in school or a mixed-age group of learners in a family situation. Different learning activities are provided for each age-group from 4 to 18 on the same mathematical theme, and mathematical games at the weekends. For classes in school these resources enable teachers to cater for learners according to their needs.

For the last five years HAPPY MATHS has run an annual 30-minute Global Maths Lesson with more than ten thousand participants across the world, last year on Fractals and this year, to commem-

orate Florence Nightingale's 200 anniversary, on health statistics and women in science. This shared activity is suitable for all ages 8 to 18, and can be done at home or in school, and there are follow-up activities for each age-group on the AIMING HIGH website.

HAPPY MATHS is part of a drive towards sustainability for AIMSSEC and securing the funding to build a larger staff team in Muizenberg. The table below is evidence, for existing and potential sponsors, that AIMSSEC has a strong impact and its learning resources are valued and used by many people worldwide. Teachers from all types of schools and communities across the world, now use AIMSSEC learning resources. The plan is to attract South African teachers next year who will find their own funding to come on AIMSSEC courses along with teachers receiving bursaries and, in the future, for AIMSSEC to offer online courses to teachers across Africa who will pay for the tuition and the qualification.

The whole AIMSSEC AIMING HIGH online resource bank which has been zero rated for data usage <https://aiminghigh.aimssec.ac.za/category/lesson-activities/> offers free lesson activities, guidance for teachers and for home-learning, and forums for sharing ideas, is downloadable for use offline (open source under creative commons) with the AIMSSEC App (<https://aimssec.app/>) so that users do not have to be connected to the internet.



To support AIMSSEC's teaching methods, the Daily Learning Activities are introduced on <http://facebook.com/aimssec>. YouTube videos suitable for lessons in schools have been produced, and links to them put into the current learning activity resources on the AIMING HIGH website. (<https://www.youtube.com/mathstoys>).



Above: Children in India who took part in the lesson on fractals

AIMSSEC FaceBook Page Report from 1 May to 27 August 2020	Number Reached	Engagements on social media	Likes
Total from 1 May	1,451,788	32,298	900
Mean daily (108 days)	12,303	274	8

New video

AIMSSEC has created a new video about the work that they do. This can be viewed at <http://bit.ly/25KXS15>



New partnerships

An MOU was signed between AIMS South Africa and the South African Mathematics Foundation (SAMF) and the strategic benefit that AIMSSEC will receive is through their applications for funding and connections with the Department of Basic Education (DBE) and corporates. So far Old Mutual Foundation and the DBE responded positively and invited AIMSSEC to submit proposals for funding.



FUTURE PLANS

Subject Advisor Empowerment Project

The Department of Basic Education (DBE) has requested AIMSSEC through the South African Mathematics Foundation (SAMF) to design the Subject Advisors Empowerment (SAE) Course and customised it for seventy-five Senior Phase subject advisors in South Africa. It must be presented from October 2020 to June 2021. It comprises three courses adapted and extended for subject advisors from the first three courses of the AIMSSEC 7-course sequence. The first of the three courses SAE1 (to be followed by SAE2 and SAE3) is based on the AIMSSEC Mathematical Thinking (MT) Course already endorsed by SACE for 20 PD points and taught thirty-three times in South Africa and East Africa. The MT course has over 2200 alumni and proven scalability. SAE1 will extend the MT course to include Inclusion and Differentiation in the Mathematics Classroom. AIMSSEC is waiting for final approval of this project.

In planning professional development courses for mathematics subject advisors AIMSSEC has the flexibility to support subject advisors in their professional work during the difficult times ahead. Above all, the teaching methodology that AIMSSEC has always promoted, namely putting understanding, and the ability to connect different ideas and to apply subject knowledge, will help subject advisors and teachers to manage covering of the subject-content to make up for lost time due to the COVID-19 pandemic in ways that will not be damaging.

Translations of AIMING High activities into Spanish

AIMSSEC and laCaixa formulated an agreement of collaboration with EduCaixa, the education division of laCaixa, with the aim to deliver high quality content and development opportunities to a wide network of teachers in Spain and Latin America. This agreement will add value to AIMSSEC's record of providing excellent resource materials. There is also the possibility to offer the newly developed online course as Teacher Professional Development for primary and secondary schools in Spain, Latin America and African countries.

Evaluation of the MT Online Course

Prof. Kerstin Jordaan from SAMF arranged a meeting between AIMSSEC and Dr Adri van der Nest (Senior Lecturer Educational Studies UNISA) and Prof. Caroline Long to discuss the possibility of doing an evaluation of the MT Online Course. This could lead to further funding by Old Mutual and other funders. AIMSSEC is keen to explore possible research opportunities with postdocs from UNISA. AIMSSEC is waiting to receive confirmation about this evaluation from SAMF.

PUBLIC ENGAGEMENT



HOUSE OF SCIENCE

The AIMS House of Science aims to deliver public engagement and advance leadership, knowledge and skills for scientific outreach and science communication for AIMS students, researchers, and academics. It also provides mentoring and capacity building to enhance and up-scale AIMS students, researchers, and academics in research dissemination and community outreach. Its strategic objectives given the pressing developmental challenges in South Africa and on the African continent, include the following critical dimensions:

- To build capacity and train AIMS students, researchers, academics and alumni so that they are better enabled, skilled and confident in undertaking public engagement activities, initiatives and community outreach.
- To promote mathematics and science engagement with the broader community in Africa, showcasing mathematical sciences and its research applications conducted at AIMS.
- To improve the participation, progression and retention rates of women and girls in STEM-related fields.
- To conduct research studies on various topical issues on science/mathematics communication and gender inclusion in STEM in Africa.
- To stimulate young people's interest to pursue careers in science, technology, engineering and mathematics (STEM) and become the next generation of scientists, academics, leaders and problem solvers.

It is without a doubt that institutional frameworks such as the House of Science framework in AIMS South Africa have a pivotal role to play not only in the promotion of the mathematical

sciences within the broader community but with the implementation of the South African Department of Science and Innovation Science Engagement Strategy.

In its second year of existence, the House of Science has made significant progress in many areas.

Strategic alignment within the core pillars of AIMS South Africa

The House of Science framework has been enabled and aligned within core pillars of AIMS South Africa research and capacity building frameworks in order to demonstrate viable and strategic alignment between the operations of AIMS South Africa and those of South Africa national government mission, vision and objectives including the transformation agenda of the National System of Innovation. The House of Science framework has also been aligned with the strategies developed at AIMS, as well as the national and international policies and strategies that place science, technology and innovation and engagement at the heart of the country's socio-economic development.

Partnerships for Growth

House of Science is in a position to deliver its two flagship programmes by the end of 2020. House of Science's success lies in its partnership with African Gong - The Pan-African Network for the Popularization of Science & Technology and Science Communication. Both organisations have undertaken a Memorandum of Understanding as a means of confirming their commitment to work in a strategic partnership across three outlined programmatic frameworks:

- **Africa Scientifique - Leadership, Knowledge & Skills for Science Communication** is a unique training and capacity-building programme designed to support young and emerging African scientists, researchers, academics and science communicators, for the advancement of research expertise and capacity on the continent, and to build advanced skills, expertise and practice of science communication and research dissemination with publics in Africa.
- **Women Advancement Forum International Exchanges, Research & Academia (WAFIRA)** is a highly innovative and African-centric capacity-building and training programme designed to meet the leadership development, career aspirations and professional development needs of African women in STEM, in academia and research.
- **Ishango Workshops on Mathematics Communication in Africa - "Communicating the 'M' in STEM in Africa"** is a unique gathering of mathematical sciences researchers, practitioners, communicators, mathematical sciences users, science policy makers across South Africa to discuss and work together on current issues of public engagement and communication of mathematics and the impacts of mathematical sciences research in the African society.

The adaptation to the COVID-19 pandemic situation

Amid the COVID-19 restrictions, AIMS House of Science had to and still is adapting and innovating ways of delivering its programmatic activities. While some programmes were able to

be delivered online, it remains critical that others such as WAFIRA and Africa Scientifique are delivered face-to-face to create an enabling environment for robust and amplified participants' engagement.

The following online initiatives were launched:

- **AIMS Women in STEM Webinar Series**
The webinars aim to provide an enabling environment for women in mathematical sciences to share knowledge, challenges, and opportunities; and to empower each other.
- **Après-Lunch with Mathematical Scientist Webinar Series**
The webinars aim to provide a platform for the graduate students to engage with inspiring mathematical scientists/role models in academia/industry and other sectors. The webinars are also aimed at recruiting students from historically disadvantaged Institutions to take up study and research in mathematical sciences at AIMS South Africa.
- **AIMS House of Science Blog**
This activity aims to encourage graduates; emerging and established researchers working in the fields of Mathematical Sciences to contribute to bridging the gap between mathematical science and society in relation to research dissemination and community outreach. To date blog topics have included: Decolonisation of the knowledge in Africa through the lens of Mathematics; Towards using mathematical sciences to develop an algorithm for translating African languages; The role of mathematical sciences research in modelling the COVID-19 Pandemic.



WEBINAR SERIES

*Women Advancement in Mathematical Sciences:
Achievements, Challenges & Opportunities*

<p>6 JUNE 2020 11:00 SAST</p>  <p>Fatumah Atuhaire (PhD Candidate), University of Southampton, UK</p> <p>20 JUNE 2020 11:00 SAST</p>  <p>Dr Gaelle Andriamaro Rabarison (R&D scientist), Thales, UK</p>	<p>13 JUNE 2020 11:00 SAST</p>  <p>Mulanga Makhubele (Data Scientist), Telkom, SA</p> <p>27 JUNE 2020 11:00 SAST</p>  <p>Dr Omowunmi Isafiade (Lecturer), University of Western Cape, SA</p>
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RSVP: <https://forms.gle/DbnbUQ25rJeWGDsa9>
Question? Email Dr Rejoyce Gavhi-Molefe at rejoyce@aims.ac.za



AIMS African Institute for Mathematical Sciences
SOUTH AFRICA



WEBINAR SERIES

Après-Lunch with the Mathematical Scientist

19 AUGUST 2020 | 14:00 SAST



Robin Msiska,
AIMS South Africa Alumnus, AWL Inc./AI Tokyo Lab, Japan

RSVP: <https://forms.gle/oZs7jpUSXqX2XryQ6>
Question(s)? Email Dr Rejoyce Gavhi-Molefe at houseofscience@aims.ac.za



AIMS African Institute for Mathematical Sciences
SOUTH AFRICA

ACHIEVEMENTS

Support infrastructure for House of Science development and sustainability

Dr Mpfareleni Rejoyce Gavhi-Molefe is in her second year as the manager for House of Science. Her roles include, among others, provision of leadership, direction and drive on the public engagement landscape.

- 1 January - 30 June 2020: Dr Gavhi-Molefe was on maternity leave. However, she started working (on a 2-day basis) from home on the 1 April 2020.
- 31 March 2020: Dr Gavhi-Molefe was awarded a Master's of Philosophy in Science and Technology Studies. Her studies were focused on Science Communication and Public Engagement offered by the Faculty of Arts and Social Sciences at SU. Her research focus was on why scientists participate in science festivals, with special reference to Scifest Africa - the largest and most celebrated annual science festival in South Africa, which is held in Makhandla (formerly known as Grahamstown) in the Eastern Cape Province. An article from her research findings has been submitted in the International Journal of Science Education, Part B: Communication and Public Engagement.

Ms Mangakane Karabo Makola, the House of Science Intern was appointed from 1 April 2019 to support the manager in development of House Science. Her one-year position ended in March 2020. However, the position was extended from April 2020 to July 2020 and further in July 2020 to 30 September 2020 due to COVID-19. Ms Makola has completed her MPhil in Science and Technology Studies (Research Management and Evaluation) at SU.

In April 2020, House of Science submitted an NRF application to participate in the 2021/2022 DSI-NRF Graduate Internship Programme. If the application is successful, House of Science will have an opportunity to host the DSI-NRF interns for a period of 24 months, from 1 March 2021 to 28 February 2023.

During this reporting period, the House of Science has worked on several funding proposals. There have been some successes and setbacks, whilst we are still awaiting feedback on some funding proposals. In June 2020, a grant proposal was submitted to the University Capacity Development Programme. The proposal seeks to conduct two capacity-Building Workshops for graduate female Academics in mathematical and statistical sciences in the Universities in two regions in South Africa, particularly historically disadvantaged institutions.

ACTIVITIES

Workshops

On 22 July 2020, AIMS House of Science, in partnership with African Gong, conducted the **Africa Scientifique** introductory online workshop for the structured master's AIMS students. The purpose of an introductory workshop was to give participants an overview of the Africa Scientifique programme background and rationale; an-African context and perspective, as well as envisaged outcomes and benefits for participants. The main Africa Scientifique programme will feature a three-day intensive and interactive workshop that will take place from 28 to 30 September 2020 at AIMS. The workshop will be followed by a four-month mentoring and project activities' support for the participating students, as they plan and deliver their science communication and public engagement projects, as a direct means of applying the practical skills and knowledge that they have gained from the Africa Scientifique programme. The Africa Scientifique programme has been customized to fit with and address the specific requirements, gaps and challenges of AIMS students', researchers and academics.

AIMS Women in Stem (AIMSWIS)

The mentoring programme for the academic year 2019-2020 kicked off in September 2019 with a 'meet and greet' event which aimed to introduce students (both male and female) to the initiative and provide a platform for the new structured masters' students to meet and establish a good rapport with fellow women students and researchers based at AIMS South Africa. The objectives of the mentoring programme are to:

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

Mentoring Lunches

AIMSWIS hosted three mentoring lunches aimed at providing AIMS women students, lectures and researchers with an informal opportunity to discuss their career journeys and developments, share life experiences as women scientists, and establish relationships with women in mathematical sciences visiting AIMS.

On 25 October 2019, Dr Magdaleen Marais an extraordinary lecturer at the University of Pretoria, an Associate Research Fellow at AIMS South Africa, and a member of the Transregional Collaborative Research Centre (SFB-TRR)195 "Symbolic Tools in Mathematics and their Application" in Germany, facilitated a session.

Prof. Lijun Zhang, a mathematician at Shandong University of Science and Technology in China facilitated a session on 31 October. Dr Nancy Neudauer, a professor of mathematics at Pacific University, led a session on 3 March 2020.



Above: *Dr Magdaleen Marais mentoring session*



Above: *Prof. Lijun Zhang mentoring session*



Above: *Dr Nancy Neudauer mentoring session*

Annual Mentoring and Networking Event

On 30 November 2019, AIMWIS held its annual Mentoring and Networking Event, under the theme “breaking the glass ceiling”. The event welcomed more than twenty AIMS Structured Master’s students, alumnae, researchers, and businesswomen. The event featured an insightful keynote address, panel discussion, interactive mentoring group activities and games. Prof. Fanelwa Ngece-Ajayi, associate professor in the Chemistry Department and one of the research leaders at SensorLab at UWC, spoke on the topic “My Versatility, My Superpower”.

The event also featured a panel discussion themed “Navigating the STEM World”. Moderated by Ms Karabo Makola, House of Science Intern, the panel comprised of Ms Anelda van der Walt, eResearch Consultant and trainer at Talarify (a company she founded); Ms Tshenolo Daumas, AIMS South Africa alumna and recipient of the Ben and Mary Turok Scholarship Award for Excellent Achievement during her graduation in November 2019; Ms Mai Rizk, AIMS South Africa alumna, who is currently doing an MSc at the UCT; Dr Nichol Furey, a postdoctoral researcher in mathematical physics at Cambridge University, on a research visit to AIMS South Africa and Prof. Ngece-Ajayi.



Above: *AIMSWIS Annual Mentoring and Networking event*

Webinar Series

During the reporting period, six webinars were held in June and July 2020. The webinars featured female role models (AIMS alumni), based in various institutions across the world and currently pursuing different career paths in academia and industry. During the webinars, they shared their insights with regards to issues related to career progression and the associated lessons learnt, research opportunities, and challenges that are unique to African women in mathematical sciences in their respective contexts.

The theme for the webinars included ‘Women Advancement in Mathematical Sciences: Achievements, Challenges & Opportunities; Developing & Sustaining Professional Relationships; ‘The Transition after AIMS training; amongst others. The webinars which have been hosted every second Saturday have been attended by AIMS students from all of the AIMS Centres, alumni, academics and researchers as well as students from South African universities and other universities on the continent.



6 JUNE

Ms Fatumah Atuhaire, PhD Candidate in Mathematical Biology, University of Southampton, UK



13 JUNE

Ms Mulanga Makhubele, Data Scientist, Telkom, SA



20 JUNE

Dr Gaelle Andriamaro Rabarison, R&D Scientist, Thales, UK



27 JUNE

Dr Omowunmi Isafiade, Academic & Researcher, UWC, SA



11 JULY

Dr Fadekemi Janet Osaye, Non-tenured Assistant Professor, Auburn University, USA



25 JULY

Dr Milaine Sergine Seuneu Tchamga, Postdoctoral Fellow, AIMS South Africa



Ms Comfort Mintah, PhD Candidate in Quantum Local Operations and Classical Communication, University of Guelph, Canada

Participant quotes

"I am grateful for the opportunity to join AIMSWS... it has helped me a lot. I had fear [sic] at first about doing a PhD since I'm in the process of starting it, but now I'm ready to take on the world."

"As a young woman in Academia, I'm on my early stage of my journey as an academic, I need someone who has more experience in journey. I have learned a lot from this webinar."

Public Lecture Series

Held every month, the Public Lectures Series provides an opportunity for scientists to showcase their research ideas and results and engage with the broader community. During the period under review, AIMS South Africa presented a series of public lectures. They were attended by members of the public and AIMS students, academics and researchers.



The 6th Muizenberg Festival took place from 7 to 13 October 2019. On 8 October, AIMS South Africa together with the Muizenberg Festival brought together experts from both basic and applied research in a public lecture themed "Basic versus Applied Research" on 8 October.

The talk titles and speakers were:



- 'Three decades of socio-ecological changes in False Bay' - Dr Maya Pfaff, Senior Scientist, Department of Environment, Forestry and Fisheries (Oceans and Coasts), and an Honorary Research Associate of UCT (Biological Sciences).



- 'Interactions between plants and their mutualists' - Prof. Cang Hui, South African Research Chair in Mathematical and Theoretical Biosciences at SU.



- 'Mathematics, the language that answers when you speak it' - Dr Daniel Nickelsen, Postdoctoral researcher, AIMS South Africa and the National Institute of Theoretical Physics



On 30 January 2020, Prof. Hans Mittelman, Professor of Computational Mathematics, Arizona State University, gave a talk titled: 'Optimization is Ubiquitous - Even if Hidden under a Different Name'.

On 3 February 2020, Dr Karina Leppik, Stratospheric Observatory for Infrared Astronomy Mission Director, NASA gave a talk titled: 'What do you get when you mix a telescope with an airplane'.



On 12 March two visiting lecturers, Prof. Douw Steyn, Professor Emeritus of Atmospheric Science, University of British Columbia (pictured top left) and Dr Stefano Galmarini, Researcher, European Commission/Joint Research Centre (pictured bottom left) gave a talk titled: 'Bias adjustments of climate variables for a more precise Climate Risk Assessment'.

Research/study visit at AIMS

From 19 to 20 September, AIMS South Africa had the pleasure of hosting two groups of students pursuing undergraduate studies in mathematics, applied mathematics, statistics, and computer science from the universities of Limpopo and Walter Sisulu. The students visited AIMS as part of their educational tour as required by the Department of Higher Education and Training.

Students were provided with an overview of the AIMS vision and mission; academic, research and public engagement programme; its impact/footprint locally and internationally. They were also exposed to role models in mathematical sciences and job opportunities available in their respective fields through a panel discussion. Some of the students felt that they received valuable information that they can use in their careers in the future. Others came to AIMS exuding a sense of despondency at their mathematical sciences degrees and said that the visit helped them gain insight into the field.

"I didn't understand what AIMS was about even when I read about it online but the description I got made me want to pursue mathematics. I'm a 2nd-year student who always wanted to study human genetics but I found myself in mathematical sciences because of limited space in my desired course but the panelists have outlined how possible it is to link mathematics with everything. AIMS has finally given me hope that I will definitely



Above: *Walter Sisulu University student visit*

get to pursue human genetics in future and I hope to do this under the guidance of this institution", said one of the students.

Another student reiterated the sentiments shared by most of the students.

"Doing a BSc degree seemed difficult until I visited AIMS South Africa. At times I felt like dropping out because it was tough. However, this visit has given me hope again. I felt like I have gained so much knowledge and I am more motivated than ever", the student said.

The research/study visit at AIMS programme aims to recruit and boost the transformation and pipeline by encouraging students from historically disadvantaged institutions to take up the opportunities in mathematical sciences offered at AIMS South Africa.

Future activities

The **WAFIRA programme**, in partnership with African Gong and UWC, is scheduled to take place in November 2020 at UWC. Partners are in place and the resources (i.e. venue and programmatic activities) have been committed to. However, WAFIRA will be rescheduled in the event of an extended national lockdown.

The **Ishango Workshops on Mathematics Communication in Africa - "Communicating the 'M' in STEM in Africa** is planned to be hosted in 2022. The concept has been initiated.

STAKEHOLDER ENGAGEMENT

Meetings

Prof. Bruce Bassett and Ms Deborah Wilsnagh represented AIMS South Africa as part of the Data Analytics & African Futures for Social Justice panel, of the Social Justice Summit organised by Prof. Thuli Madonsela on 29 August 2019. The purpose of the summit was to unpack the nature of social justice in South Africa, its various dimensions, the pathways available to address social injustice and to leverage the opportunities presented by the Sustainable



Above: *Limpopo University student visit*

Development Goals (SDG's), the National Development Plan (NDP) and the Constitution. The summit was attended by a wide range of well-known figures including Prof. Ben Turok, Minister Jackson Mthembu, former President FW de Klerk, former Statistician General, Dr Pali Lehohla, Prof. Jonathan Jansen and Nicky Newton King, CEO of the JSE. The data analytics panel agreed to form a think tank to advise on the development of tools to support social justice in South Africa, to be convened by Dr Lehohla and supported by AIMS South Africa.

The CIMPA Steering Committee Meeting was held in Valladolid, Spain, from 23 to 24 January 2020. Prof. Green chaired the meeting as CIMPA President.



Above: *University of Toronto visit*

Visitors

On 3 October, Ms Gwen Burrows, Executive Director, International Office of the Vice President and Prof. Joe Wong from the University of Toronto visited AIMS South Africa. They had a meeting with Prof. Barry Green, Prof. Wilfred Ndifon, Director of Research - AIMS Global Network, Dr Simukai Utete, Academic Director, Dr Barrie Barnard, AIMSSEC, and Dr Rejoyce Gavhi-Molefe, House of Science Manager. During the meeting research and other opportunities between the University of Toronto and the AIMS Network were explored.

On 21 November a Delegation from the Ministry of Tertiary Education, Research, Science and Technology, Botswana, visited AIMS South Africa. The delegation included Dr Theophilus Mooko, Permanent Secretary in the Ministry of Tertiary Education, Research and Science Technology and Head of Delegation and Mr Mathogonolo Mokakapadi, Deputy Permanent Secretary in the Ministry of Tertiary Education, Research, Science and Technology. They met with Prof. Green and representatives from AIMS-NEI, Mr Rana Auditto, Vice President Operations and Chief Financial Officer, Mr Roméo Essou, Vice President & Chief Programs Officer, Mrs Karen Sutherland, Director, Monitoring & Evaluation and Mr Mathias Goldstein, Director, Advancement and Partnerships. Dr Simukai Utete, Academic Director also attended the meeting. The delegation was given a tour of the centre and discussions were held to find out more about AIMS and its programmes.



Above: *Delegation from Botswana visits AIMS*

On 18 November Dr Moncef Meddeb, the Science and Technology Attaché for the French Embassy in South Africa visited AIMS South Africa. He had a meeting with Prof. Green to discuss opportunities and interactions between the French Embassy and AIMS South Africa. During the meeting it was announced that a donation would be made towards computers for the lab. AIMS South Africa was very grateful for this unexpected and generous donation.

On 17 February, a delegation consisting of members of the French embassy and the French South African Chamber of Commerce visited AIMS South Africa. The delegation included: Mr Bruno Asseray, Counsellor for Bilateral Cooperation, French Embassy, Dr Moncef Meddeb, Attaché for Science and Technology, French Embassy, Mr Jean-Claude Lasserre, CEO South Africa & Sub Saharan Africa, Saint Gobain, Mr Cédric Serre, Head of Marketing, Bureau Veritas, Mr Yves Guéron, France South Africa Chamber of Commerce, Mr Stéphane Kasédan, Eagle Travel and Mr Rémi Burdairon, Barak Fund Management. They met with Prof. Green, Prof. Bassett and Ms Linda Camara, Communications Manager. The meeting was held to discuss possible collaboration between AIMS and French companies. Dr Meddeb and Mr Asseray also took the opportunity to view the new computers that were bought with the donation received from French embassy in 2019.



Above: *Members of the French embassy and the French South African Chamber of Commerce visit AIMS*

THE AIMS NETWORK

GRADUATION

The AIMS Network graduates 162 students

In July 2020, AIMS held a virtual ceremony to honour 162 graduates (38% women) from 29 African countries, recipients of the AIMS Master's in Mathematical Sciences. Featuring a commencement address by Professor Neil Turok, AIMS Founder and Board Chair, the ceremony celebrated the graduates of the AIMS Structured Master's Program from AIMS Cameroon (32), AIMS Ghana (44), AIMS Rwanda (37), AIMS Senegal (10) and AIMS South Africa (39). Africa's youth are at the heart of the AIMS innovation and transformation ecosystem, with an alumni community now totalling over 2000.

The official graduation video can be viewed here
https://youtu.be/_OcnqPCLnNAs



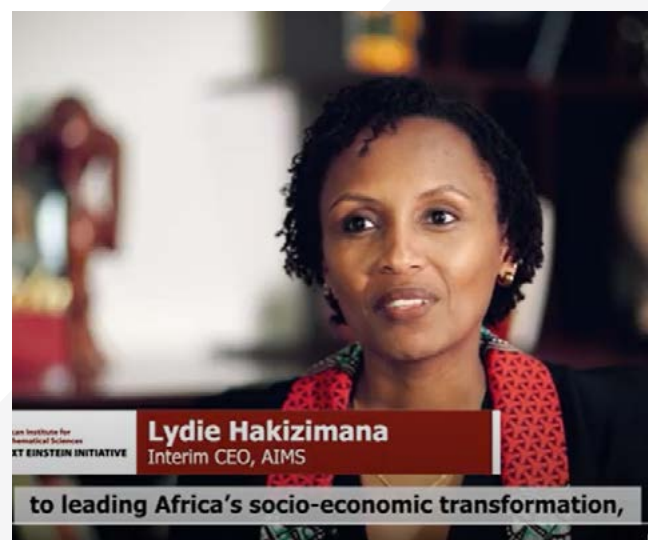
UPDATES

New appointments

In this reporting period some changes were made at the executive management level of AIMS-NEI. In March 2020, Ms Lydie Hakizimana, was appointed as the interim Chief Executive Officer. Besides her extensive experience as an educator, entrepreneur and publisher, she has been an active member of the AIMS International Governing Board for the past four years. She recently accepted the appointment as CEO. Prof. Wilfred Ndifon was appointed as the Chief Scientific Officer and Prof. Mama Foupouagnigni was appointed as the Chief Academic Officer.

AIMS Corporate Video

A new AIMS Corporate video was completed and distributed in September 2020, it can be viewed here:
<https://www.youtube.com/watch?v=FHyPbpMKQn0>



Prof. Neil Turok appointed as Inaugural Higgs Chair

Prof. Neil Turok, a world-leading researcher in theoretical and fundamental cosmology and founder of AIMS, has been appointed as the Inaugural Higgs Chair by the University of Edinburgh. Prof. Turok will be joining the Higgs Centre for Theoretical Physics in the School of Physics and Astronomy starting July 2020.

ACTIVITIES

Visit to Japan

From 26 to 30 August Prof. Barry Green visited Japan where an agreement of cooperation was signed between the AIMS-NEI Network and Tohoku University. He also gave a joint presentation with Prof. Motoko Kotani, on AIMS and interaction with the Mathematical Society of Japan, at the 7th Tokyo International Conference on African Development. Prof. Kotani is Director of the Advanced Institute for Materials Research, one of Tohoku University and a former President of the Mathematical Society of Japan.

Visit to AIMS South Africa

Mr Sampson Kofi Adotey, Reporting and Proposals Manager, Research, AIMS Global Network, visited AIMS South Africa from 11 to 18 September. During this visit he took the opportunity to conduct interviews with various researchers as well as hosting a session for the students on the AIMS Community platform. This platform has been set up to facilitate engagement and knowledge exchange.



Above: AIMS Portal Student Session with Mr Sampson Kofi Adotey

Second cohort of AIMS Women in Climate Change Science Fellows

On 28 February, AIMS announced its second cohort of AIMS Women in Climate Change Science whose research is contributing to the fight to preserve humanity in the face of climate change.

The three fellows are Dr Naomi Kumi, Ghana, Senior Meteorologist and Head of Climatological Unit at the Ghana Meteorological Agency, Dr Ossénatou Mamadou, Benin, Lecturer and Researcher at the Institute of Mathematics and Physical Sciences and Dr Lala Kounta, Senegal, Post-doctoral Researcher at the Laboratoire de Physique de l'Atmosphère et de l'Océan Simeon Fongang.

Each Fellow, selected by an international scientific committee



Above:
Dr Naomi Kumi



Above: Dr Ossénatou
Mamadou



Above:
Dr Lala Kounta

through a rigorous process, is awarded around USD 35,000 over a one-year period to execute a self-initiated research project in a selected African host institution. The projects have potential to contribute significantly to the understanding of climate change and its impacts, and to the development and implementation of innovative, empirically grounded policies and strategies for climate change adaptation and resilience.



Above: Howard Alper and Prof. Mama Foupagnigni

Fact-finding Mission

From 4 to 5 March Prof. Mama Foupagnigni and Prof. Howard Alper visited AIMS South Africa as part of a network wide Academic Fact-finding Mission. Meetings were held to discuss the Academic Programme with those concerned at each of the centres. To highlight and suggest best practices, suggest areas where improvement should be made and in a supportive way determine the overall health of the academic and research departments within the AIMS Network. Discussions were held with all involved: AIMS Students, Tutors, Researchers, the Academic Director and Chief Operating Officer as well as the Centre Director.

NITheP Colloquium

On 4 May Prof. Wilfred Ndifon, Professor of Theoretical Biology & Research Director AIMS and Prof. Neil Turok, Director Perimeter Institute and AIMS Founder gave a talk titled: 'A strategy for finding people infected with COVID-19: optimising the efficiency of pooled testing.' To view the talk visit <https://www.youtube.com/watch?v=CeWaQh0a7l4&feature=youtu.be&t=2>



Above: NITheP Colloquium

GOVERNANCE AND ADMINISTRATION

Trust

AIMS South Africa was saddened to announce the passing of Prof. Ben Turok, a Trustee and long-time supporter of AIMS on 8 December 2019.

The Trust meeting was held on 20 January 2020 and Ms Nasima Badsha, Prof. Fritz Hahne, Prof. Neil Turok, and Prof. Daya Reddy were all in attendance.

Council

The AIMS South Africa Council meeting took place on 20 January 2020. Council members in attendance included Prof. David Holgate, Prof. Stéphane Ouvry (via skype), Prof. Daya Reddy (Chair), Prof. Balazs Szendroi, Prof. Neil Turok, Prof. Louise Warnich and Prof. Grae Worster (via skype). They were joined by Prof. Barry Green, Ms Deborah Wilsnagh, Ms Lynne Texeira and Mr Rana Auditto, Vice President Operations and Chief Financial Officer of AIMS-NEI (via Skype).



Above: AIMS council members

Advisory Board

The AIMS South Africa Advisory Board which 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, is still under revision.

Executive Team

The AIMS South Africa Executive Team assists the director and academic director with the selection of students for the Master's programme and facilitates the relationship between AIMS and the three participating universities. Members during this period were Dr Hannes Kriel and Dr Karin-Therese Howell (SU), Prof. Nicola Mulder and Dr Julien Larena (UCT), and Prof. Kailash Patidar and Dr Sylvain Halindintwali (UWC).

Staff

Prof. Barry Green, Director, is assisted by the Management Team consisting of Dr Barrie Barnard (AIMSSEC Manager), Ms Linda Camara (Communications Manager), Mr Jan Groenewald (IT Manager), Mr Igsaan Kamalie (Facilities and Logistics Manager), Dr Rejoyce Gavhi-Molefe (House of Science Manager), Dr Simukai Utete (Academic Directors) and Ms Deborah Wilsnagh (Chief Operating Officer).

In June 2020, a valued colleague, Ms Rene January, Senior Administrative Officer, left AIMS to follow other opportunities.

Following the announcement of the National Lockdown from midnight on 26 March 2020, all AIMS South Africa staff not resident at AIMS worked from home, with only online interaction with AIMS.



Information Technology

During 2019-20 the AIMS South Africa IT department expanded configuration management, zfs usage, and completed extensive upgrades of laptops, desktops, and servers to Debian 10. The AIMS Desktop distribution was also updated to be based on Debian 10.

In November 2019 we started replacing the hardware of almost decade-old desktops with 10 new systems, later augmented by a donation from the French Embassy in South Africa. Over 100 further desktops are needed to complete a campus-wide upgrade.

New dual-band wireless access points were installed to expand the capacity in the lecture room and main computer lab, and the computer lab printer was replaced. The Impro Controller which runs the access tag system for the campus buildings was also upgraded. To better cater for load shedding, the batteries in 3 UPSes were replaced, and one new UPS purchased to keep the admin and finance offices connected to the internet during power outages.

The Stellenbosch High Performance Computing staff created a separate Graphics Processing Unit queue in the job scheduler software and the underlying operating system was upgraded, where the AIMS German Research Chair in Data Science has a server and GPU hosted. Then upgrades could proceed to newer versions of Nvidia GPU drivers and libraries, up to the version of tensorflow machine learning platform preferred by AIMS research students. This allows specified users to request the GPU as a computing resource when submitting code to run rather than having to manually request a computer.

During the first part of the year workshops and researchers were supported as usual, with ad-hoc software changes, but the global COVID-19 pandemic and lockdown regulations brought an abrupt end to physical gatherings. IT support shifted gear into supporting multiple video conferencing platforms to support both work-from-home and remote-teaching. AIMS already used Google Suite for office productivity, ensuring a smooth transition. Existing Google Meet, special licensing for Zoom available from TENET, and for Teams available from SU allowed us to use premium features on these platforms. The two "TV trolleys" on campus were used both for student-supervisor meetings, and for conducting and recording the oral defences of the 2019-20 structured Master's research projects.

Tutor Mr Lebeko Poulo assisted in the IT department with support and tutoring, while also lecturing Python courses, and Jonathan Carter continued as Systems Architect, while previous intern Mr Kyle Robbertze joined as a part-time junior System Administrator for 2020.

International internet connectivity on campus remains at 24.17M, with excellent reliability and support from TENET.

Classes in Computing and LaTeX, AIMS Desktop, online collaboration, revision control, and related computing topics were taught to the AIMS South Africa August and January Structured Master's intakes.

Communications Report

For the period under review we've achieved a noteworthy increase in our reach on our social platforms.

As predicted from the results of previous years, our YouTube channel has achieved a massive growth of 2227 new subscribers, reaching a current number of 10,2k channel subscribers. This increase exceeds the growth of the previous year by 627 new subscribers. Within this period we've had 218,792 views on this video platform, of which only 10,8% are from actual subscribers to our channel. The majority of our viewers fall into the age group 18-34 (42,8%), closely followed by the age group 25-34 (37,5%). In terms of location, most of our viewership reside in India (19,1%) and the United States (17,3%). We have a 3% reach on the African continent. The gender discrepancy has successfully reduced from viewership of 95% male and 5% female (in the previous year), to

89% male and 11% female. Our top viewed videos are the first two lessons from Tadashi Tokieda's course on Topology & Geometry with 55,949 views being the top ranked single video. Tadashi Tokieda's course was again promoted on social media during the COVID-19 pandemic as a free and fully accessible AIMS Course.

Our network on our Facebook page has increased by 394 users since last year, leaving us at 4,417 page likes. The top performing Facebook post, 11,021 people reached, was a motivational post for 'International Day of Women and Girls in Science'. This visual graphic encourages women and shows that in unity, as a team, women in STEM can silence the negative voices which tell them that they cannot do science because of their gender. The post received 954 engagements, 102 comments and 40 shares.

Our reach on Twitter has persisted and grown by 361 new followers to 2,592 followers. Our least used platform due to link sharing limitations, Instagram, has still increased by 61 followers currently reaching 380 followers.

With the workspace changes of the COVID-19 pandemic, New Media at AIMS South Africa has shifted from content creation which focuses on documenting events taking place on campus, to facilitating content created by AIMS affiliates. In order to achieve the most professional quality given the circumstances, video skills training and guides are made available where possible.

Overall, there has been a significant increase of reach on all our social sites, and there is progress towards attracting more women to AIMS South Africa through social media.

Newsletters continue to be sent out on a regular basis and other marketing literature such as posters, websites, certificates etc. have been created to support workshops, events and talks at the centre and hosted online. The ARC Report 2020 was produced and distributed online. A new AIMS South Africa brochure and leaflet were produced in collaboration with the AIMS Network Communications Team. Work has also commenced on the new website.

Facilities Report

Following the announcement of a National Lockdown, AIMS South Africa made the following arrangements which were coordinated by the facilities team.

- The Main AIMS Building in Melrose road was locked down and only those staying there had access, which was controlled. These included the students and the Facilities and Logistics Manager, Mr Igsaan Kamalie, and his family.
- Only essential (reduced) catering and cleaning staff, as allowed within the national regulations for essential services and subject to the hygienic safety regulations, were allowed to access the building.
- The Administrative and Research Centre Buildings, as well as the AIMSSEC Offices in the Watson Street Building were closed and locked throughout the National Lockdown, and not accessible to anyone.
- Tutors, Researchers, Postdoctoral Fellows, Research Master's, and PhD students living at the St Claire and Watson Street Buildings were expected to lock down in those building subject to the national regulations. Arrangements were made for food to be delivered to these residences.
- The Facilities Manager had discussions with those locked down in the Main Building and Watson Street/ St Claire beforehand to discuss the details of the contingency plan, which included health related support.

FINANCIAL OVERVIEW

Financial Report 2019-20

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

Figure 1: Total income per main component

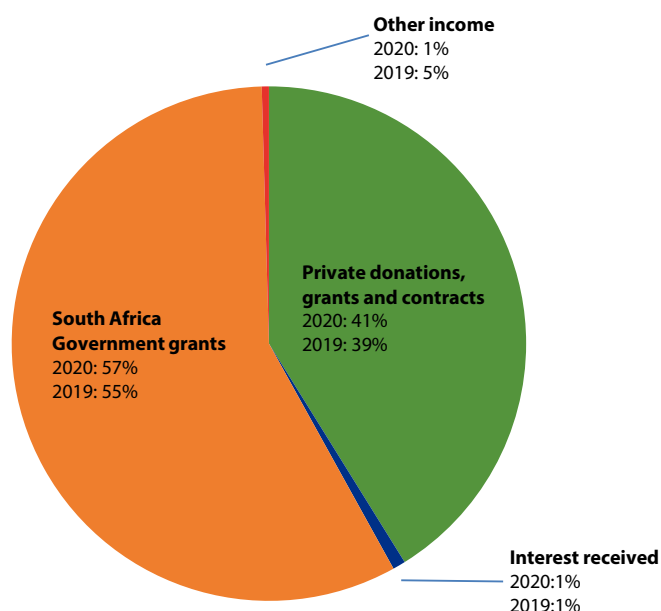


Figure 1: shows the comparison of AIMS South Africa's income per main component as well as the relative ratio to total income

Total income for 2020 decreased by 9% to R34,481 million compared to R37,997 million in 2019. The variance is as a result of a lower grant approved by the Department of Science and Innovation, the fact that AIMSSEC could not hold the teacher training residential training course in June 2020, which impacted on the National Skills Fund grant payment and due to several workshops being cancelled as a result of the COVID-19 pandemic.

South African Government grants for the 2020 and 2019 years are as follows:

Department	Programme	2020	2019
Department of Higher Education and Training	Academic Programme	R 6 171 000	R 5 844 000
Department of Science and Innovation	Academic Programme, Research Programme and Post AIMS Bursaries	R 2 887 500	R 4 067 857
National Research Foundation	Research Programme	R 5 754 269	R 5 383 499
National Skills Fund	Teacher Training Academic Programme, South African Taught Master's and Teacher Training bursaries	R 5 208 452	R 5 953 151
Total South African Government Grants		R 20 021 221	R 21 248 507

Private donations, grants and contracts, is comprised mainly of funding from MasterCard Foundation towards the Taught Masters' Programme, grants from The Alexander Von Humboldt Foundation towards two German Research Chairs and DAAD scholarships.

Private donations, grants and contract income for the 2020 and 2019 years are as follows:

Department	Programme	2020	2019
MasterCard Foundation	Taught Master's Programme and Teacher Training Bursaries	R 4 155 097	R 4 205 646
The Alexander Von Humboldt Foundation	German Research Chairs	R 3 620 690	R 2 181 771
AIMS-NEI Research	Research Programme	R 507 932	R -
The Robert Bosch Foundation	Research Programme	R -	R 1 356 427
The Oppenheimer Memorial Trust	Teacher Training Programme	R -	R 300 000
DAAD	Bursaries/Scholarships	R 1 126 827	R 1 974 437
Other private donations	Taught Master's, ESMT, DSI, SIAM and Teacher Training Programmes	R 4 893 788	R 4 881 732
Total Private donations, grants and contract income		R 14 304 334	R 14 900 013

Figure 2: Total expense per main component

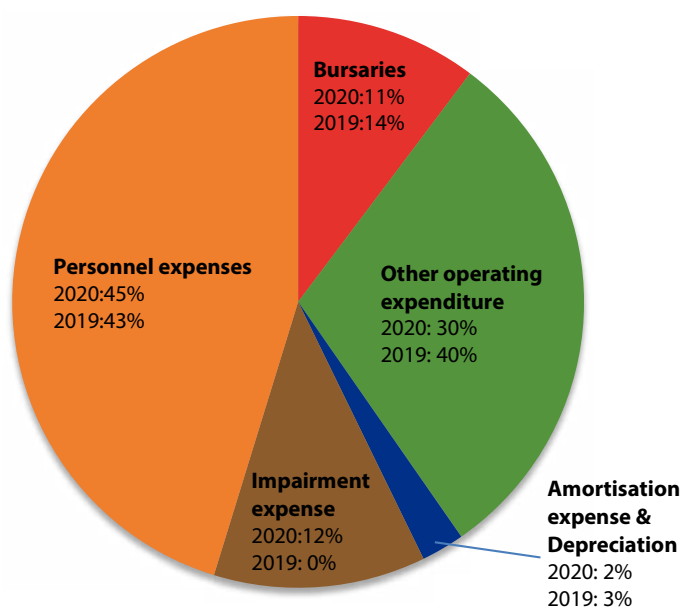


Figure 2: shows the comparison of AIMS South Africa's expenditure per main component as well as the relative ratio to total expenditure

Total expenditure for 2020 increased by 5% from R41,465 million to R43,637 million and is largely due to an impairment expense of R5,23 mil as a result of the independent property valuation completed on the AIMS Main Building, 6 Melrose Road Muizenberg and depreciation of R1.06 mil. However, should the impairment expense and depreciation be ignored, actual expenditure decreased by 7% due to savings as a result of the impact of COVID-19 on normal activities.

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

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

Remuneration costs increased by 11% due to a 5.5% annual cost of employment adjustment which was approved for all qualifying staff and new staff appointments which includes research and IT staff appointments as well as the new German Research Chair.

Expenditure is monitored carefully, within prescribed limits, determined by funder regulations and requirements.

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES *SOUTH AFRICA*

CONSOLIDATED STATEMENT OF FINANCIAL POSITION AT 30 JUNE 2020

	2020	2019
	R	R
ASSETS		
NON-CURRENT ASSETS	28 122 541	34 646 784
Property, plant and equipment	24 295 995	30 269 651
Intangible Assets	1 156	7 093
Financial Assets	3 825 390	4 370 040
CURRENT ASSETS	3 924 511	7 579 775
Cash and cash equivalents	1 879 763	132 940
Trade and other receivables	208 032	4 736 323
Stellenbosch University receivable	1 836 716	2 710 512
TOTAL ASSETS	32 047 052	42 226 559
FUNDS AND LIABILITIES		
FUNDS AND RESERVES	25 789 229	35 283 716
Accumulated funds	21 797 471	30 405 318
Restricted reserve: endowment fund	1 997 306	1 902 502
Restricted reserve: other	143 611	508 358
Fair value reserve	1 850 842	2 467 538
CURRENT LIABILITIES	6 257 822	6 942 843
Trade and other payables	6 257 822	6 942 843
TOTAL FUNDS AND LIABILITIES	32 047 052	42 226 559

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES *SOUTH AFRICA*

CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2020

	2020	2019
	R	R
Government grants	20 021 221	21 248 507
Donations Income	14 304 334	14 900 013
Other income	155 373	1 848 936
Gross Income	34 480 928	37 997 456
Operating expenses	(43 636 663)	(41 464 722)
Operating deficit	(9 155 735)	(3 467 266)
Finance income	277 945	318 423
Deficit for the year	(8 877 790)	(3 148 843)
Other comprehensive income:		
Item that may be subsequently reclassified to profit or loss		
Change in value of available-for-sale financial assets	(616 696)	(216 739)
Total comprehensive deficit for the year	(9 494 486)	(3 365 582)

SUPPORTERS FOR PERIOD UNDER REVIEW

AIMS South Africa Donors

AIMS Endowed Scholarships contributors

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

Alexander von Humboldt Foundation

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

European School of Management and Technology (ESMT Berlin)

German Academic Exchange Service (DAAD)

German Federal Ministry of Economic Cooperation and Development (BMZ)

German Federal Ministry of Education and Research (BMBF)

Google Inc.

Government of South Africa:

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

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

The Mastercard Foundation Scholars Program

Perimeter Institute for Theoretical Physics

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

Stellenbosch University

Université Paris-Sud XI

University of Cambridge

University of Cape Town

University of Oxford

University of Pretoria

University of the Western Cape

US Fulbright Specialist Program

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

Wilson Lamb

Paul Taylor

Richard Katz

Peter Grindrod

For a list of all AIMS South Africa supporters, please visit:
<https://www.aims.ac.za/en/support/supporters>

AIMSSEC is grateful to its sponsors for supporting its programmes.

Anghileri Family Trust, UK

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Government of South Africa DHET through the National Skills Fund

Homerton College, Cambridge

Mawethu Training

METEA Mathematics Education to Empower Africa UK Charity

Old Mutual Foundation through the South African Mathematics Foundation

St John's College, Cambridge

The Principals Academy

FOREXCELLENCE PROGRAM

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

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



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