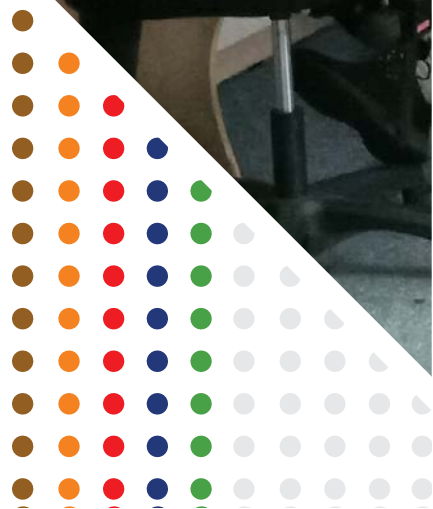![AIMS logo] **AIMS** | African Institute for Mathematical Sciences **SOUTH AFRICA**

ANNUAL
REPORT
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ABOUT US

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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).*

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.

This is the annual report of AIMS South Africa for the period 1 August 2020 to 31 July 2021. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2020 calendar year.

Since AIMS South Africa opened in 2003, 919 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 Next Einstein Initiative,**
Kigali, Rwanda, Email: info@nexteinstein.org.

For further information, see www.nexteinstein.org

AIMS South Africa offers:

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

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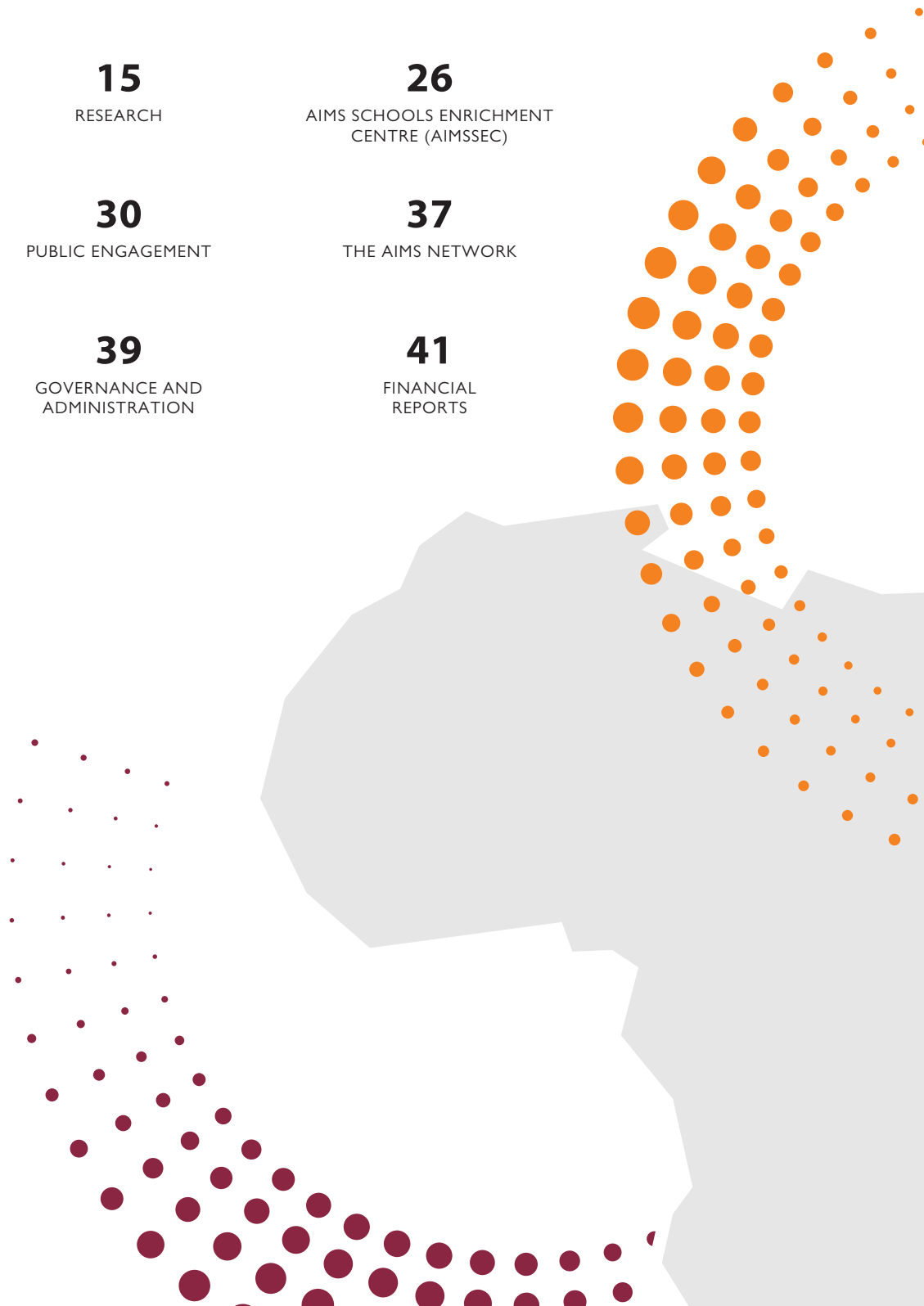
FOREWORD

This year's annual report has fewer pictures than normal, which reflects the changed life at AIMS South Africa. There were very few visitors and the COVID-19 pandemic kept us locked up for most of the time. Nevertheless, we were able to run our core academic, teacher training and outreach programmes successfully, and it is a pleasure to acknowledge the enormous effort made by our staff, ensuring we achieved our goals. Our academic, IT, facilities, and administrative staff, contributed to this effort in a special way, and often work at AIMS became work for AIMS at home, with new demands. So it is a pleasure to acknowledge their effort here and to thank them all. Added to this our students and lecturers, local and international, adjusted well to online work. It is a pleasure to acknowledge the lecturers' contribution and students' achievements presented in this report.

For the 2020-21 cohort we selected students from the southern regions of Africa, and the AIMS centres in Senegal, Ghana, Cameroon, and Rwanda made similar selections in their regions, so as a network we still managed to offer the AIMS Master's to students from all of Africa. The academic year started much later in 2020, only in November, due to lockdown regulations and the availability of flights, and so extended to August 2021. Because we couldn't accommodate more than one student per room in our living quarters, we selected fewer students than normal and we were pleased that 31 students graduated successfully, among them 14 women. There are another 11 students on our January intake who are due to graduate in December this year. This brings the total number of students who have graduated at AIMS South Africa to over 900, of whom more than 100 are South African. They are all making a significant contribution after AIMS, which we are proud of.

Onsite research activities were significantly reduced, but these were replaced by an online Journal Club, coordinated by Dr Daniel Nickelsen, as well as meetings and events organised by the Data Science and Cosmology groups. PhD and Master's defences, now attracted a larger attendance. In July we successfully hosted the first SIAM Summer School in Africa on the Theory and Practice of Deep Learning. This was a hybrid onsite-online event and included participation by the AIMS centres in Cameroon and Rwanda too.

The AIMS Schools Enrichment Centre (AIMSSEC) offered Mathematical Thinking and Mathematical Communications and Language Courses online for the first time. These were attended by more than 150 teachers from all over South Africa, including rural areas. The success of these courses has paved the way for an onsite-online offering in future. Since AIMSSEC was founded in 2003 it has encouraged, enthused and trained more than 2300 teachers on its Mathematical Thinking Course, which we are most proud of.

Our House of Science led by Dr Rejoyce Gavhi-Molefe offered an interesting programme which is presented in detail in the report. This was particularly upbuilding and rewarding for our students at AIMS, who have been quite isolated in the lockdown situation. These events and activities, even though online or in hybrid format helped them grow and feel linked to the broader scientific community. The Africa Scientifique Workshop which was presented with Africa Gong, was very positive as well as other gender and science growth activities.

The gradual easing of lockdown regulations and vaccinations are helping us return to normal in a controlled way, opening our centre to its exciting routine of activities. We are hopeful that there will be onsite lectures from early 2022, including visitors and workshops hosted by AIMS.

We all look forward to that!

BARRY GREEN
- D I R E C T O R -

ACADEMIC
PROGRAMMES

The AIMS Structured Master's academic programme is completed in three phases: compulsory skills courses, elective review courses and a 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 2020 intake, the 2020-21 intake and the January 2021 group.

Master's in Mathematical Sciences (January 2020 intake)

The January 2020 intake students worked on their research projects from July 2020, following the completion of their lecture courses. They submitted their projects in September and were examined during October. As with the 2019-20 student examinations, the process was run via video recordings. Most examination panel members were able to attend these online sessions in real time. Twelve students completed their programme in October. A further five students completed work for the Structured Master's programme by November 2020. There were six project Distinctions in the group, and one overall programme Distinction (for project and courses combined).

RESEARCH PROJECTS OF THE JANUARY 2020 INTAKE

Full name	Gender	Origin	Research Project Title	Supervisors
Kerol Roussin Djoumessi Donteu	M	Cameroon	Improved Bayesian model selection through non-equilibrium stochastic processes	D Nickelsen & B Bah, AIMS South Africa
Arinze Lawrence Folarin	M	Nigeria	An Analysis of Bandit Algorithms for Malaria Control	N Makondo, IBM Research-Africa & Witwatersrand
Grace Airenghe Ikhizama	F	Nigeria	Applications of machine learning in healthcare	J Shock, Cape Town
Siphamandla Khumalo	M	South Africa	Numerical investigation of some mathematical models for the COVID-19	J B Munyakazi, Western Cape
Oratile Legae	M	South Africa	Calibration and pricing under Heston model using deep learning algorithms	P Mashele, North-West & AIMS South Africa
Gladstone Thabo Madito	M	South Africa	Basic reproduction number in mathematical epidemiology	J Banasiak, Pretoria
Kentse Maefo	M	South Africa	Lie group analysis of the (2+1)–dimensional extended Calogero–Bogoyavlenskii–Schiff equation	C M Khalique, North-West
Tshepo Bafana Maila	M	South Africa	Augmenting Bioacoustic Datasets using Generative Adversarial Networks	E Dufourq, AIMS South Africa & Stellenbosch, & I Durbach, St Andrews, UK & Cape Town
Thabang Wilson Malapane	M	South Africa	Pruning Neural Networks for Bioacoustic Monitoring	E Dufourq, AIMS South Africa & Stellenbosch, & I Durbach, St Andrews, UK & Cape Town
Tintswalo Kissey Mhelembe	F	South Africa	Cyber Risk Detection Using Machine Learning Algorithms	P Mashele, North-West & AIMS South Africa
Nontokozo Mkhwamubi	F	South Africa	Optimum Sitting Arrangement During COVID-19 Pandemic	S L Tilahun, Zululand
Richard Mwale	M	Zambia	Two-Point Flux Approximation for Pricing Options under Local Volatility	H A Donfack, Johannesburg & R S Koffi, AIMS South Africa
Cebolenkosi Lohengrin Ngema	M	South Africa	Decision aiding on admitting COVID-19 patients in health centres	S L Tilahun, Zululand
Gulfornia Thakana Phahlane	F	South Africa	Credit risk prediction using artificial neural network algorithm	P Mashele, North-West & AIMS South Africa
Tumelo Donald Sereo	M	South Africa	Growth/Decay-Fragmentation Equations	J Banasiak, Pretoria
Dumisani Zawokane	M	South Africa	Fitted finite volume method for pricing options under jump diffusion process	P Mashele, North-West & AIMS South Africa
Winfred Musengya Mutinda (August 2019 intake)	F	South Africa	Predicting cryptocurrency prices using Long Short-Term Memory (LSTM) and Artificial Neural Networks (ANN)	P Mashele, North-West & AIMS South Africa

COMBINED COURSES TABLE

Period	Lecturer	Course	MSc Nov 2020	MSc Jan 2021	Hons Bio-maths 2021
2020					
16 Nov – 11 Dec	Jan Groenewald, AIMS South Africa	Computing and LaTeX	x		
17 Nov – 11 Dec	Paul Taylor, National Institutes of Health & Nafissatou Pouye, Centre for Humanitarian Data	Python Programming	x		
14 – 18 Dec 4 – 15 Jan	Yae Gaba, African Centre for Advanced Studies & Evans Doe Ocansey, Johannes Kepler University	Experimental Mathematics with Sage	x		
21 Dec – 15 Jan	Siaka Lougue, Institut de Recherche en Science de la Santé (IRSS)	Statistics	x		
2021					
18 Jan – 5 Feb	Eric Andriantiana, Rhodes University	Mathematical Problem Solving	x		
25 Jan – 5 Feb	Simukai Utete, AIMS South Africa	Distributed Coordination	x		
28 Jan – 5 Feb	Mathematics in Industry Study Group	Workshop	x		
8 – 26 Feb	Fernando Pestana da Costa, University of Aberta	Differential Equations	x		
	Karin-Therese Howell, Stellenbosch University	Algebraic Methods	x		
22 – 26 Feb	Jan Groenewald, AIMS South Africa	Introduction to Computing and LaTeX		x	
1 – 19 Mar	Bubacarr Bah, AIMS South Africa, Pete Grindrod, Oxford & Hans-Georg Zimmerman, Fraunhofer IBMT	Data Science	x	x	
	Tevian Dray & Corinne Manogue, Oregon State University	The Geometry of Maxwell's Equations	x	x	
	Ronnie Becker, AIMS South Africa & Hans-Georg Zimmerman, Fraunhofer IBMT	Financial Mathematics	x	x	
	Paul Taylor, National Institutes of Health & Martha Kamkuemah, Stellenbosch University	Python Programming		x	
22 Mar – 9 Apr	Stéphane Ouvry, Université Paris Saclay	Introduction to Random Systems, Information Theory, and related topics	x	x	
	Phil Knight, University of Strathclyde	Networks	x	x	
	Jacek Banasiak, University of Pretoria	Introduction to Multiscale Models and their Analysis	x	x	
	Yae Gaba, African Centre for Advanced Studies & Evans Doe Ocansey, Johannes Kepler University	Experimental Mathematics with Sage		x	
12 – 30 Apr	Lyndsay Kerr, Edinburgh University	Analytical Techniques in Mathematical Biology	x	x	x
	Wolfram Decker and Gerhard Pfister, TU Kaiserslautern	Computational Algebra	x	x	
	Grae Worster, University of Cambridge & Richard Katz, University of Oxford	Fluid Dynamics	x	x	
10 – 28 May	Daisuke Takagi, University of Hawaii at Manoa	Biophysics at the Microscale	x	x	x
	Masood Khalique, North-West University & Abdul Kara, University of the Witwatersrand	Symmetry Analysis of Differential Equations	x	x	
	Jeff Sanders, AIMS South Africa	Distributed Systems	x	x	
	Daniel Nickelsen, AIMS South Africa	Probability and Statistics		x	
31 May – 18 Jun	Matt Macauley, Clemson University	Algebraic Biology	x	x	x
	Dugald MacPherson, University of Leeds & Gareth Boxall, Stellenbosch University	Model Theory and Homogeneous Structures	x	x	
	Juerg Weber, University of Western Australia	Risk Management and Insurance Economics	x	x	
	David Aschman, University of Cape Town	Concepts and Problem Solving in Physics	x	x	
21 – 25 Jun	Karen Hidden, Independent Consultant	Entrepreneurship Skills and Cases	x	x	
28 Jun – 16 Jul	Dimbinaina Ralaivaosaona, Stellenbosch University	Mathematical Problem Solving		x	
	Laure Gouba, Abdus Salam International Centre for Theoretical Physics	Curves and Surfaces for Computer Graphics		x	
19 Jul – 6 Aug	Montaz Ali, University of the Witwatersrand	Optimisation		x	
	Henri Laurie, University of Cape Town	Programming with Julia		x	
9 – 27 Aug	Alessandro Crimi, AIMS Ghana	Machine Learning Applied to Medicine		x	
30 Aug – 17 Sep	Simon Mukwembi, University of the Witwatersrand & Bernado Rodrigues University of Pretoria	Graphs, Designs and Applications		x	
	Emile Chimusa, University of Cape Town	Statistical Genomics and Mapping Complex disease		x	
20 Sep - 1 Oct	Justin Munyakazi, University of the Western Cape	Numerical Mathematics		x	

Master's in Mathematical Sciences 2020-2021 Intake

With the restricted travel possibilities in 2020, AIMS South Africa, like other centres, opted to accept students from the region in the hope that regional travel would open sooner. Even so, most students were only able to travel in November 2020 rather than in August when the academic year would usually start. A further group arrived in early 2021, after following the programme from home while waiting to be able to travel. Courses were held online.

Skills courses during 2020-21 included Python Programming with Dr Paul Taylor and Ms Nafissatou Pouye, Entrepreneurship Skills and Cases, with Ms Karen Hidden, Concepts and Problem Solving in Physics with Prof. David Aschman and Mathematical Problem Solving with Dr Eric Andriantiana. Electives included Analytical Techniques in Mathematical Biology, lectured this year by Dr Lyndsay Kerr, Biophysics with Prof. Daisuke Takagi, and a course on the Geometry of Maxwell's Equations given by Prof. Tevian Dray and Prof. Corinne Manogue. Ms Noluvuyo Hobana gave a number of Communication Skills classes to both Structured Master's intakes in a series of Saturday classes. Mr Jan Groenewald, the IT Manager, ran Computing and Latex sessions which form part of the compulsory skills part of the academic programme. The Mathematics in Industry Study Group was run online through the University of the Witwatersrand, and students were able to take this as a course, subsequently working on projects and presentations under the guidance of Prof. Neville Fowkes (University of Western Australia).

Machine learning and financial mathematics topics were popular choices for 2020-2021 research projects, and there were also several topical projects on epidemiology. A number of projects gave clear expositions of areas of investigation. Examples include a project on Pagerank completed by Ms Lovejoy Musundire under the supervision of Prof. Phillip Knight (Strathclyde University), as well as Ms Abigael Buttia's project, titled: 'A Topological Method in Ordinary Differential Equations: Wazewski's Principle and some Applications', supervised by Prof. Fernando Pestana da Costa (Aberta University). Amongst works with a physics focus was Mr Milanto Rasolofohery's project, supervised by Dr Alessandro Crimi, on the topic, 'Quantum Machine Learning Approaches for Neuro-degenerative Diseases'. Other projects tackled subjects such as model selection, natural language processing and Markov blankets applied to corn production.

As always, tutors played an important role in the delivery of the academic programme. This year's tutors included Ms Alice Nanyanzi (Head Tutor), Dr Dinna Ranirina, Ms Ephifania Geza (Biomathematics tutor), Dr Faraniana Rasolofoson, Ms Karimatou Djenabou, Mr Kendall Born, Dr Oluwaseun Francis Egbelowo and Dr Shaun de Carvalho.

There were a number of formal and informal events forming part of the wider programme at AIMS. These included a talk by Prof. Federico Ardila (San Francisco State University) entitled 'Mathematical Polyrhythm: The power of many points of view.' Prof. Jeff Sanders (AIMS) spoke to students on reading and writing mathematics. Prof. Pete Grindrod (University of Oxford) gave two lectures, scheduled for all students, covering topics including ethics in Data Science. 'Evening with the Prof.' sessions continued with presentations by specialists about potential project research areas. A SU presentation covered wellness in online learning.

The challenges of online learning meant the programme was different in many ways, requiring flexibility on the part of students and lecturers. The IT Department's role was central to the programme implementation with lecturing taking place remotely from different countries. The Facilities Department supported the students in residence and maintained their onsite learning environment through the lockdowns. Examinations were held online, as was also necessary in 2020, with students giving their blackboard presentations to the examination panels over Zoom video calls. Recordings were kept as backup.

Thirty-one students completed the 2020-2021 programme in early September 2021.

The academic programme constitutes many activities, in addition to those mentioned. As always, the academic programme involved all AIMS departments, the AIMS network, partner universities and collaboration with a range of institutions and staff from outside AIMS including supervisors, examiners, and lecturers, amongst others.

RESEARCH PROJECTS OF THE NOVEMBER 2020 INTAKE

Full name	Gender	Origin	Research Project Title	Supervisors
Tolotranirina Gabriel Andrianarisoa	M	Madagascar	Elliptic Modular Forms	D Ralaivaosaona, Stellenbosch
Abigael Jelimo Buttia	F	Kenya	A Topological Method in Ordinary Differential Equations: Wazewski's Principle and some Applications.	F P da Costa Aberta, Portugal
Saviour Chibeti	M	Zambia	Extensions of fields	G Boxall, Stellenbosch
Everlyn Asiko Chimoto	F	Kenya	Neural Machine Translation for Low-Resource Language	B Bassett, AIMS South Africa
Joe Chinoya	M	Zambia	Introduction to Computational Algebraic Geometry	F Mohammadi Ghent, Belgium
Precious Chiwira	F	Zimbabwe	Deriving the Stability Criteria of Complex Ecological Networks Using the Loop Analysis	C Hui, Stellenbosch
Thembelihle Rose Dlamini	F	Swaziland	Spectral Analysis of the Equilibration of Isolated Quantum Spin Chains	D Nickelsen, AIMS South Africa
Thandiwe Siphesihle Dlamini	F	Swaziland	Epidemics on Networks	P Knight Strathclyde, UK
Norest Gwasha	M	Zimbabwe	Optimising Double Vaccine Delivery for COVID-19	B Bassett, AIMS South Africa
Nobukhosi Siphiwe Jama	F	Zimbabwe	Application of Artificial Intelligence in Algorithmic Trading	P Mashele & E Sonono, North-West
Gracious Kunda	M	Zambia	Modelling Futures and Forwards with Convenience Yield	R Becker, AIMS South Africa
Iness Kyapwanyama	F	Zambia	Matrix nearrings	K T Howell, Stellenbosch
George Mwangi Macharia	M	Kenya	Inverse Lyapunov Theorems with Applications to Stability Analysis of Dynamical Systems	J Banasiak, Pretoria
Stamili Twahiru Makurunge	M	Tanzania	Portfolio Selection Using Network Theory	E Sonono & P Mashele, North-West
Tendai Nancy Mashiri	F	Zimbabwe	Situational Awareness for Mobile Robots	S Utete, AIMS South Africa
Abrange Alberto Mavimbele	M	Mozambique	Markov Blankets with an application to corn production	J W Sanders, AIMS South Africa
Japhet Simalike Mlenga	M	Tanzania	Improved estimation of Bayesian model evidence through fitted statistics of non-equilibrium simulations	D Nickelsen, AIMS South Africa
Rehema Mwedadi Msuya	F	Tanzania	Estimation of Spreading Rate of Species with Multiple Life Stages	C Hui, Stellenbosch
Lovejoy Musundire	F	Zimbabwe	Pagerank, the internet and beyond	P Knight, Strathclyde, UK
Ketty Muwowo	F	Zambia	Series Solutions of Laplace Problems	N Hale, Stellenbosch
Mathews Ntambwe	M	Zambia	Maximal by inclusion product-free sets	C S Anabanti, Pretoria
Florence Aketch Owino	F	Kenya	Regular Perturbations on Infinite Interval with Applications to Analysis of Long-term Behaviour of Dynamical System	J Banasiak, Pretoria
Hanitriniala Malalatiana Rakotondrasoa	F	Madagascar	Determining the most parsimonious tree	M Bucher, Paris, & F Petruccione & I Sinayskiy, KwaZulu-Natal
Minosoa Valérie Emmanuellah Rakotovao	F	Madagascar	Novelty issue in swarm intelligence algorithms	S Tilahun, Addis Ababa Science & Technology University
Sitraka Mahonona Randrianarivo	M	Madagascar	Rational reconstruction for homological constructions	M Marais, Stellenbosch & J Böhm Kaiserslautern, Germany
Milanto Ferdinand Rasolofohery	M	Madagascar	Quantum machine learning approaches for neurodegenerative diseases	A Crimi, University of Zurich
Lighton Sakala	M	Zambia	Tunnelling of Quantum Particles Through a Potential Barrier	I Mandal, The Henryka Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Poland
Bright Simbeye	M	Zambia	Band Theory of Solids	I Mandal, The Henryka Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Poland
William Simfukwe	M	Zambia	Quantum Computing and Differential Equations	R I Nepomechie, Miami, USA & F P da Costa Aberta, Portugal
Khuthadzo Meshack Tshifura	M	South Africa	Anti-community detection in complex networks	P Knight, Strathclyde, UK
Joseph Muthui Wacira	M	Kenya	Low Rank Matrix Approximation for Imputing Missing Categorical Data.	B Bah, AIMS South Africa

GRADUATE
PROFILES

Mr Thabang Malapane
AIMS South Africa 2020

Thabang graduated in 2020 and is currently studying towards a Research Master's in the AIMS South Africa Research Centre. His research focuses on computer vision.

He completed his undergraduate studies a BSc in Mathematical Sciences majoring in Pure and Applied Mathematics at the University of Limpopo in South Africa.

His AIMS project was titled 'Pruning Neural Networks for Bioacoustic Monitoring'.

"Coming to AIMS is one of the best choices I will forever be proud of. Apart from graduating there's a lot to gain, the best networking. Having an opportunity to meet new people from all over the world and learn about their cultures, an unforgettable event."

Ms Iness Kyapwanyama
AIMS South Africa 2021

Iness pursued a Bachelor of Science in Mathematics for her undergraduate degree at the Copperbelt University in Zambia. Thereafter she was admitted for her Master's at AIMS and graduated in 2021.

Before joining AIMS she had an interest in mathematics and really looked forward to joining AIMS to have a platform to enhance her mathematical skills.

While at AIMS she was exposed to different mathematical courses and the mathematics behind the computing courses. Furthermore, she learnt that understanding mathematics is independent of your first language.

During her studies at AIMS, Iness participated in the AIMS-ESMT industry Immersion Programme. She also signed up to be an Ikamva Youth tutor and as an AIMS House of Science volunteer where she gained many transferable skills. Her final AIMS research project was on 'Matrix Nearrings'. In abstract Nearrings are rings that are missing a few properties.

"I look forward to joining industry and learning to apply mathematics in the real world."

Mr Sitraka Mahonona Randrianarivo
AIMS South Africa 2021

During high school Sitraka, from Madagascar, was fascinated by the beauty of Mathematics and all of the mysteries behind it, "Mathematics is the language of the universe" so he decided to pursue an undergraduate degree in Mathematics at the University of Antananarivo.

Upon completion he applied to AIMS. "Through AIMS, I have learnt more about Mathematics and its applications. The AIMS programme provided us with a lot of courses and the one I was most interested in was 'Computational algebra'. I decided to base my research project on computational and abstract algebra. It was titled: 'Rational reconstruction for homological constructions.'

He plans to complete a PhD in Mathematics in his field of interest.

January 2021 Intake

Master's in Mathematical Sciences January 2021 Intake

This year, the January 2021 intake students began their programme in March 2021, the later start date allowing students to complete 2020 programmes, some of which were delayed. This intake is scheduled to complete their programme in November 2021.

STUDENTS ON THE JANUARY 2021 INTAKE

Full name	Gender	Country	Previous institution
Madou Bayoulou	M	Burkina Faso	University of Alioune Diop de Bambey
Tebogo Doctor Malatsi	M	South Africa	University of the Witwatersrand
Nhlangano Dale Maluleke	F	South Africa	University of Venda
Kanting Evidence Motimele	M	South Africa	University of the Western Cape
Aaron Mubatapasango	M	Zimbabwe	University of Zimbabwe
Phumudzo Nematswerani	M	South Africa	University of Venda
Mary Njeri	F	Kenya	Laikipia University
Sinethemba Nongqoto	M	South Africa	University of Limpopo
Joel-Pascal Ntwali N'Konzi	M	DRC	University of Lubumbashi
Londani Tshindane	M	South Africa	University of Venda

BSc (Honours) in Mathematics with a focus in Biomathematics

Students doing the BSc Honours in Mathematics with a focus in Biomathematics at Stellenbosch University take courses at AIMS as part of their programme. Three students - Ms Belinda Lombard, Mr Wesley Douglas and Ms Ziyabukwa Mthi - joined for the period March to July 2021.

GRADUATIONS

January 2020 Intake

On 13 October, AIMS celebrated the success of 14 students (including 11 South Africans) from the January 2020 intake during an online ceremony.

Dr Simukai Utete, the Academic Director, congratulated the students for adapting to the very challenging circumstances and managing to complete the programme. "We wish you the very best for your next career steps and hope you will encourage others to come to AIMS so that they can benefit in the same ways you have."

The guest speaker was Dr Ndivhuwo Makondo, a Research Scientist in Machine Learning at IBM Research | Africa, in the South Africa Lab. He advised the students that they should do work that they are very passionate about as then 'it does not feel like hard work'. He also went on to say that finding mentors is key as "mentors can expose you to opportunities and help you find better ways of going about your career."

The first student speaker, Mr Tumelo Donald Sereo noted that the students should really celebrate and be very proud of what they have achieved, but he noted that this would not have been possible without the support of AIMS staff, lecturers, tutors and supervisors. "It is now our responsibility to go back and develop the skills in our communities and Africa as a whole. The future is in our hands.'
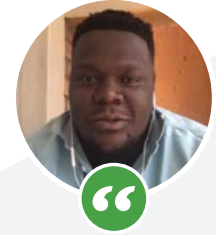
I advise you all to do work that you are passionate about as then it does not feel like hard work.

DR NDIVHUWO MAKONDO
GUEST SPEAKER

Ms Gulfornia Thakana Phahlane also reiterated her thanks and noted "AIMS was quite a journey and it was not easy and we would not have made it without all the support that we have received."

Prof. Barry Green, Director went on to congratulate the students again and thanked everyone for supporting the students and making this another successful year at AIMS South Africa.

Students subsequently graduated at their respective university graduation ceremonies.

Mr Arinza Lawrence Folarin

Ms Grace Airenghe Ikhizama

Mr Siphamandla Khumalo

Mr Gladstone Thabo Madito

Mr Kentse Maefo

Mr Tshepo Bafana Maila

Mr Thabang Wilson Malapane

Ms Tinswalo Kissey Mhelembe

Ms Nontokoza Mkhwamubi

Mr Richard Mwale

Mr Cebolenkosi Lohengrin Ngema

Ms Gulfornia Thakana Phahlane

Mr Tumelo Donald Sereo

Mr Dumisani Zawokane

GRADUATIONS

2020-2021 Intake

Due to lockdown restrictions graduation ceremonies could not take place and AIMS once again celebrated the success of its structured Master's Students, by producing a short Recognition of Achievement Video highlighting the achievements of this group of students. This video can be viewed at **https://youtu.be/LQ9C8g53ptU.**

Thirty-one students, among them 14 women, completed the Master's in Mathematical Sciences Programme successfully. There were 11 students who obtained Distinctions for their research projects, which were very interesting and of a high standard. Five students obtained overall Distinctions.

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

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 Ms Hanitriniala Malalatiana Rakotondrasoa from Madagascar.
- The Martin Rees Scholarship, was awarded to Mr Tolotranirina Gabriel Andrianarisoa from Madagascar
- The Paul G. Allen Scholarship was awarded to Ms Everlyn Asiko Chimoto from Kenya

It is a pleasure to congratulate our 2020-21 Master's group who displayed self-discipline and academic maturity in successfully completing the Master's programme in what has been without a doubt an unusual year. We wish them all the best for the future.

I would like to congratulate all our students for their adaptability and flexibility in a learning environment that was of necessity different from the usual set-up.

DR SIMUKAI UTETE
ACADEMIC DIRECTOR

Mr Tolotranirina Gabriel Andruanarisoa

Ms Abigael Jelimo Buttia

Mr Saviour Chibeti

Ms Everlyn Asiko Chimoto

Mr Joe Chinoya

Ms Precious Chiwira

Ms Thembelihle Rose Dlamini

Ms Thandiwe Siphesihle Dlamini

Mr Norest Gwasha

Ms Nobukhosi Siphiwe Jama

Mr Gracious Kunda

Ms Iness Kyapwanyama

Mr George Mwangi Macharia

Mr Stamili Twahiru Makurunge

Ms Tendai Mashiri

Mr Abrange Alberto Mavimbele

Mr Japhet Simalike Mlenga

Ms Rehema Mwedadi Msuya

Ms Lovejoy Musundire

Ms Ketty Muwowo

Mr Mathews Ntambwe

Ms Florence Aketch Owino

Ms Hanitriniala Malalatiana Rakotondrasoa

Ms Minosoa Valerie Emmanuellah Rakotovao

Mr Sitraka Mahonona Randrianarivo

Mr Milanto Ferdinand Rasolofohery

Mr Lighton Sakala

Mr Bright Simbeye

Mr William Simfukwe

Mr Khuthadza Meshack Tshifura

Mr Joseph Muthui Wacira

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 1 such bursary for Master's study. The recipient is asterisked in the table below.

PROGRESS OF RECENT STUDENTS

Full name	Gender	Origin	Institution	Programme/ Position
Graduates from January 2020 intake				
Kerol Roussin Djoumessi Donteu	M	Cameroon	International Max Planck Research School for Intelligent Systems (University of Tübingen)	PhD
Arinze Lawrence Folarin*	M	Nigeria	Cape Town	Research Master's
Grace Airenghe Ikhizama	F	Nigeria	Still exploring opportunities	
Siphamandla Khumalo	M	South Africa	Western Cape	PhD
Oratile Legae	M	South Africa	MTN South Africa	Marketing Intelligence & Research
Gladstone Thabo Madito	M	South Africa	Still exploring opportunities	
Kentse Maefo	M	South Africa	North-West	Research Master's
Tshepo Bafana Maila	M	South Africa	Still exploring opportunities	
Thabang Wilson Malapane	M	South Africa	AIMS/Stellenbosch	Research Master's
Tintswalo Kissey Mhelembe	F	South Africa	Old Mutual South Africa	GAP Trainee
Nontokozo Mkhwamubi	F	South Africa	Still exploring opportunities	
Winfred Musengya Mutinda (August 2019 intake)	F	South Africa	Explore Academy	Data Science Programme
Richard Mwale	M	Zambia	University of Lusaka, Zambia	Mathematics Lecturer
Cebolenkosi Lohengrin Ngema	M	South Africa	Still exploring opportunities	
Gulfornia Thakana Phahlane	F	South Africa	Absa Group	Graduate Technical Analyst
Tumelo Donald Sereo	M	South Africa	Stellenbosch	Research Master's
Dumisani Zawokane	M	South Africa	Still exploring opportunities	
Graduates from November 2020 intake				
Tolotranirina Gabriel Andrianarisoa	M	Madagascar	Still exploring opportunities	
Abigael Jelimo Buttia	F	Kenya	Still exploring opportunities	
Saviour Chibeti	M	Zambia	Still exploring opportunities	
Everlyn Asiko Chimoto	F	Kenya	Cape Town	Research Master's
Joe Chinoya	M	Zambia	AIMS-ESMT IIP (2021)	
Precious Chiwira	F	Zimbabwe	Still exploring research opportunities	
Thembelihle Rose Dlamini	F	Swaziland	Still exploring opportunities	

Full name	Gender	Origin	Institution	Programme/ Position
Thandiwe Siphesihle Dlamini	F	Swaziland	Government	Teacher
Norest Gwasha	M	Zimbabwe	AIMS-ESMT IIP (2021)	
Nobukhosi Siphiwe Jama	F	Zimbabwe	Still exploring research opportunities	
Gracious Kunda	M	Zambia	Still exploring opportunities	
Iness Kyapwanyama	F	Zambia	AIMS-ESMT IIP (2021)	
George Mwangi Macharia	M	Kenya	AIMS-ESMT IIP (2021)	
Stamili Twahiru Makurunge	M	Tanzania	Still exploring opportunities	
Tendai Nancy Mashiri	F	Zimbabwe	UNDP Copenhagen Denmark	Green Energy Support Engineer
Abrange Alberto Mavimbele	M	Mozambique	Goverment	Mathematics Teacher
Japhet Simalike Mlenga	M	Tanzania	Still exploring opportunities	
Rehema Mwedadi Msuya	F	Tanzania	Still exploring opportunities	
Lovejoy Musundire	F	Zimbabwe	AIMS-ESMT IIP (2021)	
Ketty Muwowo	F	Zambia	Still exploring opportunities	
Mathews Ntambwe	M	Zambia	AIMS-ESMT IIP (2021)	
Florence Aketch Owino	F	Kenya	AIMS-ESMT IIP (2021)	
Hanitriniala Malalatiana Rakotondrasoa	F	Madagascar	Still exploring opportunities	
Minosoa Valérie Emmanuellah Rakotovao	F	Madagascar	Still exploring opportunities	PhD
Sitraka Mahonona Randrianarivo	M	Madagascar	Still exploring research opportunities	
Milanto Ferdinand Rasolofohery	M	Madagascar	Still exploring opportunities	
Lighton Sakala	M	Zambia	Still exploring opportunities	
Bright Simbeye	M	Zambia	Still exploring opportunities	
William Simfukwe	M	Zambia	AIMS-ESMT IIP (2021)	
Khuthadzo Meshack Tshifura	M	South Africa	UWC	Research Master's
Joseph Muthui Wacira	M	Kenya	Stellenbosch University	Research Master's

The AIMS-ESMT Industry Immersion Programme

The AIMS-ESMT Industry Immersion Programme (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 programme launched in 2017 is currently in its fourth and final year of the pilot term. The joint founders of the programme were Prof. Wulff Plinke and Mr Nick Barniville, and Mr Mark Heerden and Dr David Attipoe, an AIMS alumnus, both at AIMS. The IIP team partnered with Academics Without Borders (AWB) in Canada to scale the programme outside of AIMS.

Following a challenging 2020 with the onset of the COVID-19 pandemic, we managed, with the support of all the partners, to deliver yet another successful "Online Blended Programme". 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 & Decisions and Data Analytics for Business introduced. We further improved the delivery of the programme by introducing "Engageli" an online engagement learning platform which offers an inclusive, secure virtual classroom for higher education and is designed to recreate high-quality, small group collaborative experiences, even in a large-scale environment. This year, we introduced Design Thinking and Live Case, two complementary courses from the University of Victoria in Canada and INSEAD in France, respectively.

Another first for the IIP was the 2021 cohort, comprising 40 AIMS and 11 graduate students from Strathmore University in Kenya. The students were from 12 countries and they were hosted at AIMS South Africa, AIMS Ghana, AIMS Rwanda and in Kenya, to take account of social distancing requirements. The IIP was run for five weeks from 19 July to 20 August 2021. Dr Attipoe led the Online Blended Program remotely assisted by part-time MBA tutors present in the other programme centres.

The importance of internships continues to be key to the success of the programme. 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. In partnership with AIMS Ghana, the IIP team launched a new Hybrid Internship Hub model that will place the IIP fellows into teams of 2 or 3 in Tech hubs across the continent to work for companies both in Africa and around the world.

With the conclusion of the pilot programme last year, the IIP team is actively working with their partners to scale the programme further and the AWB team are the allied partner to this scaling process.

Alumni Updates

Mr Kerol Roussin Djoumessi Donteu, who graduated from AIMS South Africa in 2020, has been awarded a PhD position at the International Max Planck Research School (IMPRS) for Intelligent Systems (IS) affiliated with the University of Tübingen. He started in May 2021, on the topic 'Resource-efficient deep neural networks in ophthalmology' with Prof. Philipp Berens, and Prof. Jakob Macke.

Ms Fameno Rakotoniaina and Mr Patrick Rakotoarisoa both AIMS South Africa alumni and Mr Joseph Ijuptil, an AIMS Ghana alumnus were awarded DAAD scholarships to complete a Research Master's at Stellenbosch University. Ms Asmaa Tbaeen, AIMS South Africa alumna was awarded a PhD scholarship.

The AIMS-ESMT participants at AIMS Ghana

The AIMS-ESMT participants at AIMS South Afrika

ALUMNI
PROFILES

Dr Nicodemus Banagaaya
AIMS South Africa 2008

Originally from Uganda, Nicodemus graduated from AIMS in 2008. His hardwork and dedication saw him complete two Master's degrees from Johannes Kepler Universitat, Austria and Technische Universiteit Eindhoven, Netherlands. He was grateful when an internship at NV MAGWEL, Belgium enabled him to implement techniques learnt in his Master's training in industrial software. He then returned to the Eindhoven University of Technology for his PhD in Applied Mathematics and later, a postdoc at the Max Planck Institute for Dynamics of Complex Systems.

Currently he is back at MAGWEL as a Senior Software Engineer. He has conducted considerable research in electromagnetic problems many results of which have been published.

Besides his academic achievements, Nicodemus is an active participant on the AIMS Chat platform and has shared numerous academic positions and opportunities that many AIMS alumni have benefited from.

Ms Sitraka Nandrianina Tolojanahary
AIMS South Africa 2020

After obtaining a Bachelor's Degree in Science Physics from the Faculty of Science, University of Antananarivo Madagascar, Sitraka pursued a Master's in Geophysics at the Institute and Observatory of Geophysics in Antananarivo (IOGA). Her Master's was focused on Climate Science; "Contribution to the study of Climate Change in Madagascar using CORDEX outputs". Involved in data acquisition within the RenovRisk Project, she continued to investigate the climate issues in her country and the surroundings. She completed one-year training with the "Development in Africa with Radio Astronomy" (DARA) before accepting a place at AIMS South Africa.

"My journey at AIMS was such an amazing opportunity. I had met many people from different cultures, and many lecturers from different fields. AIMS improved my knowledge and view in mathematics and its application in many career areas, and in computer science such as Machine Learning."

She is currently completing a Research Master's at the Department of Ocean-ography, University of Cape Town.

Her goal is to do her part in climate risk mitigation for her country Madagascar and Africa. As part of her activities, she is also involved in leadership within some associations that bring development to Malagasy communities such as teaching illiterate children *(Teach for Madagascar)*, promote Malagasy culture *(Tamihako)*, helping unprivileged children go to school *(Challenge For Kids)*, and promoting a young climate generation *(CliMates)*.

Mr Kondwani Kampenya
AIMS South Africa 2012

Kondwani graduated from AIMS in 2012 and joined UKZN for a Research Master's in Finance. Upon completion, unlike the majority of the AIMS Alumni, he took the management route, enrolling for an MBA at ESMT Berlin. This was followed by various consultancy positions in Germany before returning to Malawi as a country Manager for the JBJ Foundation. He is currently also a board member for mHub Malawi where he provides strategic leadership and governance to Malawi's first and leading technology innovation and entrepreneurship hub.

"I am passionate about developing innovative solutions to solve some of the world's most challenging problems. I do this by blending years of experience from academia, management consulting, and business. At present, I focus on developing and scaling high-impact development solutions in education and healthcare in Malawi and by extension, Africa. This unique position allows me to work with leaders in technology, government, philanthropy, and the non-profit sector."

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 13 years old and hosts researchers working in several focus areas under the theme Mathematical Modelling in a Multidisciplinary Context.

In this reporting period, Dr Dennis Ikpe's appointment as a Research Associate ended on 31 January 2021 and Prof. Ronnie Becker's appointment ended on 30 June 2021.

Dr Emmanuel Dufourq, who was a postdoc in the Research Centre, accepted the appointment as an AIMS Canadian Junior Research Chair in Climate Science in August 2021. He is also a data science lecturer at SU (50% allocated to the Department of Industrial Engineering and 50% to the School for Data Science and Computational Thinking).

RESIDENT RESEARCHERS

Name	Current Position	Gender	Area of research
Dr Bubacarr Bah	German Research Chair	M	Applied mathematics and computer science
Prof. Bruce Bassett	Senior Resident Researcher	M	Cosmology and astrophysics
Prof. Ronnie Becker	Senior Resident Researcher (appointment ended 30 June 2021)	M	Mathematical finance
Dr Emmanuel Dufourq	AIMS Canadian Junior Research Chair in Climate Science (appointed August 2021)	M	Machine learning
Dr Rejoyce Gavhi-Molefe	Resident Researcher	F	Computational mathematics: subdivision
Prof. Barry Green	Senior Resident Researcher	M	Pure mathematics
Prof. Cang Hui	South African Research Chair Mathematical and Theoretical Biosciences (SU-AIMS)	M	Mathematical and theoretical physical biosciences
Dr Dennis Ikpe	Research Associate (appointment ended 31 January 2021)	M	Mathematical finance
Prof. Phillip Mashele	Part-time Senior Resident Researcher	M	Mathematical finance
Dr Gaston Mazandu	Part-time Researcher	M	AIMS-H3ABioNet
Prof. Jeff Sanders	Senior Resident Researcher	M	Theoretical computer science
Dr Mario Santos	South African Research Chair in Cosmology with Multi-Wavelength Data (UWC-SAAO-AIMS)	M	Cosmology and astrophysics
Dr Marc Sedjro	German Research Chair	M	Applied mathematics with specialization in Partial Differential Equations and Calculus of Variations
Dr Simukai Utete	Senior Resident Researcher	F	Robotics

In Memorium

DR GASTON MAZANDU

It is with great sadness that we heard that Dr Gaston Mazandu passed away on 24 September 2021 in Stellenbosch from COVID-19 complications.

Gaston belonged to the second cohort of students at AIMS in Muizenberg, 2004-2005, and throughout his career remained very close to AIMS as a special member of our family and a strong supporter of all our activities. For several years he was a member of our Research Centre as one of the Canadian Junior Research Chairs, and then following that as an affiliated researcher, while a member of Prof Nicola Mulder's Bioinformatics group in the UCT Medical Faculty. He supervised many students and made a great effort to involve AIMS in successful research projects and activities, the most notable being the H3ABioNet, related to genomic data and analysis research.

We all remember Gaston as a warm, enthusiastic and committed person, and a very kind-hearted member and friend of AIMS. It was terribly sad to hear of his passing, still at a young age and our thoughts and prayers go out to his family, with sincere condolences and a feeling of loss.

The AIMS Data Science Research Group (DSG) successfully hosted the Gene Golub Summer School - the first of these conferences held in Africa. The Group also contributed to the establishment of the Doctoral Training School in Data Science at QLA. Several DSG members undertook successful internships and produced good publications and presentations at top conferences.

DR BUBACARR BAH

Our recent paper on Why scientists agree to participate in science festivals: Evidence from South Africa highlights the need for universities and research institutions to build expertise and provide continuous support to improve scientists' participation and effective delivery of science communication activities in South Africa.

DR REJOYCE GAVHI-MOLEFE

I was part of the team that organised an online workshop in Mean Field Games that gathered many young African mathematicians and experts from all over the world.

DR MARC SEDJRO

I have worked with Ms Kamkuemah on privacy in the Internet of Things, and on modelling consciousness with Professors Chen, Becker and Zimmermann.

PROF. JEFF SANDERS

My research concerns combination of information. In data fusion, this might be information obtained from multiple sensors. In multi-robot systems, robots might combine strategies or actions. The aim is to develop systems with the ability to work in concert, but with high levels of autonomy.

DR SIMUKAI UTETE

We began exploring neural machine translation for low-resource African languages, showing that significant improvements are possible if we get the algorithm to learn multiple related languages simultaneously, such as isiXhosa and IsiZulu. I also began new research with Profs Benji Rosman, Jonathan Shock and Mark Solms on the nature of consciousness and whether we can build artificial agents which exhibit affect.

PROF. BRUCE BASSETT

I am proud to have been appointed as a junior research chair for machine learning research towards conservation ecology and contribute towards positive impacts on wildlife.

DR EMMANUEL DUFOURQ

Drawing from my background in statistical physics, I am developing an unsupervised algorithm that, out of innumerable many candidate models, finds the one model that maximises the probability of being correct for given data. I am happy that I can take a few AIMS students with me on this journey.

DR DANIEL NICKELSON

I was very pleased to be appointed as the Research Director of the Unit for Business Mathematics and Informatics at NWU.

PROF. PHILLIP MASHELE

Achievements

DR EMMANUEL DUFOURQ was awarded the Microsoft Azure AI for Earth grant to work on bioacoustic research.

PROF. BRUCE BASSETT has been invited to be on the founding editorial board of the new Royal Astronomical Society journal RAS Techniques and Instruments (RASTI). RASTI is the first new Royal Society Journal in near 100 years and will provide an international and open-access forum for high-quality papers in all branches of Astronomy and Geophysics that describe advances in methods including AI, collection and evaluation of data and spanning topics from new instrumentation to innovative data processing and analysis procedures.

POSTDOCTORAL FELLOWS

There were five postdoctoral fellowships during the period under review.

Name	Citizenship	Gender	Start date to end date	Research Field	Supervisor/ Host
Shankar Agarwal	India	M	I April 2018 – 31 December 2022	Data Science	Dr B Bah
Emmanuel Dufourq	Mauritius	M	I August 2019 – 31 July 2021	Evolutionary deep learning	Prof. I Durbach
Sthembiso Reuben Gumede	South Africa	M	I September 2019 – 31 August 2021	Dynamic modelling of species distributions in response to climate change	Prof. C Hui
Daniel Nickelson	Germany	M	I October 2019 – 30 September 2021	Estimation of Marginal Likelihood for Complex Models	Dr B Bah
Dinna Ranirina	Madagascar	F	I January 2019 – 31 July 2021	Data Science	Dr B Bah
Milaine Tchamga	Cameroon	F	I July 2018 – 30 June 2021	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 32 during the period under review. Eighteen of these are doctoral students. The 10 students who have graduated are asterisked in the table below.

PHD STUDENTS

No.	Name of student	Citizenship	Gender	Study duration	Supervisor/Host	Based at
1	David Attipoe*	Ghana	M	1 February 2015 – December 2021	Dr A Tambue	AIMS/UCT
2	Buri Gershom	Uganda	M	6 September 2016 (ongoing)	Dr W Ndifon	AIMS/SU
3	Eberechi Georgina Chris-Kalu	Nigeria	F	2019 (ongoing)	Dr D Ikpe	UNISA
4	Benjamin David Du Toit	South Africa	M	1 January 2017 (ongoing)	Prof. C Hui	SU
5	Ephifania Geza	Zimbabwe	F	24 August 2015 (ongoing)	Dr G Mazandu	AIMS/SU
6	Martha Ndeyapeuomagano Kamkuemah	South Africa	F	1 July 2016 (ongoing)	Prof. J Sanders	AIMS/SU
7	Dieudonne Kabongo Kantu*	Congo	M	1 November 2015 – 30 June 2021	Prof. I Durbach	AIMS/UCT
8	Rock Stephane Koffi*	Ivory Coast	M	1 February 2015 – 31 December 2021	Dr A Tambue	AIMS/UCT
9	Mmatlou Kubyana	South Africa	M	1 March 2020 (ongoing)	Prof. C Hui	SU
10	Irene Kyomugisha*	Uganda	F	1 March 2018 – June 2021	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 – 31 December 2020	Dr S Utete & Prof. S Kroon	AIMS/SU
14	Samuel Ofosu Mensah	Ghana	M	1 February 2019 (ongoing)	Dr B Bah	AIMS/SU
15	Thina Ncube	South Africa	F	1 February 2019	Prof. C Hui	SU
16	Chinenye Assumpta Nnyakeni*	Nigeria	F	1 Jul 2017 – 31 December 2020	Prof. C Hui	SU
17	Ethan Roberts	South Africa	M	1 March 2018 (ongoing)	Dr N Oozeer and Prof. B Bassett	AIMS/UCT
18	Abdulrahaman Lawal Suleiman*	Nigeria	M	1 January 2018 – 31 December 2020	Prof. C Hui	SU
19	Neil Watson	South Africa	M	1 January 2016 (ongoing)	Prof. I Durbach	UCT

RESEARCH MASTER'S STUDENTS

No.	Name of student	Citizenship	Gender	Study duration	Supervisor/Host	Based at
1	Ashleigh Megan Basel*	South Africa	F	1 January 2019 – 31 December 2020	Prof. C Hui	SU
2	Tshenolo Thato Daumas	South Africa	F	1 February 2020 (ongoing)	Dr B Bah	AIMS
3	Evander El-Tabonah Nyoni	Zimbabwe	M	25 August 2019 (ongoing)	Prof. B Bassett	AIMS
4	Richard Gibbs	South Africa	M	1 January 2020 (ongoing)	Prof. C Hui	SU
5	Precious Blessing Khumalo	South Africa	F	1 February 2020 (ongoing)	Dr Y Gaba and Prof. HP Kunzi	UCT
6	Kiprono Elijah Koech	Kenya	M	1 February 2020 (ongoing)	Dr B Bah	AIMS
7	Juliana Thomasia Chakirath Marcos*	Benin	F	1 October 2018 – 31 December 2020	Dr S Utete	AIMS/SU
8	Thabang Malapane	South Africa	M	1 July 2021 (ongoing)	Dr E Dufourq	SU
9	Kibidi Neocosmos	South Africa	M	1 February 2020 (ongoing)	Dr B Bah	AIMS
10	Thabani Ngcobo	South Africa	M	1 July 2019 (ongoing)	Dr N Hale & Dr M Sedjro	SU
11	Max Nieuwoudt	South Africa	M	1 February 2020 (ongoing)	Prof. B Bassett	AIMS/UCT
12	Rojo Fanamperana Randrianomentsoa*	Madagascar	F	1 October 2018 – 31 December 2020	Prof. J Sanders	AIMS
13	Emmanuel Sekyi	Ghana	M	1 February 2020 (ongoing)	Prof. B Bassett	AIMS/UCT

RESEARCH INITIATIVES

Africa Data Science Intensive (DSI) Programme 2020

The Africa Data Science Intensive (DSI) Programme uses real-world problems to give participants hands-on knowledge of the latest algorithms and techniques in data science and artificial intelligence, deep insights on industry trends, network building and practical team skills used in business to facilitate transitioning to a data science role in industry, academia or through entrepreneurship.

The second DSI Programme commenced in September 2020 with 16 participants (50% of which were women) chosen from eight African countries and an initial pool of 1,430 applicants, showing the huge demand for data science and artificial intelligence training in Africa.

In 2020 the Africa DSI programme was adapted as an online half-time course due to the COVID-19 pandemic mixing lectures and real-world projects. Lecturers for the course came from all over the world including large organisations such as Airbnb, Cambridge, DeepMind, Google, IBM and Netflix as well as young African start-ups. The online course consisted of four modules that were actively carried out over a period of five months with the final module ending on 29 January 2021.

Participants completed the following modules: Module 1: Regression; Module 2: Computer Vision and Module 3: Natural Language Processing. For the 4th module participants could choose their own topics and on 26 January 2021, they submitted their final projects, which included a blog post, project report and code file. Their final presentations took place on 28 January 2021. Final project topics included amongst others: disease image classification in humans and plants; crop yield predictions; geospatial natural language processing; restaurant and music recommendations; using voice recordings to detect early-stage Parkinson's disease; and automated summarisation of company income statements.

The top five presenters were selected to give presentations to a panel of judges on 29 January 2021. The winner of this final presentation was Mr Nathanaël Rakotonirina, from Madagascar, who gave a presentation titled: 'Video Analysis' in which he presented work done on object detection in various real-life business environments.

Mr Malcolm Wright, from Botswana, was the overall top participant for the Africa DSI 2020 programme, with Ms Fanamby Randriamahenintsoa, from Madagascar, in second place and Mr Martin Page, from South Africa in third place. Prof. Bruce Bassett also noted, "Seven of the top ten participants were women and there were three or four people within 1% of third place so it was very competitive."

MR MALCOM WRIGHT

MS FANAMBY RANDRIAMAHENINTSOA

MR MARTIN PAGE

Ms Sohana Singh spoke on behalf of the participants and said, "We are certainly all honored to have been selected for this opportunity and I can confidently say that we have all grown during this experience. Unlike the usual scenario where you have lectures and participants follow along, in the DSI we were given real world problems to work on in teams of four and we had to achieve a minimum viable product (MVP) in a relatively short amount of time. I thoroughly enjoyed this way of learning as it was much more challenging and allowed us to push ourselves and learn things about ourselves that perhaps we didn't realise before or think we were capable of doing.
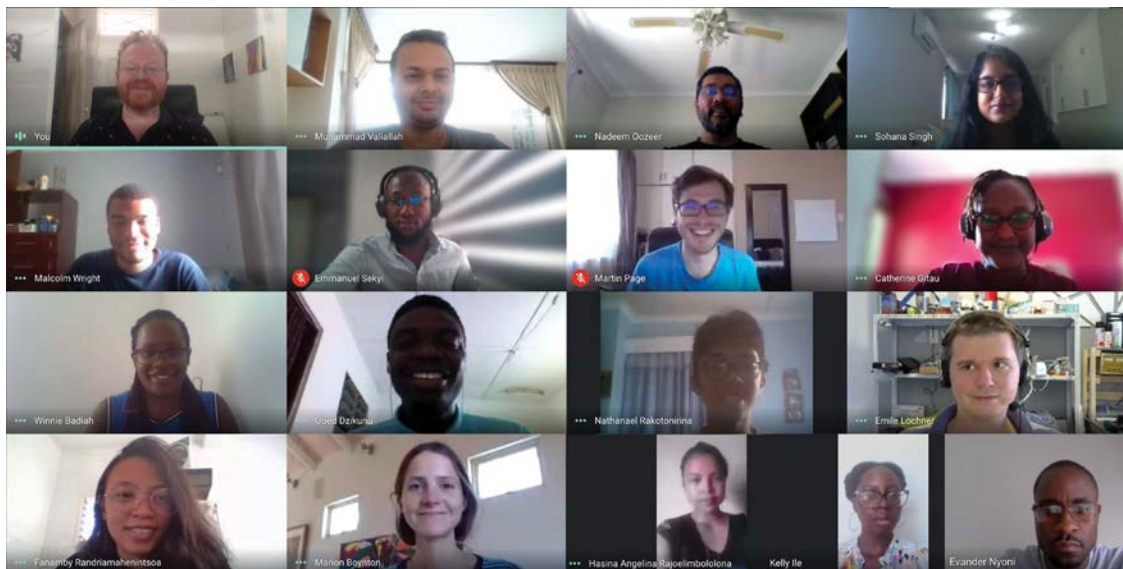
DSI 2020 participants at the final closing ceremony

We are certainly all honored to have been selected for this opportunity and I can confidently say that we have all grown during this experience.

MS SOHANA SINGH

Some of us had never worked in teams before and had never used the SCRUM method before and through this experience we learned how to select the best person for each role in the team, how to ask for help and support and also how to be organised and prioritise. I think we are all now equipped to tackle any data science project that is thrown at us."

The lead organiser of the Africa DSI was Prof. Bassett, Head of Data Science at SARAO, Head of the Cosmology Group at AIMS South Africa, Professor of Mathematics at UCT and research astronomer at SAAO.

There have been a variety of local and international lecturers on the course and the participants are supported by four tutors, Dr Nadeem Oozeer (SARAO), Mr Emile Lochner (Soldersmith) and two DSI 2018 alumni Mr Evander Nyoni and Mr Emmanuel Sekyi.

A special thank you also goes to all the lecturers and presenters who either gave lectures to the participants or joined them in online chat sessions: Gordon Amoako (DSI 2018 alumnus, FedEx); Richard Armstrong (SARAO); Sebastian Bodenstein (DeepMind); Moustapha Cisse (Head of Google AI Ghana); Blake Cunningham (Comply Advantage); Sudeep Das (Netflix); Sanghamitra Deb (Chegg); Tawanda Ewing (Siatik); Jasper Horrell (Deep Data); Pierre-Yves Lablanche (Advens); Neil Lawrence (Cambridge U) ; Michelle Lochner (SARAO/UWC); Genevieve Mannel (CIPLA); Elle O'Brien (DVC.org); Stuart Reid (Nosible) ; Thuso Simon (Techno Ponies); Navin Sivanandam (Airbnb) and Etienne Vos (IBM).

The programme sponsors were the UK – South African Newton Fund, SARAO and the South African Development in Africa with Radio Astronomy (DARA) BIG DATA AFRICA Programme. The DSI was done in collaboration with AIMS South Africa, Grailabs and the University of Portsmouth. A third programme is planned for 2022.

DSI-NRF Funds HIRAX Dark Energy Telescope

Following an intensive and rigorous review process in-volving international experts, the National Research Foundation (NRF) approved the funding of R35 million for the Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX) which will be built as a guest instrument on the South African Radio Astronomy Observatory's (SARAO) site in the Karoo. The new equipment will bolster the country's ability to perform cutting-edge astronomy research in alignment with the Grand Challenge Astronomy National Strategy.

This new investment by the Department of Science and Innovation (DSI) in partnership with the NRF, will provide funding for the telescope dishes, feeds, radio frequency over fibre system, and some backend hardware. This contribution represents a significant investment in the overall HIRAX project.

Led by UKZN, under the leadership of the principal investigator Prof. Kavilan Moodley, the HIRAX consortium has seven members, UKZN, SARAO, AIMS South Africa, Durban University of Technology, Rhodes, UCT, and UWC.

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:

- On 19 August 2020 Prof. Bassett gave a virtual seminar at the **Institute for Practicing Statisticians (ICCSSA) AGA**. The talk was titled: 'Coronavirus Statistics: What we still don't know and why it matters.'

- Dr Bah gave the following seminar: 'Practical High-Throughput, Non-Adaptive and Noise-Robust SARS-CoV-2 Testing' to members of the **Mathematics of Information Processing Group** at RWTH Aachen University on 20 August 2020 and to members of the **Department of Statistical Sciences** at **UCT** on 21 September 2020.

- On 25 August 2020 Dr Nickelsen presented a poster during the multidisciplinary conference, **Dynamics Days Digital 2020**. The title of the poster was 'Anomalous scaling of dynamical large fluctuations.'

- On 14 September 2020, Dr Nickelsen, gave a presentation at the **AIMS-TU Chemnitz Mini Symposium on Applied Mathematics**. The title of the talk was 'Sampling and normalisation of complex distributions by means of non-stationary stochastic processes'.

- Mr Samuel Mensah, a PhD student in the Data Science Group, took part in the **8th Heidelberg Laureate Forum 2020** which took place from 21 to 25 September 2020. This event was hosted virtually due to the ongoing pandemic.

- Ms Tshenolo Thato Daumas, a Research Master's student attended the **Programme for Postgraduate Capacitation workshop** which was held online from 29 September to 1 October 2020 and was facilitated by Dr Layla Cassim, PhD of ERS Consultants CC. It was a workshop that CSIR-funded students from different South African universities were required to attend. It was an intense course that covered various topics including research proposals, research design and methodology and thesis writing.

- On 13 October 2020, Prof. Bassett, gave a talk on Meetup titled: 'Machine Learning Challenges at MeerKat and the SKA.'
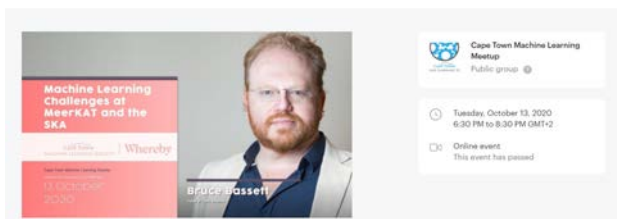
- Dr Utete, Dr Dufourq and Mr Mark Heerden, Founder of the AIMS-ESMT IIP attended the **African Bioacoustics Conference** online event from 2 to 5 November. There were about 200 attendees from around the world. Dr Dufourq presented two talks: 'Automated detection of Hainan gibbon calls for passive acoustic monitoring' and 'Creating pre-trained neural networks for bioacoustic monitoring'.

- On 28 March 2021, Prof. Bassett gave a talk at a data breakfast on '**Predictions for Covid in SA for 2021 and Beyond'** hosted by the University of KwaZulu-Natal.
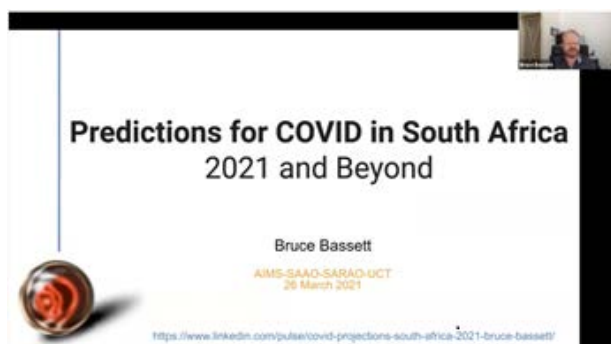
- The **Baden-Württemberg Africa Science Collaboration Conference** was held online on 20 and 21 April 2021. Dr Bah was a panellist on a panel discussing the topic 'How can digitalization contribute to a more resilient global health?' He also organised one of the workshops on the topic: 'Research informed decision making in digitalisation of health'.

- Dr Marc Sedjro gave two online talks on how hyperbolic conservation laws can provide some insight into understanding Mean Field Games. The first was for **Hampton University** on 23 April 2021 and the second was for **AIMS Ghana** on 6 May 2021.

- Prof. Bassett was one of about 30 invited international guests at the inaugural **NASA Strategic Data Management AI workshop** which took place from 12 to 14 May 2021. The workshop covered a wide range of AI and Data Science topics including identifications of gaps in NASA's capabilities around data, models and cross-divisional implementation of AI.

- Dr Bah was an organiser and speaker at **The Gambia Deep Learning INDABAX (DLIX) 2021**, held in The Gambia from 27 to 29 May 2021. Mr Samuel Ofosu Mensah and Mr Rockefeller were teaching assistants.

- Prof. Green and Prof. Bruce Bassett were part of a **NITheCS Colloquium** panel discussion titled: 'Computation as a tool for solving theoretical questions'. This was held virtually on 19 July 2021.

WEBINARS

The Journal Club

The Journal Club is a seminar series of the AIMS Research Centre, where research students, AIMS researchers, visiting researchers and invited speakers present their research. Instead of showcasing results, the focus is to share the journey of obtaining research results, including challenges faced and insights gained during the journey. The Journal Club serves as a training venue for the AIMS research students to improve presentation skills and practice scientific discussions, as well as bringing together AIMS researchers in different fields to foster interdisciplinary projects.

The Journal Club series 2020/21 started late due to the lockdown in 2020 and has been conducted online since then. The first presentation was given in November 2020 by Dr Hans-Georg Zimmermann (Siemens Corporate Research and Fraunhofer IIS in Germany), who is involved in the supervision of AIMS students. The topic of Dr Zimmermann's presentation was modelling dynamical systems using historically consistent neural networks, which are a class of neural networks to learn time series data avoiding inconsistencies between past and future modelling occurring with recurrent neural networks. Due to the interest in this topic, Dr Zimmermann gave a follow-up presentation in February 2021. Another contribution of an external established researcher was Prof Peter Grindrod (Oxford University, United Kingdom), who gave two presentations in March 2021 with the AIMS Structured Master's students joining. The topic of these two presentations were the modelling of customer relation management and gambling addiction by means of hidden Markov models, as well as trust and hype in data science.

A number of research students and postdocs presented in the Journal Club. Mr Thabani Ngcobo talked about his Master's research project on solving differential equations using radial basis functions. Mr Kiprono Elijah Koech, another Research Master's student, introduced to ensemble techniques in machine learning. Postdoctoral researcher Dr Emmanuel Dufourq shared his journey of using pre-trained neural networks to monitor endangered species, tackling the challenge of scarce data that comes naturally when monitoring wildlife of low abundance. Mr Johan du Buisson, a PhD candidate at Stellenbosch University, gave an account on the mathematical problems around random walks with reflecting boundaries. He demonstrated how these problems can be solved, allowing a statistical description of rare events in the framework of large deviation theory.

Dr Hans-Georg Zimmermann Journal Club Talk

Prof. Peter Grindrod Journal Club Talk

Financial Mathematics Webinars

The Financial Mathematics Research Group at AIMS South Africa hosted the following webinars:

DR NNEKA UMEORAH

On 18 February 2021 Dr Nneka Umeorah, North-West University (NWU), gave a talk titled: 'Valuation of Basket Credit Default Swaps Under Stochastic Default Intensity Models.

DR MODISANE SEITSHIRO

On 25 March 2021, Dr Modisane Seitshiro, NWU, gave a talk titled: 'Assessing distributional model risk under parametric bootstrap methods.'

DR JULES MBA

On 29 April 2021, Dr Jules Mba, University of Johannesburg, gave a talk titled: 'Cryptoassets portfolio selection and optimization'.

DR RODWELL KUFAKUNESU

On 27 May 2021, Dr Rodwell Kufakunesu, Snr Lecturer, Department of Mathematics and Applied Mathematics, University of Pretoria, gave a talk titled: 'Quanto Commodity Options.'

DR ISAAC TAKAIDZA

On 30 June 2021, Dr Isaac Takaidza, Snr Lecturer, Department of Mathematics and Applied Mathematics, North-West University (Vanderbijlpark) gave a talk titled: 'Modelling and Control of a Financial Epidemic.'

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WORKSHOPS AND
CONFERENCES

Due to the lockdown caused by COVID-19, AIMS researchers hosted two virtual workshops.

Workshop in Mean Field Games

AIMS South Africa hosted an online workshop in Mean Field Games from 22 to 25 March 2021. The event brought together about 25 participants from Africa, Europe, Asia and North America. In recent years, the theory of Mean Field Games has emerged as an interesting framework to study the dynamics of a large number of competing and rational agents. The goal of the workshop was to introduce the participants and especially AIMS students to this new research field.
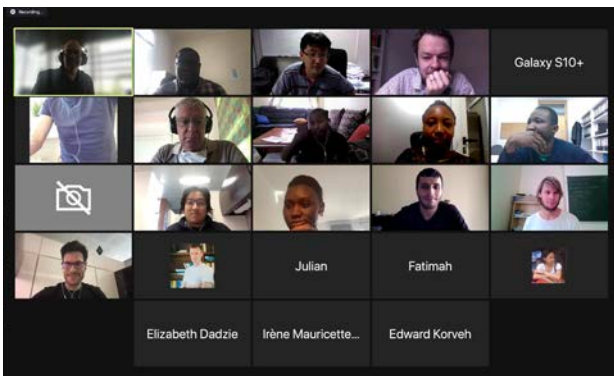
Participants at the Workshop in Mean Field Games

2021 Gene Golub SIAM Summer School

AIMS South Africa hosted the eleventh Gene Golub SIAM Summer School on the Theory and Practice of Deep Learning.

The School was held virtually from 19 to 30 July 2021 with a focus on the theory, implementation, and application of deep learning based on neural nets with many layers. Students learnt the mathematical underpinnings of deep learning using a combination of functional analysis and optimization theory. They were introduced to applications that included computer vision, nonlinear programming, and forecasting, in addition to attending lectures by practitioners of deep learning in industry.

The were 46 participants, 28% of whom were female, from around the world. Although the course was virtual there were cohorts who worked together at the AIMS Centres in Rwanda and Cameroon.

The organising committee was made up of Dr Bubacarr Bah, AIMS South Africa, Prof. Coralia Cartis, Oxford University and Prof. Kasso Okoudjou, Tufts University. Additional lecturers included Prof. Gitta Kutyniok, LMU Munich and Prof. Jared Tanner, Oxford University. Tutors from AIMS South Africa included Dr Emmanuel Dufourq and Dr Dinna Ranirina and Dr Daniel Nickelsen was the moderator.
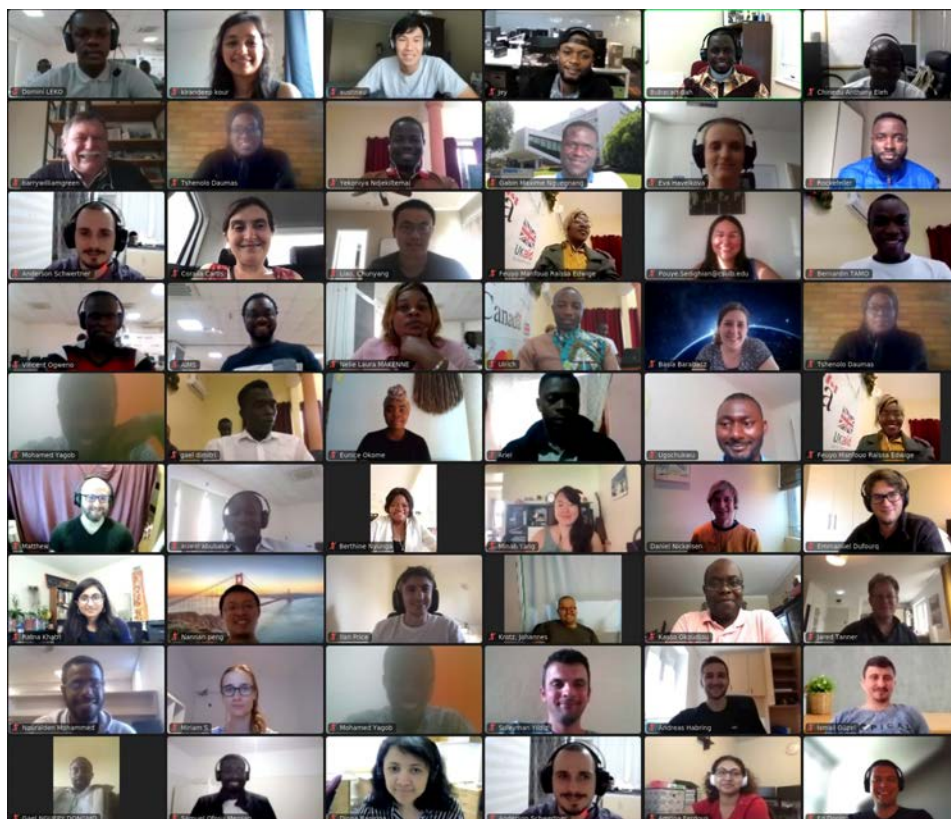
Participants at the 2021 Gene Golub SIAM Summer School

AIMSSEC
AIMS SCHOOLS ENRICHMENT CENTRE

Introduction

The AIMS Schools Enrichment Centre (AIMSSEC) in South Africa provides high quality professional development courses for mathematics teachers at the primary and secondary levels, subject advisors, and field trainers to improve the quality of teaching and learning of mathematics in South Africa. AIMSSEC seeks to introduce new teaching skills, improve subject knowledge, and empower teachers from disadvantaged communities. AIMSSEC follows a blended learning approach involving residential modules (when possible), distance learning, live webinars, interactive online forums, and final examinations. The professional development courses include intensive ICT training, building basic skills in the use of Microsoft Office, email, and the internet.

The table below provides the key courses that AIMSSEC provided, and the number of teachers trained for each course over the reporting period:

Course	# of Teachers Trained					
	July 2020- June 2021 fully online version			Total trained since programme started		
	Total	Male	Female	Total	Male	Female
1. A three-month Mathematical Thinking (MT) Course	88	35	53	2 300	920	1 380
2. Mathematical Communication and Language (MCL) Course	70	28	42	95	33	62
3. A two-year Advanced Certificate in Education (ACE)				215	86	129
Total	**158**	**63**	**95**	**2 610**	**1 039**	**1 571**

During the period, AIMSSEC continued to provide free online resources for use by teachers for remote learning and by parents faced with home-schooling their children. This comprised 2870 downloads. 450 people also continue to use the free AIMSSEC AIMING HIGH App with the lesson activities.

Teachers can access material for free on our AIMING HIGH Teacher Network on our website https://aiminghigh.aimssec.ac.za/and App https://aimssec.app/

AIMSSEC is also active on social media with ideas every day on Facebook for lesson starters linked to the AIMING HIGH learning packs; a weekly Happy Maths Hour broadcast on YouTube; monthly Global Teacher Empowerment Network (GTEN) workshops for primary and secondary teachers involving teachers in the Caribbean and other African countries and monthly workshops in Spanish for teachers in Spain and Latin America.

Mathematical Thinking (MT) Course

The Mathematical Thinking (MT SAMO 1) Online Course started on 17 August 2020 following the cancellation of the residential module in June for MT 33 due to COVID-19. The MT SAMO 1 course format was a combination of home-study, interaction with tutors and other students on WhatsApp, writing assignments and participation in three live sessions on Saturdays via Zoom.

The MT SAMO 1 Course is based on a teaching strategy that involves students regularly in problem solving. It is designed for mathematics teachers from schools that enter learners for the Old Mutual South African Mathematics Olympiad (SAMO) competitions in order, to improve the chances of success in the competitions by learners from schools in Quintiles 1 to 3. This professional development course is designed to support and help teachers to cope with the very difficult situation that the pandemic has caused, with some learners in school and some at home.

Each participant was expected to complete five assignments during the course. The format was a virtual course, where AIMSSEC had invited international and local lecturers to share course materials and record and share their sessions with the students via WhatsApp, and Google Classroom. Lecturers also facilitated live sessions with the teachers using the Google Meet platform.

A research team led by Prof. Caroline Long and Dr Adriana van der Nest, conducted an independent evaluation of the MT SAMO 1 course. Their final report stated: "Of particular note is that teachers in remote rural areas are able to access the course. Also given the AIMSSEC philosophy of sharing the information teachers receive from the course with colleagues, the extent of the reach into rural areas is even greater. It was clear from our interactions with the AIMSSEC staff on a few occasions, from early Skype meetings, to an in-person meeting on 24 November, that the staff can be described as reflective practitioners, and that they model such practice to the students".

"The majority of participants agreed, or strongly agreed that:

- the information and activities presented were relevant and useful (96%);
- the teaching skills learnt during the MT SAMO Online Course were relevant to the work they do (95%);
- the trainers (tutors) were knowledgeable, approachable, and helpful during the online training session (91%);

- the objectives of the training programme were clear and relevant to their professional development needs (91%) and
- the materials/resources/handouts provided were useful (90%).

In summary, the teachers' reactions strongly indicate that they found the MT SAMO interventions relevant and useful to their mathematics teaching and learning practices."

AIMSSEC will offer the MT 2 Online course to a further 75 teachers from 28 August to 28 November 2021.

Mathematical Communication and Language (MCL) Course

The MCL SAMO 2 is the second course in a sequence of seven AIMSSEC Subject Leader Training Courses that equips teachers to be Heads of Department, teacher trainers for an NGO or subject advisors for local government. AIMSSEC has received endorsement from the South African Council for Educators (SACE) for this course for twenty-five professional development points.

The course seeks to develop communication skills, mathematical understanding and knowledge acquisition through properly structured mathematical language. The course brings to light the pivotal role a good understanding of the language of instruction plays in achieving mathematical proficiency.

MCL SAMO 2 was offered to ninety-five mathematics teachers by AIMSSEC from 6 February till 30 May 2021 with the closing ceremony on 19 June 2021. The course format was a combination of home-study through Google Classroom, interaction with tutors and other teachers on WhatsApp, writing assignments and participation in four live sessions on Saturdays via Zoom.

This course is based on the same teaching strategy as the MT SAMO 1 Course.

AIMSSEC conducted its own internal evaluation as no funding was available for an external evaluation. Four aspects measured the impact of the course, namely: pre- and post-tests on students' ability to solve Olympiad type questions, post-course evaluation questionnaires completed by students, presenters and tutors and responses from teachers about learner performance.

RESULTS OF BOTH COURSES

Number of students on MT SAMO 1 course		Number of students on MCL SAMO 2 course				Total % of 158 students
Distinction	44	Distinction	22	Distinction	66	41,8%
Merit	24	Merit	24	Merit	48	30,4%
Pass	17	Pass	18	Pass	35	22,2 %
Fail	3	Fail	6	Fail	9	5,7%
Subtotal	88	Subtotal	70	Subtotal	158	100%
Withdrew	21	Withdrew	25	Withdrew	46	
Total	**109**	**Total**	**95**	**Total**	**204**	

Due to special provision for COVID-19 circumstances the retention rates were good considering the conditions where teachers had to catch up on lost time and had to fill in for colleagues who contracted the virus. The retention rate for the MT SAMO 1 course was 80,7% and for the MCL SAMO 2 course 73,7%. The retention rate for both courses together was 77,5%.

Participants in the final ceremony of the MCL SAMO 2 course on 19 June 2021

Outreach and public engagement activities under the name HAPPY MATHS

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

AIMSSEC FaceBook Page Report from 1 May to 27 August 2021	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

HAPPY MATHS provides a daily lesson starter for a class in school or a mixed-age group of learners in a family situation with links to Inclusion and Home Learning Guides. 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 individual needs.

For the last five years HAPPY MATHS has run an annual 30-minute Global Maths Lesson with more than 10 000 participants across the world. The theme in 2020 was on health statistics and women in science to commemorate Florence Nightingale's 200th anniversary. This shared activity is suitable for all ages 5 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. This year the Global Maths Lesson was held on 23 September 2021 with the theme Learning Maths from Games with a focus on understanding fractions.

DNA class from India

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 above 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 a variety 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.

AIMSSEC alumni are making their mark in the world of mathematics education. Worth mentioning here is the AIMSSEC alumna from Kenya who completed the MT and ACE courses, then obtained a PhD and is now teaching at Strathmore University.

The whole AIMSSEC AIMING HIGH online resource bank that 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. It 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).

Teachers can join the AIMSSEC online presentations of the Global Teacher Empowerment Network (GTEN) with free monthly workshops for primary and secondary teachers who work in disadvantaged communities around the world.

New partnership

A Memorandum of Understanding 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 and corporates. To date the Old Mutual Foundation and AECI have responded positively and awarded funding to AIMSSEC.

Future Plans

Translations of AIMING High activities into Spanish is already taking place and AIMSSEC and laCaixa signed an agreement of collaboration with EduCaixa, the education division of laCaixa. The aim is 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 future possibility to offer the newly developed online courses as Teacher Professional Development for primary and secondary schools in Spain, Latin America and other African countries. For more information follow the link: https://fundacionlacaixa.org/en/educaixa-educational-programmes.

PUBLIC ENGAGEMENT
HOUSE OF SCIENCE

Undoubtedly, the COVID-19 pandemic continues to be a stark reminder of the importance of closing the widening gap between science and broader society. AIMS South Africa addresses the aforementioned gap through its House of Science Initiative. The House of Science aims to advance science communication and public engagement at AIMS for the transformation agenda and societal development. There are pressing developmental challenges and imperatives to close the knowledge gaps that exist at all levels and gender disparities across STEM fields in South Africa and on the African continent. Thus, the House of Science strategic objectives 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.

To achieve these strategic objectives, the House of Science has established three flagship programmes: *Africa Scientifique - Leadership, Knowledge and Skills for Science Communication; Women Advancement Forum International Exchanges, Research & Academia (WAFIRA); and The Ishango Workshops on Mathematics Communication in Africa*. The three programmes are jointly delivered by AIMS and African Gong based on the MOU that both organisations undertook in 2019 as a means of confirming their commitment to work in a strategic partnership. The House of Science also delivers/participates in the added value enrichment activities such as the Public Lecture Series; Gender in STEM; Outreach Webinar Series; Outreach Campaigns; Science Festivals, amongst others.

Achievements and Activities

In its third year of existence, the House of Science has made significant progress in several critical areas of its strategic plan. The improvement was evident despite disruption by the global pandemic (COVID-19). Then, the House of Science had to (and still) adapt innovative ways of delivering its programmatic activities. The House of Science framework has now been aligned within the Core Pillars and Institutional Strategy of AIMS. Furthermore, its two flagship programmes and various added value enrichment activities were safely delivered. The next subsections provide the breakdown of achievements during the reporting period.

Strategic Alignment within Core Pillars and Institutional Strategy of AIMS

At the Centre level: The House of Science framework has been enabled and aligned within core pillars of AIMS South Africa research and capacity building frameworks to demonstrate viable and strategic alignment between its (AIMS South Africa) operations and those of the South African government's mission, vision, and objectives, including the transformation agenda of the National System of Innovation. Institutional frameworks such as that of the House of Science framework have a pivotal role to play not only in the promotion of the mathematical sciences within the broader community but also in the implementation of the South African Department of Science and Innovation Science Engagement Strategy (SES).

At the Network-level: The House of Science framework has been proved to be a user-friendly and flexible model. Thus, it will be replicated and rolled out across the AIMS centres, hence providing an oversight and coordination function for AIMS public engagement efforts in the **New** AIMS 2021-2026 Strategic Framework. This is a significant milestone for AIMS South Africa.

This strategic AIMS Network framework will encompass African capacity-building and engender pan-African partnerships across the continent. The intention is to grow the footprint, profile and visibility of the AIMS science communication and public engagement programmes, agenda, outputs, and track-record. It is estimated that over the next five years, the House of Science framework will coordinate approximately 500 public engagement and outreach events, engaging 5,000 members of the AIMS community and reaching 100,000 African members of the public. However, for the House of Science to fully reach these strategic targets and be sustainable, there are vital issues, needs, realities, constraints, and implications that need to be considered. In 2022/23, the House of Science will focus on consolidating and deepening its programmes. This will include further monitoring, evaluating, and disseminating the achievements and learning of the House of Science programmes outcomes, strengthen partnerships and secure the requisite sustainable funding. House of Science will also enhance its Human Resource capacity to support progress in its areas of strategic importance.

We are positive and delighted that the scaling-up of the House of Science framework across the AIMS Network will address the long-standing need for a coordinated, inclusive and sustainable public engagement strategy incorporating innovative programmes and delivery mechanisms.

DR REJOYCE GAVHI-MOLEFE
H O U S E O F S C I E N C E M A N A G E R

Flagship Activities: Africa Scientifique programmes for AIMS South Africa Master's students

The House of Science, in partnership with African Gong, has delivered Africa Scientifique (AS) programmes in the 2020 and 2021 academic years for two cohorts of AIMS Master's students. 17 students participated in the 2020 Inaugural AS programme and 24 in the 2021 edition. The AS programme is a unique, innovative Afro-centric capacity-building conceptualised to support young and emerging African scientists concerning the advancement of research expertise and capacity on the continent. The AS programme design entailed a three-phase process (an Introductory Workshop, a three-day Workshop and a six-month post-Workshop). The 2020 programme was delivered online on 22 July 2020 (Phase 1) and face-to-face at AIMS in Muizenberg from 28 to 30 September (Phase 2). Phase 3 was also delivered online from October 2020 to January 2021. Similarly, the 2021 AS programme was delivered online on 24 June 2021 (Phase 1) and face-to-face at AIMS from 25 to 27 August (Phase 2). Phase 3 commenced in September 2021 and will be completed in February 2022. Below are the 2020/21 AS programmes descriptions of each phase.

Phase 1 - An Introductory Workshop

This introduced participants to the background and rationale concerning the AS programme, its transformational pan-African contexts, and the envisaged outcomes for participants. During the introductory sessions, both cohorts had indicated that they had never attended any science communication capacity building training nor undertaken public engagement activity to communicate mathematics. This is not surprising, given the limited opportunities of science communication training in the South African science ecosystem and on the continent. It should also be noted that there is a perception among the mathematics community that it is challenging to communicate mathematics. The AS programme was thus the beginning of a new journey of knowledge, discovery and first-hand experience in science communication and game-changer.

Phase 2 - A three-day AS Workshop

This allowed participants to delve deeper into the world of science communication and the potential leverages that it can engender in their career advancement. Over the three days, the participants were provided with thought-provoking, hands-on, informative, inclusive, transformative, and interactive sessions and networking opportunities. The sessions were ably facilitated by dynamic and diverse African Science Communication professionals, researchers, and academics. Science policymakers, established mathematical scientists and AS programme alumni pursuing careers in academia and industry also contributed to the Workshop. The Workshop covered themes/topics such as: Research Time Management - work-life balance and successful research outcomes; Research Dissemination - public engagement and good practice in mathematics outreach activities; Gender and Socio-Cultural Inclusion in science communication; Leadership Skills for research academia and future career progression; Presentation and Communication Skills - both written and oral, utilising diverse tools, platforms and engagements;

Mentoring - science communication and progression pathways/entrepreneurship.

After the three-day Workshop, the participants were expected to draw from knowledge, skills and values attained to identify, conceptualise, and outline a specific science communication/public engagement activity that they will undertake in an individual or team capacity. After all, it was crucial that they put into practice the tools they had gained from the AS programme. The project activity framework had to feature the following critical elements:

- Clear objectives.
- Message.
- Target audience, particularly the seven groups of selected neglected/hard-to-reach publics (i.e., the science interpreters, industry, decision-makers, journalists, tourists, indigenous knowledge holders and the general public) from the DSI SES engagement platform(s).
- Tools/formats.
- Mathematical science themes or contents.
- Timeframes.
- Resources.
- Monitoring/evaluation plan.

African Scientifique 3-day Workshop 2020 Participants

African Scientifique 3-day Workshop 2021 Participants

Africa Scientifique Workshop awards

After the workshop, all the participants were awarded certificates. Two participants (Mr Tolotranirina Andrianarisoa and Ms Everlyn Chimoto) who demonstrated outstanding improvements in their engagement, enrolment, communication, and presentation skills over the three days of the workshop received AS Excellence Awards. That included a cash prize conferred by African Gong. The 2020 awardees were Ms Grace Airenghe Ikhizama and Mr Tumelo Donald Sereo.

Visit the House of Science YouTube Channel (https://www.youtube.com/channel/UCk54pq7mCovkGz-GkptdKpQ) to watch the video of participants sharing their Workshop experience.

"
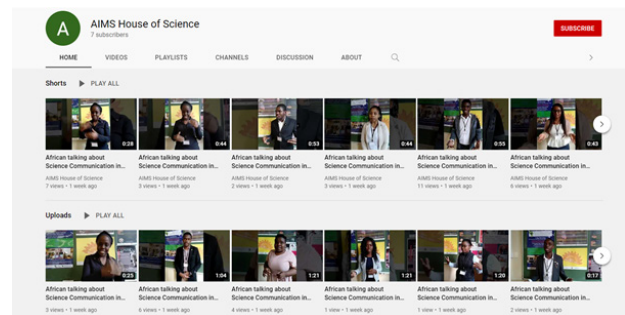
Getting a chance to conceptualize, prepare and present our proposals for mathematical projects with the social impact made me realise the potential solutions we have as science students for our communities.

AS PROGRAMME PARTICIPANT – 2021

"

I was one of the people who registered late because I never wanted to attend. But today, I can say, not attending would have been the biggest mistake of my life. I learnt a lot of skills in just 3 days and I could see the transformation in the way I present to the public. I wish it went on for a week.

AS PROGRAMME PARTICIPANT – 2021

Phase 3 – A six-month AS Post-Workshop

During this period, the participants had direct, peer-to-peer, team mentoring and support while planning, delivering, monitoring, and evaluating their practical public engagement activities. They undertook their science communication projects and their post-AIMS career progression activities with the support and mentoring from the AIMS House of Science, African Gong and volunteer mathematical scientists.

2020/21 AFRICA SCIENTIFIQUE WORKSHOP CONTRIBUTORS

Workshop Programme	Contributors' Name/Professional Category/Affiliation//Year
Introductory remarks	• Prof Barry Green, *Director* - AIMS South Africa (2020/21) • Dr Simukai Utete, *Academic Director* - AIMS South Africa (2020) • Dr Elizabeth Rasekoala, *President* - African Gong (2020/21) • Dr Rejoyce Gavhi-Molefe, *Senior Manager* - House of Science (2020/21) • Mr Isaac Ramovha, *Director of Science Promotion* - Department of Science and Innovation (DSI) (2021)
Main sessions	• Dr Rudzani Nemutudi, *Physicist* - iThemba *LABS* (2021) • Prof Fanelwal Ajayi, *Physical Chemist* - University of the Western Cape (2020) • Dr Elizabeth Rasekoala, *President* - African Gong (2020/21) • Prof Nokwanda Makunga, *Medical Plant Biotechnology expert* - Stellenbosch University (2020/21) • Dr Rejoyce Gavhi-Molefe, *Senior Manager* - House of Science (2020/21) • Ms Azeza Fredericks, *Parliamentary Liaison manager* - Council for Scientific and Industrial Research (CSIR) (2021)
Panel discussion	• Mrs Koki Selepe, *Deputy Director of Science Promotion* - DSI (2020) • Dr Beverley Damonse, *Group Executive of Science Engagement and Corporate Relations* - National Research Foundation (2020) • Ms Zinhle Mthombothi, *Junior Researcher* - South African Centre for Epidemiological Modelling and Analysis (2020) • Mr David Attipoe, *Programme Lead* - AIMS ESMT Industry Immersion Programme (2020) • Prof Edson Pindza, *CEO & Founder* - ESSENSCIA (2021) • Ms Tintswalo Mhelembe, *Graduate trainee & AS 2020 alumna* - Old Mutual South Africa (2021) • Mr Cebolenkosi Ngema, *Masters Student & AS 2020 alumnus* - North-West University (2021) • Mr Thabang Malapane, *Masters Student & AS 2020 alumnus* - AIMS South Africa (2021)

Added Value Enrichment Activities

During the reporting period, the House of Science also organised Gender in STEM and mathematics outreach activities. It also contributed to the science communication/public engagement research study.

AIMS Gender in STEM

Five *AIMS Gender in STEM (AIMSGIS): AIMS Women in STEM (AIMSWIS)* and *Mentoring for Transformative Masculinity (MTM)* in-house mentoring events were held for the students (both male and female). The objectives of the AIMSGIS mentoring programme are to:

- Create a safe space where students can obtain support from caring senior students who are willing to listen to them, serve as good role models, help them develop their life skills and build self-confidence.
- Provide a diverse environment for networking with successful professionals in STEM, including AIMS alumni.
- Encourage women and girls to pursue careers in STEM.

"

It was great to meet women in the same field, sharing their experiences. It was eye-opening.

AIMSWIS PARTICIPANT – 2021

The Mentoring online events featured 16 AIMS alumni (amongst speakers), based in various institutions worldwide and currently pursuing different career paths in academia and industry. The theme for the events included 'Embarking on AIMS and Post-AIMS Career Journey' and 'Mental Health and Wellness: Personal, Professional Growth', amongst others. The events provided an enabling environment for discussions concerning the challenging realities experienced by AIMS students and researchers regarding career progression and mental health and well-being. Such realities remain part of topical issues during the ongoing COVID-19 global pandemic. The speakers shared their career experiences, opportunities and gave tips on how to overcome the challenges.

"

I was looking for encouragement to keep on going cause at times it becomes so overwhelming and hearing from people who have already gone through the AIMS programme is really encouraging as it shows that I can push through as well despite the challenges and pressure. With hard work, all things can be done.

AIMSWIS PARTICIPANT – 2021

AIMS GENDER IN STEM SPEAKERS/MENTORS

Date	Mentor/Affiliation/Professional Category
23 January	• Dr Milaine Seuneu Tchamga, *Postdoc Fellow* - AIMS South Africa • Dr Chinenye Assumpta Onyeagoziri, *Researcher* - Stellenbosch University • Ms Rojo Randrianomentsoa, *PhD Candidate* - Vienna University of Technology, Austria • Ms Funmilayo Makinde, *PhD Candidate* - AIMS South Africa.
30 January	• Dr Michael Kateregga, *Data Analyst*, Exigent Group Limited, Cape Town • Mr Gershom Buri, *PhD Candidate* - AIMS South Africa • Mr Samuel Mensah, *PhD Candidate* - AIMS South Africa • Mr Ghislain Niyongabo, *Social Entrepreneur* - Guru Academy, Burundi.
26 February	• Dr Fadekemi Osaye, *Non-tenured Assistant Professor* - Auburn University, USA • Dr Naina Ralaivaosaona, *Lecturer* - Stellenbosch University • Dr Dinna Ranirina, *Postdoctoral Fellow* - AIMS South Africa
21 April	• Ms Jessica Phalafala, *Quantitative Analyst* - Prescient Investment Management • Ms Tshenolo Daumas, *MSc Student* - AIMS South Africa • Ms Kelebogile Baliki, *Data Analyst Intern* - Okavango Diamond Company, Botswana
23 April	• Dr Rock Koffi, *Analyst*, Elenjical Solutions, South Africa • Mr Rockefeller, *PhD Candidate* - AIMS South Africa • Dr Dennis Ikpe, *Researcher* - University of Michigan, USA
16 July	• Prof Farai Nyabadza, *Head of Department* - University of Johannesburg, South Africa • Dr Yves Semegni, *Senior Lecturer* - North-West University, South Africa

AIMS Women in STEM Outreach Webinar Series

In addition to in-house AIMSWIS mentoring events, the House of Science organised the AIMSWIS outreach webinars. These were hosted every second Saturday at 11.00 SAST. Three AIMSWIS outreach webinars were held on 8 and 22 August 2020, celebrating South African Women's Month and 5 September 2020. The webinars featured female role models (including AIMS alumni) from STEM-related career fields who shared their insights concerning challenges that are unique to African females in Mathematical Sciences in their respective contexts and the opportunities.

The topics for the webinars included Women Advancement in Mathematical Sciences: Developing & Sustaining Professional Relationships and the Importance of Negotiation Skills for Career Advancement in Mathematical Sciences. The webinars were attended by AIMS female students (South Africa, Ghana, Senegal, Rwanda & Cameroon), alumni, academics and researchers as well as industry professionals and students from South African Universities and other Universities on the continent. On average, 28 women scientists attended each webinar.

AIMS WOMEN IN STEM WEBINAR SERIES SPEAKERS

Date	Mentor/ Affiliation/Professional Category
8 August	• Dr Angela Tabiri, *AIMS-Google AI Postdoctoral fellow* - AIMS Ghana • Ms Jessica Phalafala, *Quantitative Analyst* - Prescient Investment Management
22 August	• Dr Jummy David- *Postdoctoral Fellow*, York University, Canada • Ms Siphokazi Gatyeni- *PhD Candidate*, University of Johannesburg, South Africa
5 September	• Ms Ylaney Ramlall, *Team Administrator* - Constantia Insurance, South Africa • Dr Fadekemi Osaye, *Non-tenured Assistant Professor* - Auburn University, USA

Après-Lunch with the Mathematical Scientist Webinar Series

During the reporting period, 12 Après-Lunch webinars were held. The Après-Lunch fortnightly webinar series provides a conducive environment for students, researchers, and mathematics devotees to interact with esteemed mathematical scientists/role models working in academia/industry and other sectors. The webinars thus enable graduate students to meet potential mentors in their academic careers and foster collaboration amongst the researchers. The 2020/21 Apres Lunch webinar's theme was 'Career Advancement in Mathematical Sciences in Africa'. They (the webinars) discussed the challenging realities experienced by Mathematical graduates and career opportunities in some of the most attractive, rapidly evolving, and fascinating Mathematical Sciences disciplines. They featured speakers working in Africa and/or abroad. The webinar participants include AIMS students and alumni, researchers, high school/college teachers and researchers from other institutions, students from other African universities and professionals working in the industry. On average, 50 people attended each webinar.

MR ROBIN MSISKA

The 22 August 2020 webinar featured Mr Robin Msiska, AIMS South Africa alumnus currently working as an AI Engineer in the research and development branch of AWL Inc./AI Tokyo Lab in Tokyo, Japan. Mr Msiska shared the critical career benefits of being trained at AIMS. He encouraged the audience, particularly current students, to take advantage of network opportunities and resources provided by AIMS.

MR NDIVHUWO MPHEPHU

On 2 September 2020, the Apres Lunch was hosted by Mr Ndivhuwo Mphephu, AIMS South Africa alumnus and a Quantitative Risk Analyst at the South African Reserve Bank (SARB). He shared some of the challenges specific to academia/research in the field of Mathematical Sciences in South Africa.

PROF. PHILLIP MASHELE

The 16 September 2020 the webinar featured Prof. Phillip Mashele, a Financial Mathematics Expert at North-West University and a Part-time Senior Researcher at AIMS South Africa. He shared opportunities available to graduates students who would like to pursue careers in Financial Mathematics in South Africa and challenges that the students need to be aware of.

MS MMABATHO MOKITI

The 11 February 2021 webinar was hosted in commemoration of the International Day of Women and Girls in Science. The day's speaker was Ms Mmabatho Mokiti, a dynamic and inspirational mathematician who turned into an impact entrepreneur. She is the founder and CEO of Mathemaniacs in South Africa. Mathemaniacs is a STEM corporate social investment (CSI) and monitoring and evaluation consulting agency that designs and implements CSI strategies for corporates to invest in sustainable STEM education in rural and disadvantaged areas. She shared her work and the challenges she faced as an African female mathematician in the world of entrepreneurship and what inspires her about a career in entrepreneurship.

DR GUY BLAISE DONGMO

Dr Guy Blaise Dongmo was a guest speaker for the 4 March 2021 webinar. He is AIMS South Africa alumnus and a Probabilistic Safety Assessment (PSA) Analyst at Eskom-Koeberg Nuclear Power station in South Africa. He shared his career experience and insight about the transition from academia with pure mathematics to industry.

MS OLUWAKEMI IMOLE ADEWUMI

MS MULUNGA MAKHUBELE

The 11 March 2021 webinar featured Ms Oluwakemi Imole Adewumi and Ms Mulunga Makhubele, both AIMS South Africa alumni who have inspiring career journeys in the Mathematical Sciences discipline. Ms Adewumi is currently a PhD candidate in Financial Economics at the University of Kent in the UK. Ms Makhubele is a Senior Data Scientist at Healthy Health in the UK. Ms Adewumi highlighted the effect of the diversity at AIMS in terms of modules and different teaching styles one gets to experience. Ms Makhubele shared some of the common myths and misconceptions about the field of Data Science and emphasized the importance of programming skills for aspirant data scientists.

DR MESIAS ALFEUS

Dr Mesias Alfeus was invited to the 8 April 2021 webinar. He completed an Honours in Financial Mathematics at AIMS in 2013. He is a Financial Risk Management Lecturer at Stellenbosch University in South Africa. He shared his career journey in mathematics from humble beginnings. He went further to emphasise the importance of Financial Mathematics in the development of Africa.

The 22 April 2021 webinar was hosted by Dr Abdul-Karim Iddrisu and Dr Jude Dzevela Kong. The former is an AIMS South Africa aluminus and a Lecturer at the University of Energy and Natural Resources in Ghana. Then, he was looking forward to a new job (2nd August 2021) as a Biostatistician at Synterac in South Africa. Dr Kong is a Professor in the Department of Mathematics and Statistics at York University in Canada. He is also a Director of the Africa-Canada Artificial Intelligence and Data Innovation Consortium (ACADIC) at York University. Dr Iddrisu gave insight into the career and research opportunities and challenges in Biostatistics on the continent (Africa). Dr Kong shared the main challenge that he has encountered as a senior African mathematician in Biomathematics working abroad.

DR ABDUL-KARIM IDDRISU

DR JUDE DZEVELA KONG

The 13 May 2021 webinar featured Dr Taboka Chalebgwa and Dr Michael Kateregga, AIMS Alumni. Dr Chalebgwa is a postdoctoral fellow at McMaster University in Canada. Dr Kateregga is a Data Scientist and Software Engineer at Exigent-Group Limited in South Africa. The two speakers shared their career experience, the transition from AIMS and tips on leveraging career and research opportunities, at the continental and international level.

DR TABOKA CHALEBGWA

DR MICHAEL KATEREGGA

The 27 May 2021 webinar was hosted by Dr Vukosi Marivate - an ABSA chair of Data Science at the University of Pretoria in South Africa. He shared his career journey into Data Science, major problems in Africa that can be addressed using it (Data Science) and Machine Learning, and his passion for his job.

DR VUKOSI MARIVATE

The 10 June 2021 webinar was hosted by Mr Robert Motala and Prof. Edson Pindza, both mathematicians who are now entrepreneurs. The former is an AIMS South Africa alumnus and a Software Engineer, Founder & Managing Director at ERRACO, an Information Technology & Services company in South Africa. Prof. Pindza is a Founder and CEO at ECCENSCIA, a cybersecurity company. They shared how they transitioned from academia with mathematics to the world of entrepreneurship and the challenges they faced starting their businesses.

MR ROBERT MOTALA

PROF. EDSON PINDZA

"

The biggest problem faced today in Africa by our education system is non-correlation between school knowledge and the needs of society. This webinar helped me to understand that this issue can be fixed by acquiring entrepreneurial spirit and professional skills besides academic knowledge. Furthermore, Mathematician is a Problem Solver and to be this kind of mathematician, I have to study mathematics in a way to meet the needs of our society.

APRÈS-LUNCH WEBINAR PARTICIPANT – 2021

"

The webinar has exposed me to new ideas in the field of mathematics and statistics. I now get a bit of an understanding of the application of mathematics and statistics in solving real-life problems. I am eager to learn more and have an opportunity to meet with professionals in the area of mathematics. Furthermore, this webinar helps to enhance Pan Africanism, as we are all striving for the development of our continent.

APRÈS-LUNCH WEBINAR PARTICIPANT – 2021

House of Science Outreach Activities

2021 International Day of Mathematics

On 14 March, The House of Science and the Centre International de Mathématiques Pures et Appliquées (CIMPA) celebrated the International Day of Mathematics (IDM) or Pi day with a Virtual Treasure Hunt Video Game – 'Quest of the Lost Fields Medal'. The video game was developed specifically to make mathematics accessible and enjoyable to the broader community and provide students and/or researchers from developing countries an opportunity to showcase their mathematical science communication skills.

Ms Iness Kyapwanyama and Ms Florence Owino from AIMS South Africa; Ms Victoria Okesipe, AIMS Cameroon; and Ms Nantenaina Milliarde Randrianasolo, AIMS Senegal were amongst the eight best-selected video contributions. The selected students/researchers were awarded graphic digital pen tablets for their outstanding video contributions. Despite the challenges posed by COVID-19 when filming the videos, the students/researchers indicated that participating in the game was a great learning experience and appreciated the opportunity provided to popularise mathematics.

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

Present

Online Treasure Hunt
"Quest of the Lost Fields Medal"

Sunday 14th March 2021 (Pi Day)

INTERNATIONAL DAY OF MATHEMATICS MARCH 14

To participate visit www.cimpa.info on Sunday morning.

Participants: General Public (Age 16 and up)
Join us and watch emerging mathematicians around the world as they showcase their talents and passion for mathematics.

Let's have Fun!

Question (s)? Email Dr Rejoyce Gavhi-Molefe at houseofscience@aims.ac.za

> *It is very important to show to other people that Mathematics is essential to human development despite it (math) seems invisible. The Treasure Hunt Game has shown me that there are many interesting ways to attack this problem*

TREASURE HUNT GAME PARTICIPANT – 2021

2021 Village Science and Technology (S&T) Festival

On the 11 May, the House of Science contributed to the 2021 Village Science and Technology (S&T) Festival held at Vuwani Village, in Limpopo Province, with a talk on 'Career Opportunities in Mathematics'. The three-day festival - a hybrid in nature - took place from 10 to 12 May. Rivoningo Foundation organised it in partnership with the Limpopo Department of Education and SAASTA. It has attracted more than 1500 students from various schools across Vhembe District. The festival aimed to nurture the creative talent of the learners and create interest in learners to pursue STEM-related careers. It (festival) also aims to reach the neglected learners and teachers in rural communities in Vhembe District. The festival programme was jam-packed with exhibitions, special talks on STEM subjects by scientists and hands-on activities.

Dr Gavhi-Molefe, the House of Science Manager, shared the students' challenges and opportunities with regard to mathematical sciences careers and the various aspects that students should consider before embarking on a post-High School journey in STEM fields. She also shared her inspiring story as a mathematical scientist from a Khalavha Village in Limpopo Province. She gave insight into how school-level mathematics such as algebra and trigonometry and university mathematics are used to advance animation or help make more human-like characters and special effects in the film industry such as PIXAR Animation Studios.

Science Communication and Public Engagement Research

- Dr Gavhi-Molefe co-authored - 'Why scientists agree to participate in science festivals: Evidence from South Africa' with Prof. Eric Jensen and Dr Marina Joubert. The paper was published in April 2021 by the *International Journal of Science Education* and promoted through *The Conversation Africa* as South African scientists explain why they make time for science festivals.

- On 17 June 2021, Dr Gavhi-Molefe participated in the Scottish Public Engagement Network (ScotPEN) Journal Club Session panel - a platform where the paper was discussed.

- On 15 July Dr Gavhi-Molefe presented the key research findings from the paper at the South African Agency for Science and Technology Advancement (SAASTA) SciComm Knowledge Share webinar. This monthly webinar – also known as *SciComm Knowledge Share* – provides a forum/platform for scientists to communicate and engage with science policymakers and science engagement practitioners about research relevant to the work of SAASTA and National Research Foundation (NRF). The subsequent discussions included benefits/implications for South African science policy, practice, and future research studies. Dr Gavhi-Molefe further engaged the participants on the critical challenge and imperatives of building scientists' ability and capability skills to deliver science engagement activities in South Africa. Such a challenge impacts the growth of public engagement in South Africa. The webinar was attended by SAASTA representatives, science communication practitioners and researchers from the NRF research entities.

Scientists from the NRF SA Institute for Aquatic Biodiversity (SAIAB) Water World display 2019 engaging with scientists visitors.
Photo credit: NRF SAIAB

STAKEHOLDER ENGAGEMENT

Meetings

Prof. Barry Green attended the 2nd Annual Social Justice Summit held on 4 November 2020, which was hosted by Prof. Thuli Madonsela. He was one of the participants at the Data Analytics and Poverty Mapping Session.

At a meeting of the Governing Board of CIMPA on 21 January 2021, Prof. Barry Green was re-elected as President of CIMPA for the next four years.

THE AIMS NETWORK

GRADUATES FROM OTHER AIMS CENTRES

AIMS Centre			2020/2021 Graduates
	Women	**Men**	**Total**
Cameroon	19	27	46
Ghana	23	49	72
Rwanda	35	58	93
Senegal	17	32	49

AIMS in the Alps

On 30 November, a network-wide and international event, AIMS in the Alps was held. This forum was set up as an opportunity to introduce colleagues from Swiss institutions (and possibly elsewhere!) to the AIMS academic community and describe how they can get involved as an educator. And likewise, this was an opportunity to connect AIMS students and alumni to faculty from Swiss institutions who share intellectual interests and may have research and funding opportunities to pursue together.

The Global Scientific Exchange Programme

The Global Scientific Exchange Programme (GSEP) research fellowship is a fully funded programme initiated by the cluster of excellence Science of Intelligence (SCIoI) in Germany. One of the programme's objectives is to give young African researchers at Master's level the opportunity to get hands-on experiences in an interdisciplinary environment. The GSEP research fellowship also intends to increase the chances of the beneficiaries in securing PhD positions in the Global North. For the programme pilot phase, five candidates were selected in collaboration with the AIMS. During their stay, they worked on projects in their respective labs and attended scientific soft-skill courses, career planning, training on graduate school applications as well as an introduction to the German academic system.

The selected candidates were:

- Ms Juliana Marcos, from Benin, AIMS South Africa alumna who was affiliated with the lab of Computer Vision and Robotics of Prof. Dr Guillermo Gallego.
- Ms Tatiana Ngoli, from Cameroon, AMMI graduate, who worked in the laboratory of Prof. Alan Akbik on the topic of data augmentation for NLP.
- Mr Arinze Folarin, from Nigeria, AIMS South Africa alumnus, who worked with Profs. Oliver Brock & Marc Toussaint where he used Reinforcement Learning in the field of robotics.
- Mr Emmanuel Ahenkan, from Ghana, AIMS Rwanda alumnus and AMMI graduate who worked with Prof. Klaus Obermayer, and his research focused on end-to-end learning of human exploration behaviour.
- Mr Kiprono Koech, from Kenya, AIMS South Africa alumnus, who worked with Prof. Olaf Hellwich and focused on using artificial intelligence methods to promote wildlife conservation.

MS JULIANA MARCOS

MS TATIANA NGOLI

MR ARINZE FOLARIN

MR EMMANUEL AHENKAN

MR KIPRONO KOECH

AIMS-GPSDD Data Science Fellowship Programme

AIMS is a part of the partners network of the Global Partnership for Sustainable Development Data (GPSDD). GPSDD is a global network whose mandate is to use data to achieve the Sustainable Development Goals – improving lives, fighting inequality, and promoting environmental sustainability.

AIMS in partnership with GPSDD implemented a Data Science Fellowship Programme. The programme was delivered through 4-week modular training sessions for government officials from selected National Statistics Offices and other key government institutions across Africa and an internship programme where an AIMS alumnus was embedded in the partner institutions to build and enhance capacity and as well as provide mentorship in the area of data science.

The objective of the AIMS-GPSDD Data Science Fellowship programme was to strengthen the skills and capacity of the host institutions to use data science tools and its analytical capabilities in enhancing data and statistical processes and outcomes.

Dr Bah was a trainer in the training programme and loosely supervised supporting the fellows attached to National Statistics Bureaus. Two other members of the Data Science Research Group, Mr Samuel Ofosu Mensah and Mr Rockefeller were teaching assistants and were also part of the support team for the fellows.

AIMS Doctoral Training Programme in Data Science

The field of data science is emerging as a critical discipline with high relevance to economic growth and development. This doctoral training programme established by AIMS will provide emerging African scientists the opportunity to conduct research at the forefront of data science, and work towards a PhD degree within a high-quality training programme in Africa, in cooperation with institutions internationally.

This programme is part of the training offered by Quantam Leap Africa (QLA) which was created by AIMS to catalyse top quality high impact research in data science, smart systems engineering and drive the future IT revolution through quantum information. It is also mandated to train the next generation of innovators in information science and technology. Dr Bah, was involved in setting up this programme and is one of the board members overseeing it.

GOVERNANCE AND ADMINISTRATION

Trust

The Trust meeting was held on 25 February 2021 and two new members were appointed, Dr Rob Adam and Prof. Loyiso Nongxa. They attended the meeting along with Prof. Neil Turok (Chair), **Ms** Nasima Badsha, Prof. Fritz Hahne, and Prof. Daya Reddy. They were joined by Prof. Barry Green, Ms Deborah Wilsnagh and Ms Lynne Teixeira.

Council

The AIMS South Africa Council meeting took place on 22 February 2021. Members who attended the meeting online were: Prof. Daya Reddy (University of Cape Town) Chair; Prof. Barry Green (Director, AIMS, ex-officio member); Prof. David Holgate (University of the Western Cape); Prof. Thandi Mgwebi (Nelson Mandela University); Prof. Stéphane Ouvry (Université Paris Saclay); Prof. Balazs Szendroi (Oxford University); Prof. Neil Turok (Edinburgh University); Prof. Louise Warnich (Stellenbosch University); Prof. Grae Worster (Cambridge University). Others in attendance: Ms Lydie Hakizimana (AIMS-NEI CEO); Ms Deborah Wilsnagh (AIMS South Africa COO); and Ms Lynne Teixeira (Secretariat).

DR ROB ADAM

MS NASIMA BADSHA

PROF. FRITZ HAHNE

PROF. LOYISO NONGXA

PROF. DAVID HOLGATE

DR THANDI MGWEBI

PROF. STEPHANE OUVRY

PROF. DAYA REDDY

PROF. BALAZS SZENDROI

PROF. NEIL TUROK

PROF. LOUISE WARNICH

PROF. GRAE WORSTER

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 the period under review AIMS South Africa said farewell to Ms Noluvoyo Hobana, Language and Communications Teacher, Ms Karabo Makola who completed her Internship as the AIMS House of Science and Mr Fazley Jattiem, who joined AIMS South Africa as Facilities and Logistics Assistant in May 2010.

Ms Lynne Teixeira, Senior Administrator, Academic Programmes, graduated on 14 December 2020 with an MPhil in Monitoring and Evaluation from SU. Dr Tejumade Ogundipe, AIMSSEC IT Coordinator and Lecturer successfully completed her PhD in Information Systems at UCT.

Information Technology

During the reporting period the AIMS South Africa IT department supported remote teaching, video conferencing, the use of HPC facilities, and worked on upgrading AIMS Desktop to the release of Debian GNU/Linux 11.

Mr Kyle Robbertze moved on from AIMS IT at the end of 2020, after workshops and short-term visitors were cancelled during lockdown.

The two TVs (with a Linux desktop and camera and microphone attached) are being used extensively for remote teaching, online meetings, and examinations. Enough free premium zoom licenses from TENET are assigned to tutors which removes time limits, increases group size limits, and allows recording and other premium features. Google Meet is also used by researchers, though the free recording functionality will be discontinued in 2021. AIMS' internet connectivity remains the same while the national NREN has upgraded from 10G to 100G in 2021.

Computer lab desktops are systematically being replaced with new machines better able to meet the demands of the structured Master's students' coursework.

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

Communications Report

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

The AIMS South Africa YouTube channel continues to grow consistently, reaching a current number of 12,3k channel subscribers. Our reach on Twitter has had a boost during the pandemic, reaching 3.1K followers, which is an increase of 500 new followers. Our network on our Facebook page has also consistently increased by 300 users since last year, leaving us at 4700k page likes. Our youngest and least active platform, Instagram, currently reaches 524 followers.

The increase of subscribers is important, but what is more indicative of the relevance of our platforms is the "engagements" reached for each platform. For Facebook we reached an excellent engagement of 3.6k, for twitter 707 engagements and for instagram 154 engagements.

For the period August 2020 - July 2021 we've had 205,895 views on our YouTube channel, of which only 12,3% are from actual subscribers. The majority of our viewers fall into the age group 18-34 (41,0%), closely followed by the age group 25-34 (37,0%). This is consistent with the statistics from the previous year, varying only by decimals. In terms of location, most of our viewership reside in India (17,3%) and the United States (15,3%). This is in strong contrast to our Facebook and Instagram pages, which are reaching a widespread African population.

The gender discrepancy on YouTube is still high at 90,4% male to 9,7% female, whereas on our Facebook and Instagram pages the ration is closer to 1/3 female and 2/3 male.

Our free and fully accessible AIMS Courses on YouTube still receive a high amount of views and excellent feedback.

With the workspace changes of the COVID-19 pandemic, New Media at AIMS South Africa continues to be focused on AIMS and NEI Network content distribution.

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, as well as reaching more people on the African Continent.

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.

Facilities Report

The facilities team continued to implement COVID-19 regulations as and when required throughout the period under review. They have also assisted students by providing transport to and from vaccination sites.

A decision was made to bring all catering for the centre in-house. This has helped to reduce costs significantly.

FINANCIAL OVERVIEW

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.

FIGURE1: TOTAL INCOME PER MAIN COMPONENT

Other Income:
2021: 0%
2020: 1%

Profit on sale of investments
2021: 2%
2020: 1%

South African Government grants:
2021: 46%
2020: 57%

Private donations, grants and contract
2021: 51%
2020: 41%

Interest recieved
2021: 1%
2020: 1%
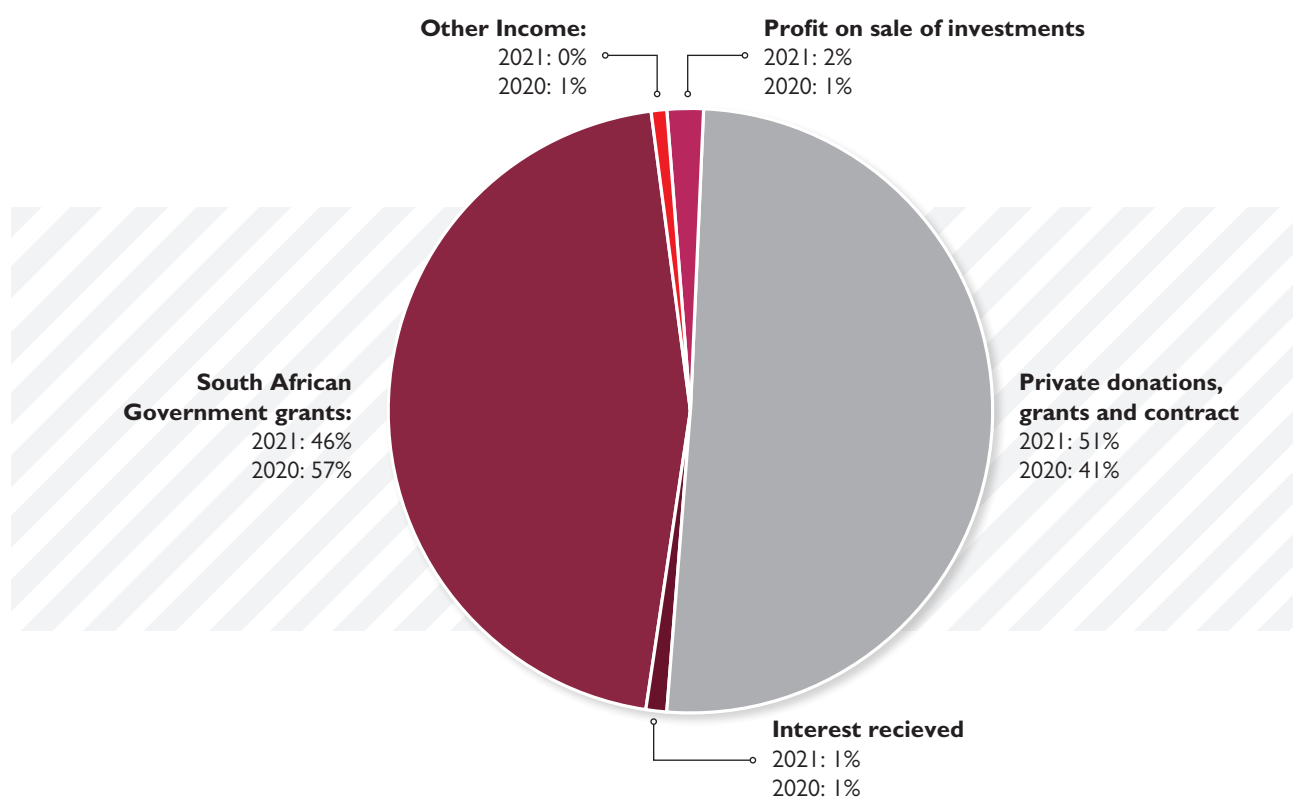
Figure 1: shows the comparison of AIMS South Africa's income per main component as well as the relative ratio to total income

Total income for 2021 decreased by 20% to R27,690 million compared to R34,481 million in 2020. The variance is due to national budgetary constraints for the National Skills Fund grant renewal and as a result of a lower grant approved by the Department of Science and Innovation.

South African Government grants for the 2021 and 2020 years are as follows:

Department	Programme	2021		2020	
Department of Higher Education and Training	Academic Programme	R	6 510 000	R	6 171 000
Department of Science and Innovation	Academic Programme, Research Programme and Post AIMS Bursaries	R	1 212 500	R	2 887 500
National Research Foundation	Research Programme	R	5 095 578	R	5 754 269
National Skills Fund (NSF)	Teacher Training Academic Programme, South African Taught Masters and Teacher Training bursaries	R	-	R	5 208 452
Total South African Government Grants		**R**	**12 818 078**	**R**	**20 021 221**

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 2021 and 2020 years are as follows:

Department	Programme		2021		2020
AIMS-NEI Bursary Funding (MasterCard Foundation)	Taught Masters Programme	R	3 909 037	R	4 155 097
The Alexander Von Humboldt Foundation	German Research Chairs	R	3 997 436	R	3 620 690
AIMS-NEI Research	Research Programme	R	329 183	R	507 932
DAAD	Bursaries/Scholarships	R	313 105	R	1 126 827
Other private donations	Taught Masters, ESMT, DSI and Teacher Training Programmes	R	5 722 116	R	4 893 788
Total Private donations, grants and contract income		**R**	**14 270 877**	**R**	**14 304 334**

Bursaries
2021: 6%
2020: 11%

Impairment expense
2021: 0%
2020: 12%

Personnel expenses
2021: 59%
2020: 45%

Other operating expenditure
2021: 33%
2020: 30%

Amortisation expense & Depreciation
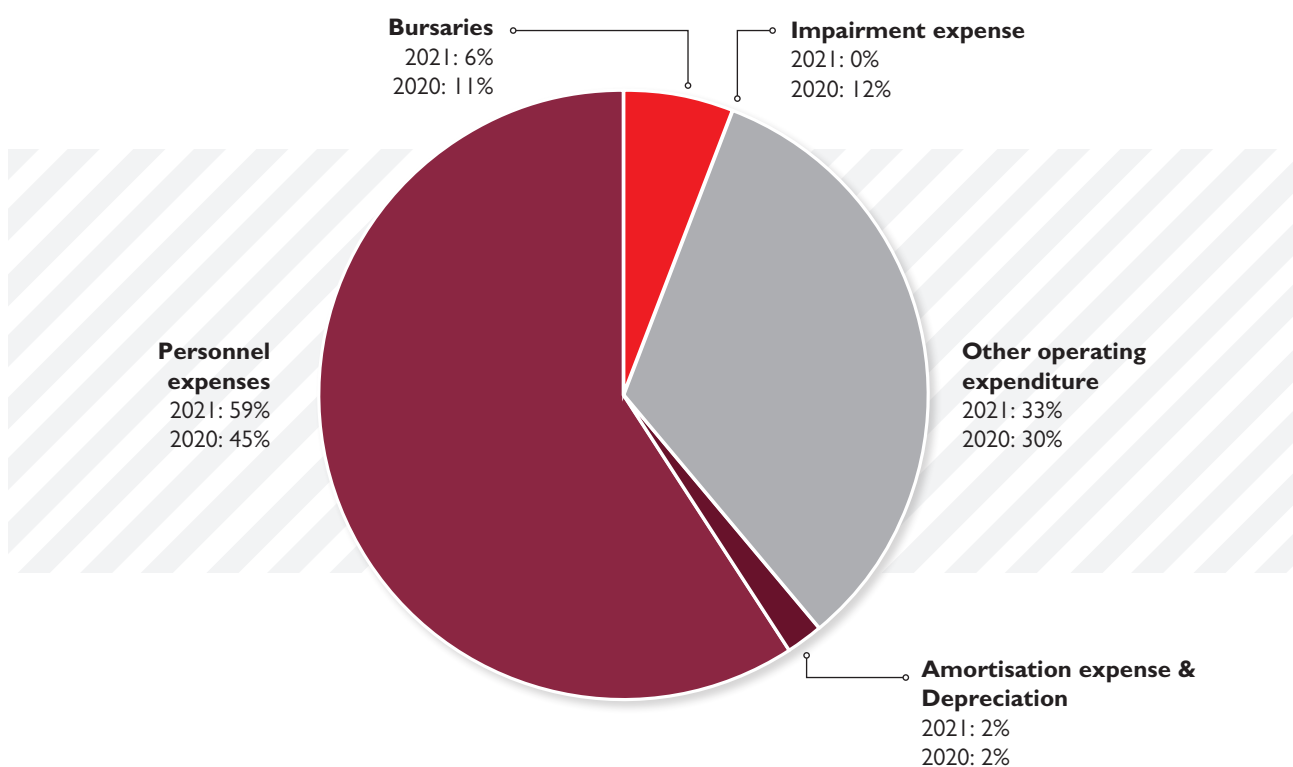2021: 2%
2020: 2%

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 2021 decreased by 27% from R43,637 million to R31,873 million and is largely due to the impact of COVID-19 on normal activities. The decision to move to an in-house caterer and forgo recommended staff salary increases also contributed to the saving.

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

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

Remuneration costs decreased by 4% despite the addition of the catering team to the staff complement and a moritorium placed on all new staff hires.

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

Events after the reporting period

As funding support from the NSF is integral to the operations of both the Taught Masters' and Teacher Training Programmes, based on the submisson of the renewal application, a due diligence visit has already been conducted and AIMS is awaiting the outcome after recent interaction with the NSF.

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

CONSOLIDATED STATEMENT OF FINANCIAL POSITION AT 30 JUNE 2021

	2021	2020
	R	R
ASSETS		
NON-CURRENT ASSETS	28 180 448	28 122 541
Property, plant and equipment	23 934 217	24 295 995
Intangible Assets	1	1 156
Financial Assets	4 246 230	3 825 390
CURRENT ASSETS	1 371 364	3 924 511
Cash and cash equivalents	172 941	1 879 763
Trade and other receivables	1 174 495	208 032
Inventory	23 928	-
Stellenbosch University receivable	-	1 836 716
TOTAL ASSETS	**29 551 812**	**32 047 052**
FUNDS AND LIABILITIES		
FUNDS AND RESERVES	22 074 259	27 789 230
Accumulated funds	17 633 622	21 797 471
Restricted reserve: endowment fund	2 119 601	1 997 306
Restricted reserve: other	171 649	143 611
Fair value reserve	2 149 387	1 850 842
CURRENT LIABILITIES	7 477 553	6 257 822
Stellenbosch University Payable	2 841 430	-
Trade and other payables	4 636 123	6 257 822
TOTAL FUNDS AND LIABILITIES	**29 551 812**	**32 047 052**

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES - SOUTH AFRICA

CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2021

	2021	2020
	R	R
Government grants	12 818 078	20 021 221
Donations Income	14 270 877	14 304 334
Other income	601 496	155 373
Gross Income	**27 690 451**	**34 480 928**
Operating expenses	(31 873 188)	(43 636 663)
Operating deficit	**(4 182 737)**	**(9 155 735)**
Finance income	169 221	277 945
Deficit for the year	**(4 013 516)**	**(8 877 790)**
Other comprehensive income:		
Item that may be subsequently reclassified to profit or loss		
Change in value of available-for-sale financial assets	298 545	(616 696)
Total comprehensive deficit for the year	**(3 714 971)**	**(9 494 486)**
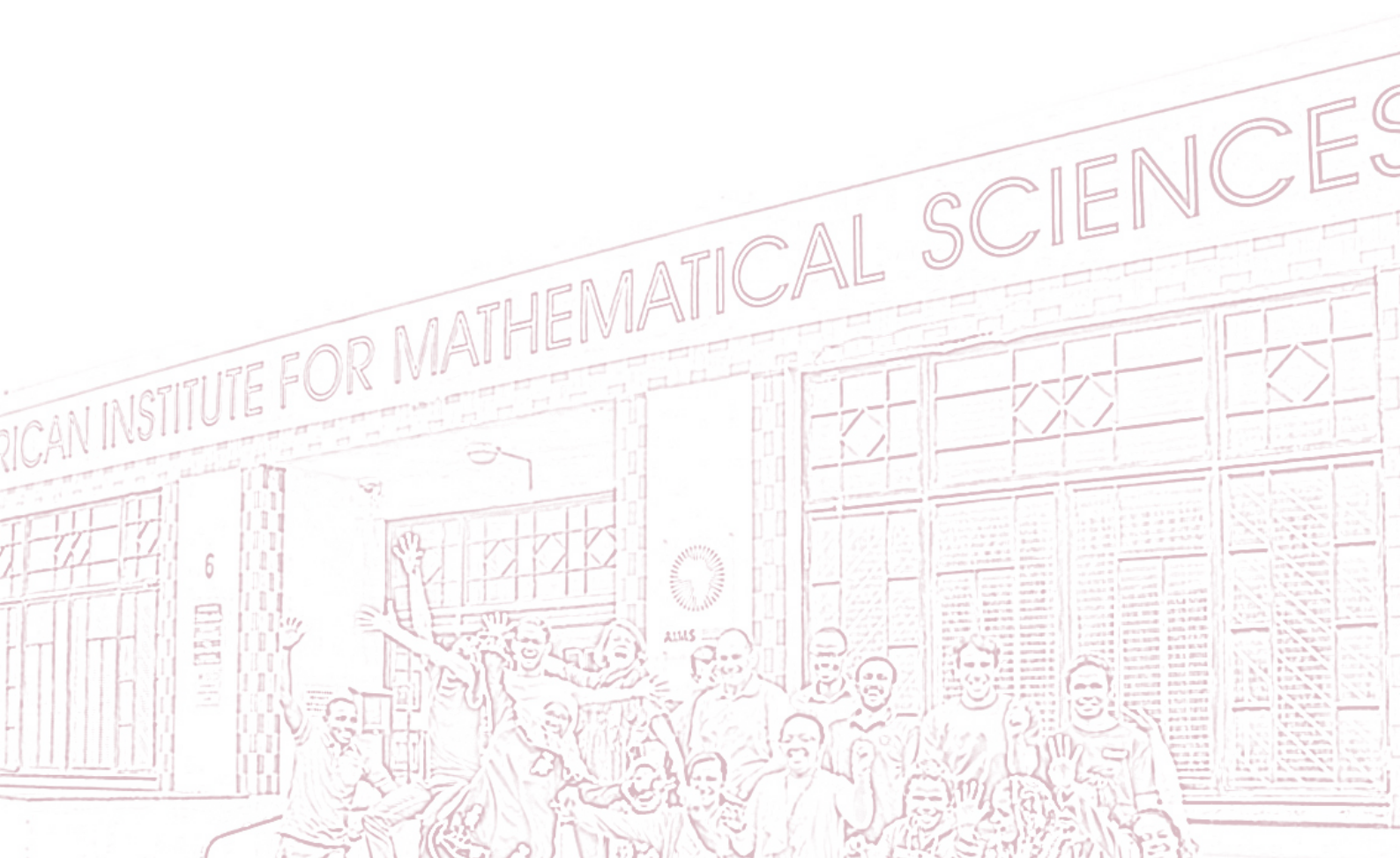
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