AfAS

African Astronomical Society

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AfAS Conference Newsletter

Editors' Note: This newsletter issue features in-depth scientific content which highlights some of the incredible scientific research and technological advancements showcased during the conference.

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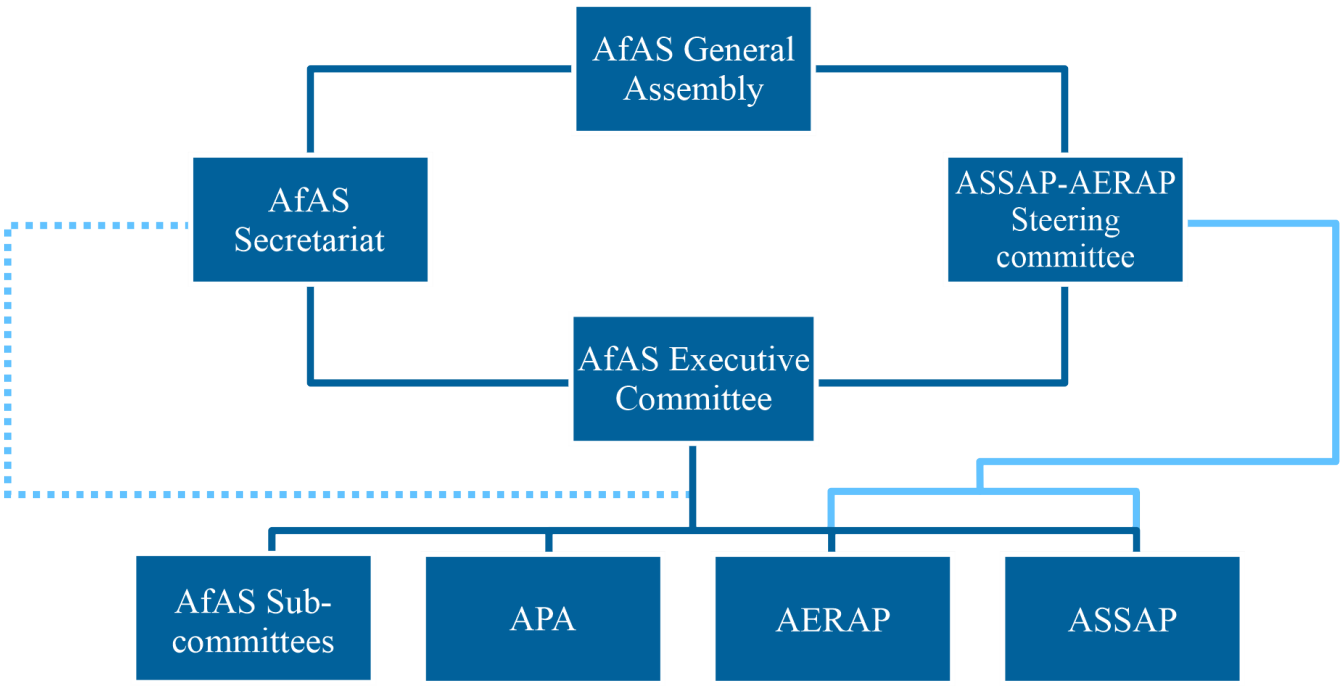
About AfAS

The African Astronomical Society (AfAS) is a Pan-African Professional Society of Astronomers, registered in South Africa, as a non-profit, voluntary society. Our vision is to create and support a globally competitive and collaborative astronomy community in Africa. Our mission is to be the voice of astronomy in Africa and to contribute to addressing the challenges faced by Africa through the promotion and advancement of astronomy. Our key objective is to develop Astronomy and Human Capacity throughout the continent of Africa through a vibrant and active AfAS. South Africa currently hosts the Secretariat of AfAS through the Department of Science, Technology and Innovation (DSTI), and our office is located at the South African Astronomical Observatory (SAAO) in Cape Town.



Our Brief History

At the 2010 launch of the African Physical Society in Dakar, astronomers from across the continent and the African diaspora resolved to form the African Astronomical Society (AfAS). Following this meeting, a whitepaper on the formation and structure of the AfAS was drafted and disseminated. An Interim Working Group was formed to conduct the formation of the AfAS at the International Astronomical Union (IAU) Symposium in Ouagadougou. The initial Constitution of the AfAS was agreed to and signed by the members of the Interim Working Group at Ouagadougou, Burkina Faso, on 16 December 2010. The interim Working Group consisted of members from Algeria, Burkina Faso, Cameroon, Ethiopia, Gabon, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa, Uganda, and the U.S.A. AfAS was officially launched at the 2nd Middle East and Africa Regional IAU Meeting in Cape Town, South Africa, in April 2011. However, AfAS had not been an active organization since its inception in 2017, and at the 4th Middle East and Africa Meeting in Ethiopia, it was decided to bring together stakeholders and relaunch AfAS. In March 2019, the Astronomy in Africa meeting was held for this purpose at the SAAO in Cape Town, South Africa. At that meeting, a revised Constitution was approved and accepted by the delegates. The AfAS Secretariat was incubated by the DSI from April 2019 to March 2020 and has been fully operational since April 2020.

Message From The President

Over 600 participants registered for the 6th Annual Conference of the African Astronomical Society, held in Kasane, Botswana - the most attended in the Society's history. More than 200 delegates attended in person, with around 30 joining sessions virtually, and over 300 people present at the opening ceremony alone. This strong in-person, virtual, and public participation across the week reflected the growing strength, visibility, and ambition of African astronomy.

The conference was further distinguished by the exceptional support of our hosts in Botswana. The opening ceremony featured senior government leaders and representatives of the Botswana International University of Science and Technology (BIUST), including the Assistant Minister of Communications and Innovation and the Acting Vice-Chancellor of BIUST. Their presence underscored the importance that Botswana attaches to science, innovation, higher education, and continental collaboration, and set a strong tone for the week.

AfAS2026 was far more than the main scientific conference. It was enriched by several pre-conference and side events - including the Data Science Hackathon, the inaugural Science Communication Workshop, the BLUEshift Africa and AstroLab workshops, the African Planetarium Association's mobile planetarium activities, and the Second African Lunar Symposium - collectively drawing hundreds of additional participants across the week. Together, these events

reflected AfAS's broadening scope, deepening participation, strengthening skills development, and creating additional spaces for collaboration, learning, and community-building.

Some significant outcomes emerged from the conference discussions. First, following strong community feedback and overwhelming interest, there was clear support for publishing conference proceedings. Second, important momentum towards establishing an AfAS-owned journal, reflecting a shared vision to strengthen African-led scholarly publishing and create lasting platforms for the dissemination of our science. The conference's dedicated session on the African Science Journal made clear that an AfAS-owned publication is the preferred direction, even as further work continues on identifying publishing and funding models.

The conference also provided an important platform for recognising excellence across our community. Seed grants were awarded to Tilahun Getachew (Ethiopia), Katlego Morakile (South Africa), and Said Hmiddouch (Morocco). Student prizes were awarded at Masters level to Kira Yasmin Hanmer (South Africa) and Redait Yetayew (Ethiopia), and at PhD level to Shimeles Mengistue (Ethiopia), Shavani Naicker (South Africa), Abdallah Ali (Egypt), and Godson Abbey (Nigeria). The AfNWA Mid-Career Award was presented to Dr. Zara Randriamanakoto (South Africa), and the Early-Career Award to Dr. Mona Molham (Egypt). These awards are a reminder of the remarkable talent across our continent, and of AfAS's commitment to nurturing it.

Beyond the conference halls, AfAS2026 introduced astronomy to the local community. Fifty volunteers visited primary and high schools across the Chobe District on three separate days, reaching approximately 120 learners per day through sessions covering astronomy, career guidance, and hands-on robotics workshops led by the South African Radio Astronomy Observatory (NRF|SARAO), alongside mobile planetarium shows by the African Planetarium Association. A dedicated teacher training workshop attracted 30 teachers in the days before the conference, extending the reach of our outreach well beyond the event itself.

The Business Meeting also marked meaningful governance progress. The Constitution Review Working Group presented proposed revisions to the AfAS constitution, ethics document, and by-laws. The Membership Committee reported on the introduction of membership fees for full members from 1 April 2026 - a significant step towards the Society's long-term financial sustainability. Benefits will accrue exclusively to paid-up members, with fees for other membership categories following soon.

Across the week, the conference showcased excellent science, outreach, education, and science communication, while deepening the sense of common purpose across our continent. Special thanks are owed to BIUST and the Local Organising Committee for the exceptional hospitality and partnership that made Kasane such a fitting host city. I also extend my sincere gratitude to the Scientific Organising Committee, our valued partners - including the South African Department of Science, Technology and Innovation, the Botswana Department of Communications and Innovation, Square Kilometre Array Observatory, South African Radio Astronomy Observatory, South African Astronomical Observatory, Inter-university Institute for Data Intensive Astronomy, and IAU-Office of Astronomy for Development - as well as our sponsors, volunteers, and all participants who contributed to making AfAS2026 a resounding success.

We look forward with great anticipation to AfAS2027, which will be hosted by Rhodes University in Makhanda, South Africa - a return to the country that has been home to AfAS since its relaunch, and a venue with a proud tradition of academic excellence and scientific inquiry. May the momentum from Kasane carry forward into deeper collaborations, bolder discoveries, and a stronger future for astronomy in Africa.

Prof. Amare Abebe
President, African Astronomical Society (AfAS)

Update from the Executive Officer

Dear AfAS community,

I am pleased to share this update in my capacity as Executive Officer of AfAS.

Since taking up this role in February, I have been focusing on supporting the continuity of the Society's activities and strengthening coordination within the Secretariat. This includes working closely with the Executive Committee, supporting ongoing initiatives, enhancing internal communication, and engaging with partners to ensure the smooth and effective functioning of AfAS operations.

The recent AfAS Conference in Botswana was an important and inspiring moment for our community. Beyond the rich scientific discussions, what stood out most was the strong sense of connection shared among participants from across the continent and beyond. Bringing together people from different countries, backgrounds, and experiences, the conference truly reflected the spirit of AfAS, one built on collaboration, openness, and mutual support. It was especially encouraging to see the active participation of young researchers and the many initiatives contributing to a more inclusive and supportive scientific environment. Being part of this gathering was both energising and meaningful, and a reminder of the strength of our community when we come together.

In addition, the Secretariat is actively working on strengthening internal processes and improving communication channels to support our members and activities across the continent. A key priority moving forward is to enhance the visibility of AfAS initiatives and ensure more consistent and effective communication with our community.

We are also placing emphasis on strengthening our relationships with partners and stakeholders, recognizing their essential role in supporting the growth and impact of the Society. Building and maintaining these collaborations is central in advancing AfAS's mission across Africa and beyond. Another important area of development is the ongoing work on the AfAS membership fee structure. Efforts are underway to further refine and expand the membership framework, with the aim of making it more inclusive, accessible, and representative of the diverse astronomy community across the continent.
In parallel, we have launched the new AfAS website, which provides an improved platform for communication, visibility, and engagement. This is an important step in strengthening our connection with members and sharing opportunities, resources, and activities effectively.

Looking ahead, the Secretariat will continue to focus on supporting the Society's strategic priorities, enhancing coordination across its structures, and encouraging stronger engagement within the community.

I look forward to working with all of you in advancing the mission of AfAS and contributing to the continued growth of astronomy across Africa.

Kind regards,
Dr Meryem Guennoun
Executive Officer of the African Astronomical Society (AfAS)

The AfAS Conference 2026 Hackathon

Narusha Isaacs
IDIA

The AfAS Conference 2026 Hackathon, held in Kasane, Botswana, from 20 - 22 March 2026, brought together 28 students from diverse African countries and academic backgrounds to tackle a photometric redshift challenge. Hosted by the African Astronomical Society (AfAS) in collaboration with the Inter-University Institute for Data-Intensive Astronomy (IDIA), the Development in Africa with Radio Astronomy (DARA) programme, and the IAU Office of Astronomy for Development (OAD). The event served as a precursor to the AfAS Annual Conference (22–27 March 2026) and marked the fourth annual AfAS Hackathon.

The challenge focused on developing machine learning models to estimate distances to galaxies and quasars using multi-band photometric data. Open to participants with basic to intermediate Python skills and an interest in astronomy or data science, it emphasised collaboration, innovation, and hands-on experience in building and applying machine learning models. Participants worked on the ilifu cloud server, generously provided by IDIA, which enabled access to essential computational resources and data. IDIA also contributed staff for technical support and facilitation, including Theophilus Matsepane and Narusha Isaacs-Klein, ensuring a smooth experience.

The organising team, Nikhita Ramkilowan (DARA), Charles Takalana (IAU-OAD), Narusha Isaacs-Klein (IDIA/BRICS Astronomy), Nombali Qodi (AfAS), Zodwa Tiki, and Thembela Mantungwa (NRF|SAAO/AfAS), prepared and guided the event. Facilitators Ginés Martínez Solaeche (IAA-CSIC), Narusha Isaacs-Klein, Joyful Mdhluli (IAU-OAD), Nikhita Ramkilowan, and Thobekile Ngwane (NRF|SAAO) worked to support participants during the event. The hackathon involved training and validating models on a provided dataset, followed by predictions on a blind test set with standard objects and challenging out-of-distribution cases.

Through this event, participants gained hands-on experience with realistic research problems in modern astrophysics, learning to handle imperfect and heterogeneous observational conditions. Teams explored various machine learning approaches, with many finding artificial neural networks more effective than random forests. The winning team implemented advanced boosting methods, such as XGBoost and LightGBM, to take first place. A key takeaway was the importance of model robustness for test objects differing from training data.

The hackathon offered practical exposure to photometric redshift estimation, galaxies and quasars, photometric data exploration, and machine learning model training. It encouraged original ideas and collaboration, with diverse participants sharing knowledge and expertise. Judges Miora Rakototafika, Zolile Mguda, Narusha Isaacs-Klein and Nikhita Ramkilowan praised the creativity on display.

The AfAS 2026 Hackathon was a resounding success, fostering skills development and creating meaningful connections among the next generation of African astronomers and data scientists across the continent.

When the Stars Aligned in Kasane

How five students from across Africa built a Universe-measuring machine and what they learned along the way

Walter Maketso, Seipone Sebina, Magnus Makgasane, Rubinah Solomon, Joy Ugonma Olayiwolz

There is a town in northern Botswana where the Chobe River meets the Kasane forest, where elephants wander at dusk and the night sky is extraordinary. It was here, at the edge of one of Africa's most untouched wilderness areas, that five students sat hunched over their laptops, trying to measure the distance to galaxies billions of light-years away.

That is not a metaphor. That was our weekend. We are BKN Machine, a team of five from Botswana, Kenya, and Nigeria brought together by the 2026 African Astronomical Society (AfAS) Hackathon, held in Kasane from 20th to 22nd March. None of us had worked together before. Two data analytics students, one physicist, one computer systems engineer, and one PhD candidate in computer science. What we shared was curiosity and the willingness to try something hard.

The challenge was this: when astronomers want to know how far away a galaxy is, the most reliable method of spectroscopy is expensive and slow. With modern surveys now cataloguing millions of celestial objects, we simply cannot afford to measure each one the old way. Our task was to train a machine learning model to estimate these distances, called redshifts, from photographic observations alone, fast, at scale, and accurately enough to be scientifically useful.
Why does this matter for Africa? Because the

continent is home to some of the world's most ambitious astronomy infrastructure, including MeerKAT in South Africa and the forthcoming Square Kilometre Array. Africa is not just a participant in the global astronomy conversation: it is becoming central to it. Building the local human capacity to analyse this data is not optional. It is necessary and urgent.

Our solution, BKN Machines, treated galaxies and quasars as two separate problems rather than forcing one model to solve both. We engineered 258 features from the raw photometric data, then trained specialist models for each object type using gradient boosted decision trees, specifically LightGBM and XGBoost. Crucially, we anticipated messy real-world data by simulating it during training: randomly removing up to all 54 photometric bands and applying extreme distortions to the data. This made our models resilient, where others broke down. Our final loss score was 0.019, well below the 0.35 threshold that unlocked bonus training data from the organisers.

But the number is only part of the story.

The real education happened in the room. We learned an enormous amount from Dr Ginés Martínez Solaeche, whose clarity in explaining both the astrophysics and the modelling process helped us understand not just what to build, but why. Watching how he approached a problem methodically, without ego, was a lesson that extended well beyond this competition.

We also made friends. Genuinely. The other teams brought different ideas, different tools, different instincts, and watching those approaches unfold in real time was one of the most valuable parts of the experience. One colleague's model, suddenly producing strong results in the middle of the night, changed the energy in the room entirely; it reminded everyone that the goal was shared.

There were difficulties, too. Slow internet. Late nights. Code that refused to cooperate. But those moments revealed something about what a team actually is: not a group that avoids failure, but one that moves through it together.

"From different countries, different disciplines, different everything, but when the model finally worked, we all felt it the same way." BKN Machine

Our advice to future participants is simple: understand the problem before you touch the data, build for robustness not just accuracy, and do not underestimate what you can learn from the people in the room with you.

Kasane gave us a spectacular backdrop, a rigorous challenge, and something rarer: a network of people across Africa who care about science and are willing to stay up until 3 am proving it.
The stars were always there. We just learned, together, how to reach them.

BLUEshift Africa Workshop at AfAS 2026: Advancing Undergraduate Astronomy Teaching

Tabitha Alango

Linda Strubbe

The second edition of the BLUEshift Africa Workshop was held on 21–22 March 2026 at the African Astronomical Society (AfAS) 2026 Conference, hosted by the Botswana International University of Science and Technology in Kasane, Botswana. The workshop brought together 29 early-career astronomers and educators from 13 African countries for two intensive days focusing on undergraduate astronomy teaching.

BLUEshift Africa, which stands for Building Learning in Undergraduate Education in Astronomy, is led by Dr. Linda Strubbe of Strubbe Educational Consulting, with support from Dr. Tom Rice, director of education programs at the American Astronomical Society (AAS). The project is funded through an American Institute of Physics Venture Grant, through AAS and in partnership with AfAS. It aims to equip early-career educators with research-informed teaching strategies, build a continent-wide community around university-level astronomy education, and support more interactive and inclusive classrooms across Africa. This second edition was co-facilitated by Linda Strubbe and Tabitha Alango, a PhD student at the University of South Africa and an alum of BLUEshift 2025.

Day one opened with participants sharing their motivations and teaching experiences, before diving into the core framework: the How Learning Works principles, which include prior knowledge, active engagement, social interaction, feedback and reflection, inclusive classrooms, and scaffolding. The afternoon explored teaching inclusively and examined real-world case studies drawn from participants' own classroom experiences.

Day two shifted towards practical application. Participants learned strategies for facilitating Think-Pair-Share activities and small-group work, then collaborated in teams to design their own active learning teaching activities, afterwards presenting their designs in a "gallery walk." This exercise enabled participants to align learning objectives, teaching strategies, and assessment methods, with a focus on applicability across diverse institutional settings in Africa. The workshop closed with structured reflections on personal teaching journeys and a commitment to concrete next steps.

Beyond the in-person workshop weekend, participants will continue engagement through BLUEshift Africa's online Communities of Teaching later in the year, aimed at sustaining collaboration, reflection, and ongoing professional development. These efforts contribute to building a stronger, more connected community of astronomy educators and advancing the quality and inclusivity of university-level astronomy education across Africa.

Science engagement activities at the AfAS 2026 conference

Duduzile Kubheka(SAAO/BRICS Astronomy)

Onkabetse Sengate (BIUST)

The African Astronomical Society is no doubt growing each year, and the 2026 meeting was a testament to that. But even more promising is the community's consciousness and dedication to not just advancing the science of astronomy, but also in ensuring stronger human capital development and public engagement initiatives. Thanks to a community of dedicated and selfless astronomers, this year's engagements in Botswana had a reach across various target groups. Teams came together to run a range of activities, including school visits, teacher training programmes, science communication training, hackathons, and more.

These engagements are especially important in Africa as we continue to grow astronomy across the continent. They ensure the sharing of knowledge, the training and development of people, and the opening up of opportunities to those who might otherwise not have access. It is important for people to actively engage with science and interact with astronomers, helping to make astronomy more accessible, particularly in remote communities where access to knowledge is limited.

Ensuring that these engagements take place alongside conferences is a significant step in the right direction, helping us ensure that our meetings are not only about science, but also about people.

Following a call to the community for volunteers, we received over 50 sign-ups from individuals expressing interest in participating in these engagement initiatives. Some of the organisations represented include the South African Radio Astronomy Observatory, the Square Kilometre Array Observatory, the South African Astronomical Observatory, the National Space Research and Development Agency, the Pan African Citizen Science e-Laboratory, Iziko Museums of South Africa, the Instituto de Astrofísica de Andalucía, the Space Science and Geospatial Institute, the University of Namibia, and the Centre for Basic Space Science and Astronomy (National Space Research and Development Agency), Nsukka, among others.

Through these collective efforts, we reached over 500 learners and 30 teachers in 11 schools across the Chobe District.

For the school visits, sessions focused on career guidance and role modelling, alongside key astronomy topics, including:

- The Solar System: the Sun (as a star), the eight planets, moons, asteroids, and comets
- Earth-Moon-Sun System: rotation (day/night), revolution (orbits), and Earth's tilt
- Patterns in the Sky: phases of the Moon, solar and lunar eclipses, and seasons
- Beyond our Solar System: stars, constellations, galaxies (including the Milky Way), and gravity

- Space Exploration: history of telescopes, satellites, and human space travel
- Quiz/games and tabletop telescope demonstrations, with additional topics including exoplanets, our place in the universe, and the electromagnetic spectrum

In addition to the outreach visits, teacher training sessions were conducted over two days. Day 1 focused on coding and robotics training organised by NRF|SARAO, while Day 2 featured a broader range of presenters and topics. These included Introduction to Astronomy, Astronomical Projects in Botswana, Indigenous storytelling and teaching on stars, effective ways of teaching astronomy, the electromagnetic spectrum, careers in astronomy, and a variety of interactive and hands-on activities.

Science Communication Training

Run by BRICS Astronomy and AfAS, in collaboration with NRF|SAAO, this programme is designed to equip researchers, students, professionals, and science communicators in astronomy and other basic sciences across BRICS and African countries with essential science communication skills. The initiative aims to strengthen participants' ability to effectively convey scientific knowledge, engage the public and policy-makers, and inspire greater interest in astronomy and the sciences more broadly.

The workshop featured expert presenters with academic and practical experience. It also sought to bridge the gap between academia and practice, addressing the current divide in science communication. The outcomes of the programme are to:

- Equip researchers with practical skills in science communication and public engagement
- Foster collaboration between BRICS and the African astronomy community under a shared vision of inclusion and engagement
- Strengthen science communication capacity across the Global South through coordinated training and mentoring
- Encourage participants to develop outreach initiatives and serve as ambassadors for astronomy within their communities

The session focused on the importance of science communication and covered key topics, including an overview of science engagement and its impact, science communication and media engagement, and engaging policymakers and understanding policy-making processes. The session was conducted in a hybrid format, with participants and presenters joining from across the globe.

This programme will now move into more advanced stages, developing structured modules for more targeted engagement and clearer segmentation of audiences. This next phase will involve collaboration with additional partners across Africa, BRICS, and the broader Global South, including regionally tailored training sessions delivered in partnership with local organisations. These efforts aim to support the continued growth and development of the field, while establishing stronger communities of practice and networks.

To everyone who contributed to the success of these engagements: thank you for your support and selfless service. We recognise that this requires sacrificing valuable conference time. Thank you for your patience, especially when things seemed uncertain, and for your flexibility as you adapted to the different conditions we encountered. May we continue to work together to advance astronomy in the continent, and at all times remembering to put people first.

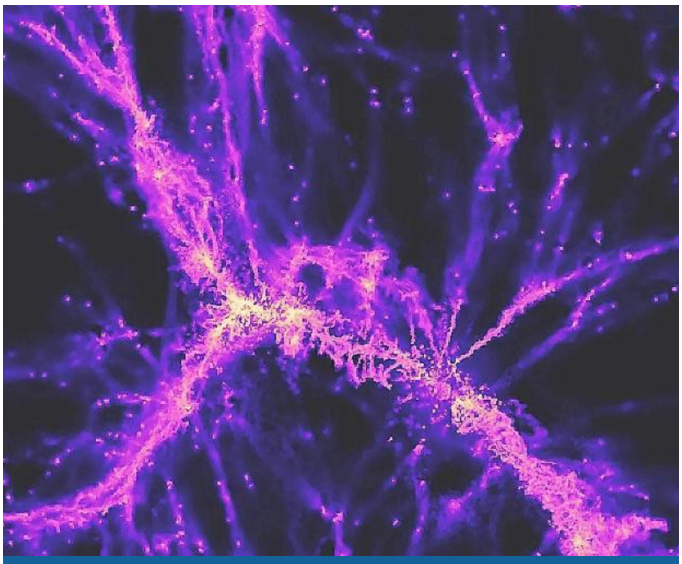
Exploring the Dark Universe: Insights from AfAS 2026

Hichem Guergouri
Research Unit in Scientific Culture and Medication (CERIST)/AfAS

Understanding the nature of the dark Universe, comprising dark matter and dark energy, remains one of the central challenges in modern cosmology. Contributions presented during the AfAS2026 conference highlighted how a combination of observational and theoretical approaches is pushing beyond the standard ΛCDM model.

Where are the Universe's missing baryons?

One of the long-standing problems in cosmology is the "missing baryons" problem: while models predict the total amount of ordinary matter in the Universe, only a small fraction is observed in stars and galaxies. Addressing this issue, Prof. Yin-Zhe Ma (Stellenbosch University) presented observational evidence that these baryons are not missing, but reside in diffuse, warm–hot gas within the cosmic web. By combining probes such as Sunyaev–Zeldovich effects, gravitational lensing, and cosmic void analyses, his work reveals a coherent picture in which baryons trace large-scale structure. These results suggest the problem lies more in detection than absence, although fully accounting for all baryons remains an open challenge.



The cosmic web: a vast network of filaments connecting galaxies and clusters, where much of the Universe's ordinary matter resides.

What is the nature of the dark Universe?

Despite its success in explaining the formation of galaxies and large-scale structure, the true nature of the dark Universe, comprising dark matter and dark energy, remains unknown. While the standard cosmological model assumes cold, weakly interacting dark matter and a constant dark energy component, recent observations are beginning to test these assumptions at both small and large scales.

On the dark matter side, Prof. John McKean (University of Pretoria, South Africa) used extremely high-resolution gravitational lensing to probe structure at sub-galactic scales. By analyzing flux-ratio anomalies with Very Long Baseline Interferometry (VLBI) and ALMA, his work is sensitive to low-mass haloes that are otherwise undetectable. Notably, the observations reveal a ~10^6 solar mass dark object difficult to reconcile with standard cold or warm dark matter models, potentially pointing to more complex scenarios such as self-interacting dark matter.

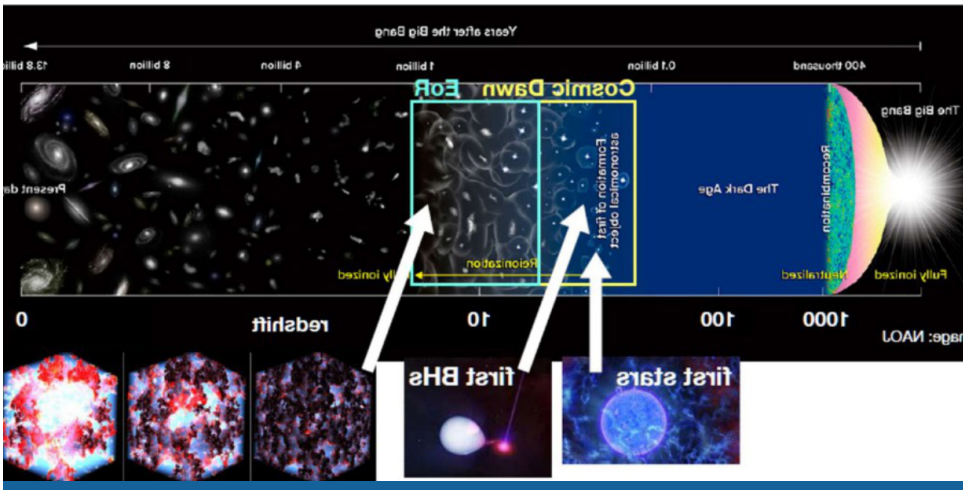
At larger scales, the nature of dark energy remains equally uncertain. Marcel van der Westhuizen (North-West University) explored inter-

acting dark energy models, where dark matter and dark energy exchange energy over cosmic time. Using recent datasets such as DESI DR2 and Pantheon+, his results suggest a small but non-zero interaction, with a possible change in the direction of energy transfer over cosmic history, hinting at a dynamical form of dark energy. However, such models may introduce instabilities or unphysical energy densities.

Distinguishing between these models remains challenging. Enas Mohamed (Botswana International University of Science and Technology) showed that at low redshift ($z \leq 1$), cosmic variance makes different models nearly indistinguishable. However, relativistic effects may provide observable signatures at very low redshift ($z \leq 0.5$), while at higher redshift ($z \geq 3$), lensing alone approximates the full signal.

Conceptual diagram of gravitational lensing and magnification

How did the first structures form?



From the Dark Ages to reionization, when the first stars and galaxies transformed the Universe. 21 cm observations trace this transition and its timing.

Looking back to the early Universe, one of the key questions is how and when the first stars and galaxies formed, and how they transformed the intergalactic medium.

Gianni Bernardi (INAF-IRA & Rhodes University) presented new constraints on the epoch of reionization using the redshifted 21 cm line. His results indicate that the intergalactic medium was heated above the adiabatic limit before $z \sim 8$, suggesting early heating sources such as X-ray binaries. In addition, 21 cm absorption studies of high-redshift quasars place strong limits on cold neutral hydrogen at the end of reionization, effectively ruling out large pockets of unheated gas. These findings constrain the timing and physical processes of this key phase in cosmic history.

How do plasma processes influence the Universe?

While cosmology often focuses on large scales, understanding the Universe also requires insight into processes in extreme environments. Lukiya Nazziwa (Mbarara University of Science and Technology) investigated nonlinear ion-acoustic solitons in magnetized electron–positron–ion plasmas, relevant to pulsar magnetospheres. Using a Korteweg–de Vries framework, her work shows how soliton properties, such as amplitude and width, depend on plasma conditions, including particle distributions, temperature ratios, and magnetic field orientation. These results provide insight into wave propagation in space plasmas and may help explain features such as pulsar radio emission.

Looking Ahead: Cosmology in Africa and Beyond

The contributions presented at AfAS 2026 highlight how cosmology on the African continent is increasingly aligned with, and contributing to, global scientific efforts. From high-resolution gravitational lensing to 21 cm observations and large-scale surveys, researchers based in Africa are actively participating in addressing some of the most fundamental questions about the Universe. The growing involvement in major international collaborations, alongside the development of local expertise, reflects a strong and evolving research landscape.

At the same time, the field is entering a new era driven by emerging technologies. Facilities such as the upcoming instruments like the Square Kilometre Array (SKA), along with next-generation surveys (DESI, LSST), are expected to significantly improve observational precision and open new windows on the dark Universe. As these tools come online, future conference cycles will likely focus on resolving current tensions in cosmology and testing new theoretical models, bringing us closer to understanding the nature of dark matter, dark energy, and the evolution of the Universe.

Cosmology in Focus: From the African Continent to the Cosmic Frontier

Simthembile Dlamini
University of Cape Town

Conference Highlights

The 6th AfAS Conference took place from 22–27 March 2026 at Wild View Resorts in Kasane, Botswana, hosted in partnership with the Botswana International University of Science and Technology (BIUST). The setting alone was worth the trip - Kasane sits at the meeting point of four countries and right next to Chobe National Park - but it was the science that really stood out this year. The cosmology programme, in particular, had a strong showing, and I want to highlight a few talks that I think capture where African cosmology is heading.

Kavilan Moodley (University of KwaZulu-Natal) gave an invited plenary on dark energy with HIRAX, the Hydrogen Intensity Mapping and Real-time Analysis eXperiment. HIRAX is a 21 cm intensity mapping experiment that will operate at 400–800 MHz and target dark energy evolution over z = 0.8–2.5 using baryon acoustic oscillations as a standard ruler. The instrument will consist of 1024 six-metre dishes in a compact configuration, sited in the radio-quiet Karoo reserve. What made the talk particularly interesting was the breadth of the science case: beyond dark energy. Moodley discussed how HIRAX will enable cross-correlations with other southern sky surveys, detect large numbers of pulsars and transients, including fast radio bursts (FRBs) and how outriggers in African partner countries will be used to localise those FRBs. It is a genuinely multi-purpose instrument, and the fact that it is being built on the continent matters.

Trends and Recent Developments

If you work in cosmology right now, you know the field is unsettled, and that is what makes it exciting.

The Hubble tension remains the biggest open problem. The early-universe measurement from Planck gives $H0 \approx 67$ km s^{-1} Mpc^{-1}, while the local distance-ladder measurement from SH0ES gives $H0 \approx 73$ km s^{-1} Mpc^{-1}. The discrepancy has now reached roughly 5σ, meaning the probability that this is a statistical fluke is less than one in three million. A lot of people expected the James Webb Space Telescope to resolve this by finding systematic errors in the Cepheid calibrations, but so far JWST has reinforced the local measurement rather than bringing it down. Nobody has a clean solution yet.

On the dark energy front, the DESI collaboration released its second data release (DR2) in 2025, and the results have put real pressure on the cosmological constant. The BAO measurements hint that dark energy may be evolving with time; phantom-like ($w < -1$) at high redshift and quintessence-like ($w > -1$) at low redshift. If this holds up with more data, it would be a fundamental shift from the standard ΛCDM picture. It is worth being cautious here; there are internal tensions between different supernova datasets that complicate the interpretation, but the direction is clear: ΛCDM is under more scrutiny than it has been in two decades.

On the probes side, FRBs are starting to make a real case for themselves as cosmological tools. Their dispersion measures trace the integrated

electron density along the line of sight, which makes them sensitive to the baryon content of the intergalactic medium, the Hubble parameter, and even primordial non-Gaussianity from inflation. In my own recent work (Dlamini 2026, arXiv:2604.04897), I showed that by cross-correlating FRB dispersion measures with Shapiro timing delays along multiple interferometric baselines, you can break the degeneracy between the IGM electron bias be and the primordial non-Gaussianity parameter fNL. This self-calibration approach recovers σ(fNL) to within a few percent of the idealised fixed-bias case. The absolute constraints are not yet competitive with galaxy surveys- that require larger FRB samples and tomographic techniques but the methodology is new, and the path to improvement is concrete. This builds on earlier multi-tracer work with galaxy surveys and 21 cm intensity mapping (Jolicoeur, Maartens & Dlamini 2023, Eur. Phys. J. C 83, 320).

Africa and the International Landscape

The narrative that African astronomy is "catching up" to the rest of the world does not really hold anymore, at least not in radio cosmology.

MeerKAT is the clearest example. In 2025, the MeerKAT Galaxy Cluster Legacy Survey mapped 115 galaxy clusters and identified over 60 diffuse radio structures that were completely invisible to previous telescopes; faint emission stretching millions of light-years across the intracluster medium. These observations showed that turbulence and magnetic fields in galaxy clusters were established much earlier than models predicted, pushing the timeline back more than seven billion years. MeerKAT also detected the most distant hydroxyl megamaser on record, in a merging galaxy over eight billion light-years away. This is world-leading science by any measure.

HERA, located alongside MeerKAT in the Northern Cape, is targeting the Epoch of Reionization through the redshifted 21 cm hydrogen signal. A detection would be transformative; it would give us direct observational access to the period when the first luminous sources ionized the intergalactic medium. The challenge, as Bernardi discussed at the conference, is separating that signal from foregrounds that are thousands of times brighter. But the sensitivity is improving with every observing season.

Internationally, the ESA Euclid mission is now accumulating data for an independent map of large-scale structure, with primary cosmological results expected from 2026. DESI continues surveying tens of millions of galaxies and quasars. Africa's radio facilities complement these optical and spectroscopic efforts in a genuinely strategic way; the southern sky coverage and the sensitivity of MeerKAT give the continent an advantage that is not easily replicated elsewhere.

Looking Ahead

In January 2026, the SKA Observatory achieved first fringes with two of its SKA-Mid dishes in South Africa. When complete, SKA-Mid will integrate MeerKAT's 64 dishes with 133 new antennas, creating what will be the most sensitive radio telescope ever built. The science case covers everything from FRB cosmology to dark energy to the cosmic dawn, and it will keep African radio astronomy at the forefront for decades.

HIRAX, as Moodley presented, will add a dedicated intensity mapping capability to the mix. Combined with SKA and the growing FRB detection rates from next-generation instruments, the tools for precision radio cosmology on the continent are coming together in a way that would have been hard to imagine ten years ago. As FRB catalogues grow into the tens of thousands, techniques like dispersion-measure to mography, cross-correlation with timing delays, and multi-tracer analyses will start delivering independent constraints on the Hubble constant, the baryon density, and fNL. The methodology is being built now; the data will follow.

What the AfAS 2026 conference showed me is that the community is ready. The quality of the science presented in Kasane was strong, the range of topics was broad, and the mix of established researchers and early-career scientists was encouraging. The challenge going forward is making sure that the growing talent on the continent is matched by sustained funding, computing infrastructure, and international partnerships. The instruments are here. The people are here. The rest is execution.

A comparative study of galaxies in the Fornax Core Cluster vs. the Fornax A Subgroup

Nabeelah M. Adam (PhD candidate, UCT)
Supervisors: D.J. Pisano (UCT), P.Serra (INAF)

The Fornax Cluster, located 20 million parsecs away in the southern sky, is a dynamic neighbourhood of galaxies dominated by the giant elliptical NGC 1399. To its southwest lies the Fornax A subgroup, centred on NGC 1316, the third brightest radio source in the southern sky. This subgroup is currently falling into the main cluster, and its journey is revealing fascinating interactions.

Fornax sits at the intersection of two cosmic filaments and is actively accreting (attracting) dwarf galaxies. Compared to more massive clusters like Virgo and Coma, Fornax is smaller in mass, but what it lacks in size, it makes up for in activity.

Using optical data from the Fornax Deep Survey, Su et al. (2021) found that galaxies in the Fornax A subgroup are generally bluer, more asymmetric, and clumpier than those in the core cluster, which indicates signs of younger or ongoing star formation. In X-rays, the eRosita all-sky survey (Reiprich et al. 2025) revealed a low-emission bridge connecting the subgroup to the core, suggesting that the cluster is stripping gas from the infalling group. Finally, the MeerKAT Fornax Survey is providing ultra-sensitive views of hydrogen gas (HI) in the region. While results for the subgroup are still preliminary, earlier data from the cluster core revealed six galaxies with extended one-sided gas tails, showing clear evidence of environmental influence (Serra et al.2023).

Together, these multi-wavelength observations are painting a vivid picture of how galaxies evolve as they fall from group to cluster environments.

Investigating the Nature of Compact Galactic Radio Source G012.883–00.285

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Compact Galactic radio sources like G012.883–00.285 challenge our understanding of how massive stars interact with and reshape their surrounding environments, and how we distinguish between fundamentally different emission processes in our Galaxy. H ii regions, protostars, and supernova remnants (SNRs) can appear strikingly similar in radio images despite being fundamentally different objects. Thermal free–free emission from ionized gas in H ii regions can mimic non-thermal synchrotron radiation from shock-accelerated electrons in SNRs.

Multi-epoch radio continuum data from the Very Large Array (VLA; 1996) and MeerKAT (2018) reveal extended emission in MeerKAT beyond VLA limits, indicating real source growth over 22 years. Gaussian fits show the source expanded from 0.37 Jy integrated flux to 0.60 Jy, implying an expansion velocity of 103 km s−1, vastly exceeding the 10–20 km s−1 typical for compact H ii regions. Spectral index maps display a central $\alpha \approx -0.3$ (optically thin thermal-like) steepening outward, hinting at non-thermal electrons undergoing energy losses or acceleration. FUGIN survey molecular line data (12CO, 13CO, C18O) show a central depression in dense gas tracers, with enhanced emission around the perimeter, suggesting energetic clearing rather than a quiescent protostellar core. A Bayesian kinematic model using VLSR = 35.7 ± 0.1 km s−1 places the source in a spiral arm (Scutum–Centaurus or Norma), consistent with active massive star formation regions.

Recent MeerKAT Galactic Plane surveys, such as MeerGAL, provide new insights into feedback in star forming regions, mapping ionized gas structures from hypercompact H ii regions to large-scale filamentary shocks. Similar to the spectral index maps presented here, these surveys build on Expanded Very Large Array (EVLA) techniques to distinguish thermal free–free emission ($\alpha \approx +0.1$ to -0.1) from non-thermal synchrotron emission ($\alpha < -0.5$), even along complex inner Galaxy sightlines toward sources such as G012.883–00.285. Furthermore, SOFIA [C ii] observations indicate typical H ii region expansion velocities of □ 12 km s−1 at photodissociation region (PDR) interfaces. In contrast, the extreme 103 km s−1 expansion inferred from our multi-epoch VLA/MeerKAT analysis suggests a more unusual phenomenon, such as flickering ionization fronts or non-thermal outbursts.

Collectively, these diagnostics challenge a classical H ii region interpretation, instead pointing toward complex, possibly non-thermal processes such as shocks or feedback. While not conclusive on their own, the observed expansion, spectral gradient, and molecular cavity evoke either a young SNR or “flickering” H ii region variability, requiring deeper multi-wavelength investigation.

PAP2SN: Expanding Opportunities in Planetary and Space Science for Africans

Saul Phiri

The advancement of astronomy and space science in Africa continues to be strengthened through collaborative initiatives that prioritise education, mobility, and innovation. One such initiative is the Pan-African Network of Planetary Science and Technology (PAP2SN), an Academic Mobility project funded by the Intra-Africa Mobility Scheme of the European Education and Culture Executive Agency (EACEA). The Principal Investigator for the project is Dr. Saul Paul Phiri from the Copperbelt University, which is the coordinating institution of the project.

PAP2SN brings together universities, researchers, and students across Africa to advance training, research, and skills development in Planetary, Space Science & Technology. With partner institutions in Ethiopia, Namibia, Nigeria, South Africa, and Zambia, the network reflects a strong commitment to building a continent-wide ecosystem for scientific excellence and collaboration.

A key highlight of the programme is its scholarship scheme, which provides African students with opportunities to pursue postgraduate studies, research, and training across partner institutions. The current call for applications officially opened on 2nd April 2026 and includes opportunities for PhD and Master's degrees, as well as short-term staff mobility. These scholarships are comprehensive, covering tuition fees, travel costs, visa expenses, insurance, and a monthly stipend, along with support towards research costs. Importantly, the programme is committed to inclusivity, with 50% of scholarships reserved for women and candidates from disadvantaged or marginalised groups.

Benefits

The benefits of PAP2SN for African students are significant. Through academic mobility, students gain exposure to diverse learning environments, access to specialised facilities, and the opportunity to collaborate with leading researchers across the continent. The programme also integrates Science, Technology, Engineering, Mathematics (STEM), and ICT, equipping participants with interdisciplinary skills that are highly relevant in today's rapidly evolving scientific landscape. These experiences not only enhance academic development but also improve employability and research capacity.

Eligibility and application

Eligibility for PAP2SN is open to African nationals and residents enrolled in or graduated from relevant fields such as physics, astronomy, Space technology, and Remote Sensing. Applicants can apply to any of the partner institutions, except those in their country of origin. Candidates are typically required to demonstrate strong academic performance, motivation, and a clear interest in planetary and space science. It is important to note that previous recipients of Intra-ACP or Intra-Africa scholarships are not eligible to apply. The application process is conducted online through the official PAP2SN platform (www.pap2sn.com), where detailed guidelines and requirements are provided.

Impacts

The PAP2SN team from the Copperbelt University was very active at the AfAS 2026 Conference which attracted significant attention, showcasing the programme's impact and opportunities. The booth's success was further enhanced by a visit from a government minister from Botswana, reflecting growing recognition of the initiative at both academic and policy levels. The Principal Investigator presented talks about PAP2SN in two sessions at the conference, highlighting the opportunities the project is offering. Such engagements play an important role in raising awareness and inspiring more students to explore careers in space science and technology.

In conclusion, PAP2SN stands as a transformative initiative that is not only expanding access to quality education and research opportunities. But also building a strong, interconnected network of African scientists, and empowering a new generation to contribute meaningfully to global scientific advancement.

African Astronomical Society (AfAS) Best Phd Thesis Prize 2025 (All-Of-Africa)

Dr. Godson Fortune Abbey
Postdoctoral Fellow, Department of Physics, Copperbelt University, Zambia
PhD in Theoretical Astrophysics – Copperbelt University

A SEISMIC SHIFT IN FUNDAMENTAL ASTROPHYSICS

Kasane, Botswana – March 2026 – At the just-concluded African Astronomical Society (AfAS) Conference held in Kasane, Botswana, Dr. Godson Fortune Abbey of Copperbelt University (CBU), Zambia, was jointly awarded the 2025 Best PhD Thesis Prize in All-of-Africa for his groundbreaking doctoral research on gamma-ray bursts (GRBs).

Dr. Abbey's thesis, titled "Investigation into the Cause of Time Lags in the Arrival Time of Photons of Different Frequencies Emanating from Gamma-ray Bursts," tackles one of the most profound questions in modern physics: Does the photon have mass? Standard physics textbooks assume the photon is massless. Dr. Abbey's work challenges that assumption. By analysing time delays in radio photons arriving from distant gamma-ray bursts—among the most energetic explosions in the universe—he and his supervisors, Prof. G. G. Nyambuya (NUST Bulawayo, Zimbabwe) and Dr. J. Simfukwe (CBU, Zambia), inferred a non-zero photon mass of approximately $(1.58 \pm 0.009) \times 10^{-37}$ kg.

If confirmed, this result would be a major seismic shift in the currently troubled world of physics. Textbooks may need revision," said Prof. Nyambuya.

FROM NIGERIA TO ZAMBIA: A PAN-AFRICAN JOURNEY

Born in Port Harcourt, Nigeria, Dr. Abbey earned his BSc in Astrophysics from Rivers State University and an MSc in Astrophysics and Space Science from the University of Nigeria, Nsukka. He was the first PhD student of the Pan African Planetary and Space Science Network (PAPSSN) and is now a DARA Development in Africa with Radio Astronomy (DARA) Postdoctoral Fellow at the Copperbelt University, Zambia.

THE SCIENCE: TIME LAGS, PLASMA, AND PHOTON MASS

Dr. Abbey developed a novel "Linear Frequency Dependent Speed of Light (LFDSL) model"—derived from Maxwell's equations, dispersion effects, and plasma physics. He derived the frequency equivalence of interstellar medium conductance.

- Estimated shockwave dimensions from GRB jets.
- Calculated independent distance measures to GRB events.
- Obtained a coherent photon mass consistent across multiple bursts.

His findings support both the "fireball model" and "multiple shockwave models" of GRBs, opening new windows into relativistic outflows, electron-photon interactions, and cosmic distance measurements.

RECOGNITION AND IMPACT

Dr. Abbey's work has been published in peer-reviewed journals, including the "International Journal of Astronomy and Astrophysics (IJAA)", and presented at international workshops and conferences. Three independent measurements are now converging on the same non-zero photon mass value, and the team is consolidating findings with further tests.

"This award is not just a personal honour, it is a testament to the power of African collaboration and the world-class research emerging from our continent. I am grateful to PAPSSN, DARA, CBU, my supervisors, and the African Astronomical Society for this recognition. Our work is only beginning." Dr. G. F. Abbey

AfAS 2025 PhD Prize Winner

*My name is **Shavani Naicker.** I am currently in my second year of postdoctoral research within the Astrophysics Research Centre (ARC) at the University of KwaZulu-Natal (UKZN). I received my PhD in 2025.*

• A brief overview of my research:

My research area is within the field of applied mathematics with a specialisation in relativistic astrophysics, focusing on studying the gravitational behaviour of stellar models in Lovelock gravity. Lovelock gravity is a natural extension of Einstein's theory of general relativity to dimensions greater than the standard four and includes additional mathematical terms that describe curvature. My work involves solving the governing equations (which are nonlinear differential equations) describing stellar models in Lovelock gravity. These equations are quite complicated and challenging to solve. However, I was able to use innovative techniques to obtain new solutions to the relevant equations. This is a fundamental process for understanding and gaining deeper insights into the behaviour and physical properties of gravitating systems and observed astrophysical phenomena in the Universe, such as stars, black holes and galaxies.

• The impact and relevance of my work:

The significance of my research lies in its potential to deepen our understanding of gravity in extreme conditions, such as near black holes or in the early universe, in which Einstein's gravity may no longer be sufficient to do so. My work in Lovelock gravity contributes to developing our understanding of the Universe, how astrophysical objects behave in higher dimensions, and the influence of the additional curvature terms in Lovelock gravity on the gravitational dynamics of these objects. This could then lend insights

into unresolved problems in cosmology, black hole physics and quantum physics. Furthermore, this work not only contributes to theoretical advancements but also closely aligns with national and international astronomical research strategies like the MeerKAT and the SKA telescope projects.

• Personal journey and experience in the field:

As a young girl, I was always fascinated by the night sky, which inspired my academic journey into astrophysics. So, I began reading basic-level books about the cosmos and watching NASA documentaries. I was also inspired by many great minds like Einstein, Hawking and Newton. Curiosity sparked my interest in astrophysics. In my 11th year of high school, I was exposed to various career days at the University of KwaZulu Natal (UKZN). Here, I met several academic lecturers within the field of mathematics and astrophysics. This provided me with a clear overview of the various academic programmes, leading to astronomy, offered at UKZN. From this exposure, I knew I had to pursue a career in astrophysics. With the support of my parents, I enrolled for a Bachelor of Science (BSc) in M stream at UKZN with majors in astronomy and mathematics. This was an exciting journey as I found I could use mathematics as a tool to understand the inner workings of stars and galaxies. Hereafter, I enrolled for a BSc Honours and was exposed to a research component. With the guidance of my academic lecturers, I was encouraged to further my studies and enrol for a Master of Science, which was one year and ultimately a PhD in applied mathematics specialising in relativistic astrophysics.

My doctoral advisors were Professor Sunil D. Maharaj and Associate Professor Byron P. Brassel. I was able to compile my results from my PhD and my postdoc into seven research publications in high quality journals with two additional outputs currently under review.

Furthermore, my postgraduate journey was enriched by attending various local and international research conferences. Presenting my work and engaging with experts in the field proved to be an invaluable experience. Key highlights include the **17th Marcel Grossmann Meeting** (Italy, 2024), the **11th Heidelberg Laureate Forum** (Germany, 2024), and the **GR24 & Amaldi 16** conference (Scotland, 2025). These conferences are highly competitive and only a select number of students receive an invite.

Beyond research, I have gained extensive experience in academic leadership and community engagement. My professional background includes serving as an ad-hoc lecturer and an applied mathematics tutor at UKZN. I am also deeply involved in the broader scientific community as a member of the South African Gravity Society (SAGS) and the organising committee for the Astrophysics Research Centre's seminars. Additionally, I am passionate about fostering the next generation of scientists, as I am actively involved in the STEM MentHER programme at UKZN as a mentor.

Advice:

Never stop asking questions, embrace failures and follow your passion.

Building Momentum Towards AfAS2027 at Rhodes University

Kenda Knowles
Rhodes University/AfAS

Rhodes University was proud to play an active role in this year's African Astronomical Society (AfAS) conference, contributing across both the Science and Engineering and Education, Development, and Outreach (EDO) themes. Representing the Centre for Radio Astronomy Techniques and Technologies (RATT), the Rhodes delegation reflects the institution's strong commitment to both scientific excellence and human capacity development within African astronomy.

Rhodes' scientific contributions at the 2026 conference spanned a broad range of topics, including galaxies and galaxy clusters, cosmology, stellar astrophysics, and radio frequency interference (RFI) mitigation. Several students also presented in EDO sessions, highlighting successful outreach initiatives they led beyond RATT's borders. The delegation comprised 5 staff members, 1 postdoctoral researcher, 6 PhD candidates, and 3 MSc students, collectively delivering 9 talks and presenting 6 posters. This strong student presence underscores Rhodes' emphasis on training and mentoring the next generation of researchers, with early-career scientists taking a leading role in sharing new results and engaging with the broader community.

One of the highlights of the conference was the handover moment at the gala dinner, where Senior Research Fellow Kenda Knowles accepted the AfAS flag on behalf of Rhodes University, marking the transition towards Rhodes hosting the conference in 2027. This moment signals the beginning of preparations for a meeting intended to be both scientifically strong and intentionally community-focused. In planning for 2027, Rhodes is placing particular emphasis on creating space for meaningful engagement across the continent. Alongside a robust scientific programme, the conference aims to incorporate curated networking and collaboration-building sessions designed to bring together astronomers from different African regions to exchange ideas and develop joint initiatives. The goal is to foster sustained, cross-continental partnerships that advance both scientific research and EDO activities, with outcomes extending well beyond the meeting itself.

The 7th Annual Conference of the African Astronomical Society

SAVE THE DATE

Makhanda(Grahamstown, South Africa)

Hosted by: Rhodes University

(2027)

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