SCIENCE SPAZA SPACE
Knowledge is Ncah!
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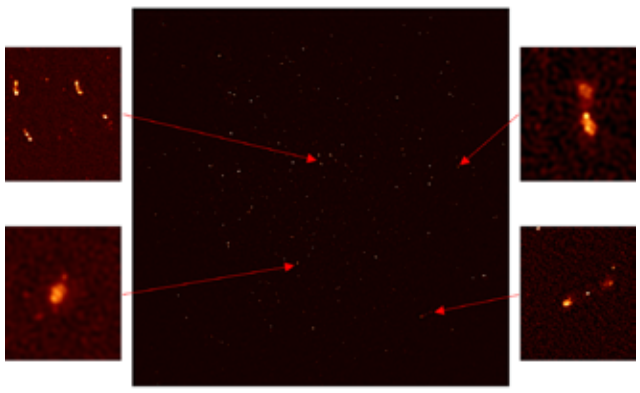
MeerKAT: The Universe is taking selfies



Left: **Some of the MeerKAT dishes in the Northern Cape, 2016.**
Above: **Montage of MeerKAT First Light radio image and four zoomed-in insets. The two panels to the right show distant galaxies with massive black holes at their centres. At lower left is a galaxy approximately 200 million light years away, where hydrogen gas is being used up to form stars in large numbers.** *Courtesy: SKA Africa*

We're part of the Universe, right? So when we take pictures of the Universe, it's almost like a selfie – the Universe taking a photo of itself! That might be a bit weird to think of, but it is so exciting. Here in South Africa, we're taking some pretty important selfies for the science world.

We are home to the best radio telescope in the Southern Hemisphere, and it's called MeerKAT. It's basically a field full of satellite dishes, receiving radio waves from space – all the time! Radio waves are actually invisible to humans, so the team of young scientists in the Karoo have begun turning these radio waves into pictures, using exciting technology. The first picture is called the MeerKAT First Light image, and it just helped us discover over a thousand more galaxies in a tiny part of the Universe! Before MeerKAT, we only knew of 70 galaxies in this little patch of space. The MeerKAT First Light image recently showed that there are actually over 1300! Some of these galaxies have black holes in the middle of them, while some are shooting out streams of powerful electrons, and they're all millions and billions of light years away.

MeerKAT only has 16 satellite dishes at the moment. Soon, it will have 64! One day, MeerKAT will grow even bigger, into the Square Kilometre Array (SKA), which will be the biggest radio telescope in the world! The SKA will have thousands of these radio receptors. If we've discovered thousands of galaxies with only 16 dishes, imagine what we can do with thousands of them! Those will be some very cool selfies.

Did You Know?

Scientists usually work in teams. Although one person might have designed the actual dishes, another person needs to know how to program the computer to turn the radio waves into images. But she might not know how to fix the actual equipment if it breaks! So a mechanical engineer is part of the team, too. This way, each person can be really good at one or two things, instead of trying to do everything all on their own.

Definitions

Galaxy: A whole lot of stars, planets, solar systems, gas and dust held together by the forces of gravity. Our galaxy is called the Milky Way.

Universe: Space, and everything in it. We are still discovering new parts of the Universe all the time. It is bigger than we could even imagine.

Solar System: Earth is one of eight planets orbiting around the Sun, along with asteroids, meteoroids and comets. All together, this collection of celestial things makes up our Solar System.

Cosmos: This is a concept or way of thinking that sees the Universe as a structured system, where everything, including humans, has a specific place or role.

SKA *and* Hip Hop Science Spaza

Music of the Stars

The Square Kilometre Array (SKA) South Africa got together with learners from Carnarvon Primary School to learn about radio astronomy, and to collaborate on the production of some awesome songs about what they learnt.

Far out in the arid Karoo lies the town of Carnarvon, a small, quiet town, and home to the MeerKAT radio telescope. On one particular day, however, the silence was replaced with an excited buzz as the learners from Carnarvon Primary School prepared to perform hip hop songs that they had created for the school, guests and community at large. 25 February 2016 was a day to remember for all involved. Everything that the children had learnt about radio astronomy came through in their lyrics as they sang and jived on stage! To round it off, popular hip hop artist iFani, too, joined in the festivities and gave a performance to the delight of the crowd.

The songs that the learners created as part of this initiative, all about radio astronomy, were professionally recorded and are available on the Science Spaza Soundcloud channel. Go to www.soundcloud.com/sciencespaza to check them out!

Science Spaza is managed under the auspices of the YAZI Centre for Science and Society in Africa (NPC-K2015047709, Non-profit Organisation 151-830 NPO). www.yazi.org.za

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Young South African Woman takes her Science to the World

16-year-old Kiara Nighin from Johannesburg won the grand prize at the Google Science Fair 2016.

She was jetted off to the US to take part as a finalist in the Google Science Fair, and was announced as the winner on 27 September 2016 at the Google Science Fair awards celebration in California. This international competition was open to high school students, and encouraged them to submit science, maths and engineering innovations that would have a positive impact on their society or environment. Kiara won the international competition with an innovative project called "No More Thirsty Crops", aimed at reducing water usage in agricultural activities during droughts. South Africa has faced some of our worst water shortages ever this year, so Kiara chose an appropriate topic that may one day be implemented in communities here.

Kiara's project focused on the invention of a new material made of orange peels and avocado skin. This material is highly absorbent, so when buried under the ground, it becomes a reservoir (a place for storing water) in the soil. Water from the ground and from rainfall soaks into the natural fibres and provides a clever, sustainable way of saving water.

As her prize, Kiara has been given a scholarship by Google to further her education. She says that physics and chemistry are her greatest passions, and is delighted for the opportunity to carry on with her science studies after high school.

Once again, South Africa is securing its place on the world science map, as the MeerKAT radio telescope captures its first image of space! But that's not all the SKA has been up to … find out more in this year's first edition of *Spaza Space*.

You can read about the **MeerKAT's First Light image** on page 1, and why this is such a success for South African science.

Right here on page 2 you can catch up with some other things that have been going on in South African science. If you've got any bright ideas that need to be heard, check out how you can get involved in some grassroots innovation.

Pages 3-6 will tell you all about **Hip Hop Science Spaza's trip to Carnarvon**, and the fun they had with learners from Carnarvon Primary School learning about the SKA.

On page 7 you can catch up with Agent Zee as she meets up with **young women in science who are working at the SKA**.

Be sure to check out what some of your fellow **Science Spaza clubs** have been up to recently in News from the Clubs on page 8.

Finally, get hold of the four **activity worksheets** (in the middle of your Spaza Space). Cut them out and do them with your friends – and remember to send us pics and feedback on your experiences!

And there's more! **You could feature in the next edition of Spaza Space!** Keep in touch and send us your news on Facebook and Twitter. Also remember to check out **Soundcloud** for some of the awesome songs that have been recorded with Science Spaza.

The Science Spaza Team

Photograph: Smokeybjb

Turtle Tales

Left: **This is a scientist's model of what Eunotosaurus might have looked like, based on Kobus Snyman's fossil. It is believed to be an ancestor of turtles. It did not have a shell, but its wide ribs may have been a step in the evolution of turtles.**

Some of the most exciting scientific discoveries happen when kids are involved!

For ages, scientists have wondered how turtle shells evolved. Then, an 8-year-old boy from the Western Cape, Kobus Snyman, discovered an important fossil (preserved remains of a prehistoric creature) on his dad's farm, with its legs, feet and broad ribs intact.

The fossil, 260 million years old, was sent to scientists at various universities. They studied it to see if it could tell them any secrets about turtle evolution. They decided that it is an important clue in the mystery of how the turtle got its shell.

So, because of an 8-year-old boy's curiosity, a new link in the chain of evolution has been found. It just goes to show that you should never stop exploring, asking questions and getting involved in science!

Did You Know?

Turtle shells were not always just for protection. Right back when dinosaurs were around, turtles used their shells for burrowing underground to shelter from the hot sun.

Although scientists know a whole lot about evolution, there are still many pieces of this big puzzle missing. Every new fossil brings new information and might just change everything we've ever known! Fossils are being discovered every day, all over the world. We are lucky to live in Africa, where some of the greatest palaeontological and archaeological discoveries of ancient life and human pre-history have been made.

Definitions

Palaeontology: The study of ancient life by analysing fossils.

Archaeology: The study of human history by analysing the physical remains found in sites where ancient people lived.

Do *you* want to reach young scientists?

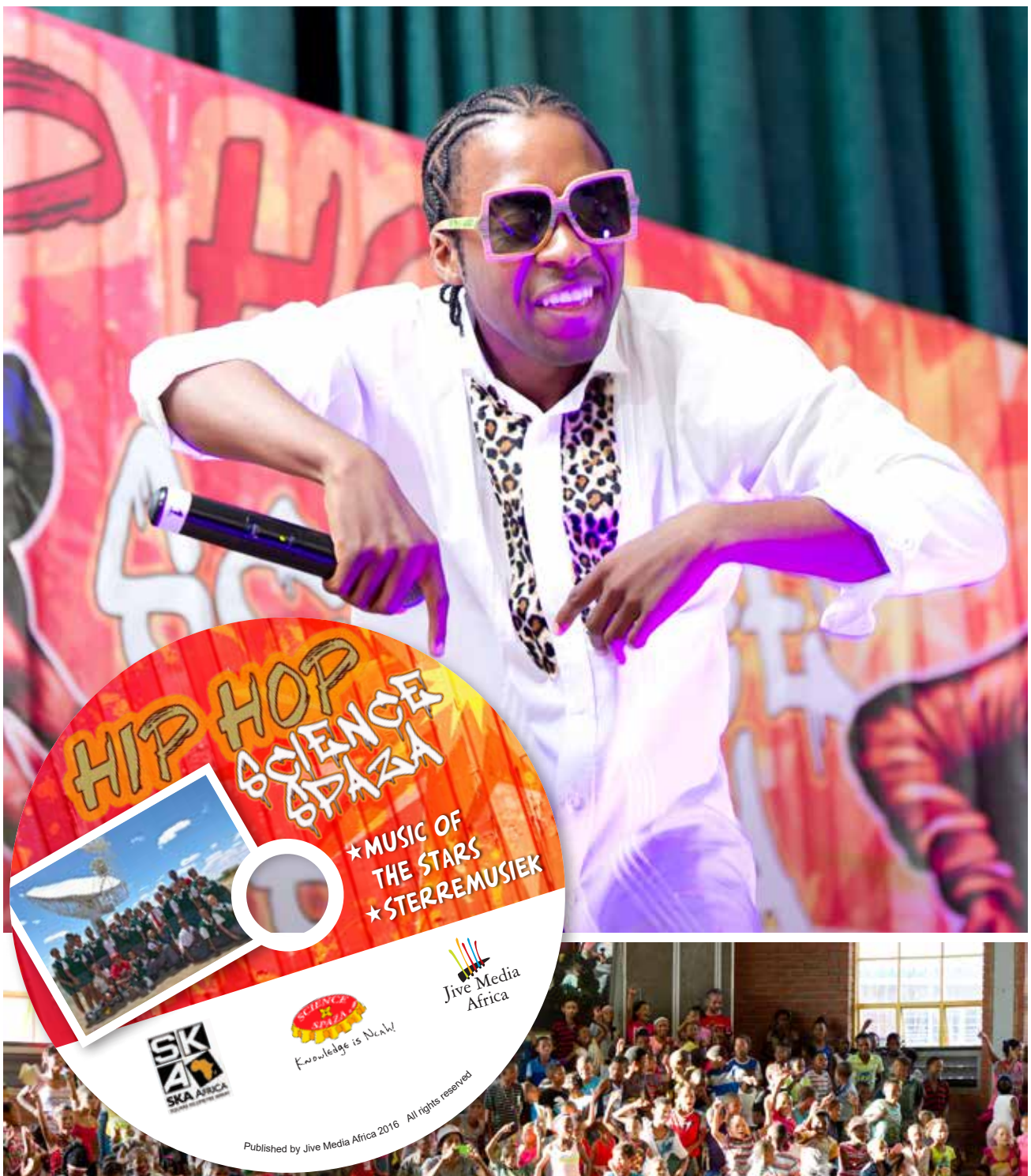
10 000 copies of Spaza Space are distributed to over 140 science clubs and 30 science centres nationally.

Email us on info@sciencespaza.org
or call us on +27 (0)33 342 9380/2

Once upon a time in Carnarvon ...

Sthabile Mazubane

Hip Hop Science Spaza made its way to Carnarvon, a small town in the Northern Cape, to engage young people in the area on the impact of the Square Kilometre Array. Science Spaza got together with Grades 6 & 7 learners from Carnarvon Primary School to produce Hip Hop tracks on aspects of SKA science.



Hip Hop Science Spaza and the SKA SA exposed the learners to science activities through which they were able to learn more about the SKA, radio telescopes and astronomy. The activities included hands-on learning about the electromagnetic spectrum, the creation of art focused on the theme of astronomy, a visit to the site of the MeerKAT telescope and an international Skype session allowing the learners in Carnarvon to engage with learners at the Jodrell Bank telescope in the United Kingdom.

Throughout the week SKA SA scientist Dr Nadeem Ozeer was present to interact with the learners and share knowledge about science and radio astronomy to ensure they would gain full value from the programme. Finally, in collaboration with surprise guest artist and Hip Hop sensation iFani, the learners in Carnarvon had the opportunity to perform their Hip Hop songs for the local Carnarvon community, to convey what they had learnt and to make a recording to share with even more young people.

Listen to their songs on the Science Spaza Soundcloud channel: **https://soundcloud.com/sciencespaza**

It's showtime!

Sthabile Mazubane

The time came for the learners from Carnarvon Primary School to perform for the entire community what they had been learning about SKA. Some of them were nervous as it was uncharted ground for them, but they braved it to throw an absolutely spectacular concert at the school. As the groups each took their turn on the stage the audience was captured more and more by how much the learners enjoyed performing what they had learnt. The tracks they had written were recorded live by Hip Hop Science Spaza. To top it all off, surprise guest artist iFani pulled out all the stops for what proved to be a delightful experience for the Carnarvon community.

Link: https://www.youtube.com/watch?v=5NZbknutwBA

Some funky lyrics

Science Musketeers

"Your science (X3)
Speak a thousand words
Your bouncing (X3)
Is like crazy lights
We are going (X3)
To the SKA"

The diamond girls

"The sun hides the stars in the daylight
The sky shines so bright at night
Refraction is the action that bends the light (X2)"

The science girls

"Concave mirrors reflect light
Yeah yeah yeah
Rays so that they can converge
Yeah yeah yeah (X2)
Come together
Come together
Lets get knowledge"

The Curvers

"Voorwerpe in die ruimte
Gee ons radio strale (X2)
SKA sal ons die pad wys
SKA sal ons die pad wys"

The Invisibles

"Some objects in space give out radio waves
Which we cannot see with our eyes
Some objects in space give out radio waves
To see all space in time
Science and society we mind the gap
A movie star I don't know about that
If you don't know about it listen to this rap
If you don't know about it listen to this rap"

Hip Hop Benders

"Lenses bend the light (X2)
Depending on the shape (X2)
Of a lens"

We are going to the SKA

Sthabile Mazubane

Imagine having the largest scientific project ever built, in your back garden? That's exactly what is happening for the communities of Carnarvon, Williston and Van Wyksvlei in the Karoo at the site of the SKA telescope. However, many of the residents of these towns have never had a chance to really get up close to the project. Science Spaza teamed up with the SKA project to give learners a first-hand experience of this exciting project. The learners had fun on the road singing all the way to the site which is about 90 kilometres away.

Learners from Carnarvon Primary School made a trip to the MeerKAT site and got a close-up tour of one of the radio telescope dishes.

Upon arrival the learners were taken through some very crucial rules to be followed when at the site and to ensure their safety and that of the very sensitive equipment they were about to see.

Finally, the time came when the learners got to see the telescopes. After touring through the first of the MeerKAT dishes and meeting scientists, the learners returned to Carnarvon where they were very excited to have an opportunity for an interactive Skype session with the learners at the Jodrell Bank Observatory, near Manchester in the United Kingdom, where the head office of the international SKA Organisation is situated. The learners connected and shared their views about the SKA telescopes being built in, literally, their back yards.

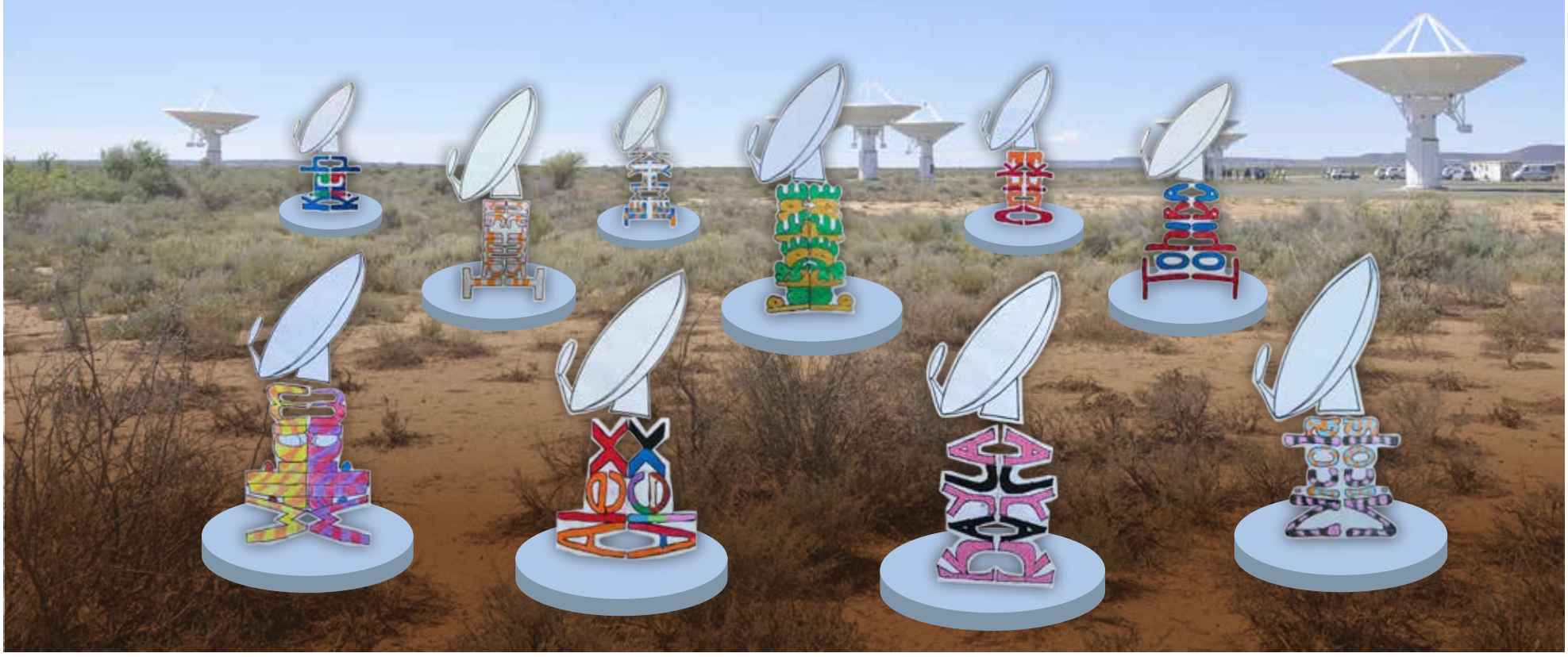
For more information on the SKA project you can visit the website: **www.ska.ac.za**

Before their visit to the SKA telescopes the learners participated in activities to learn about SKA and the science of radio astronomy, which may inspire some of them to become scientists.

Who supports the SKA?

We do!

Learners at Cararvon Primary School created MeerKAT pedestals using their names before linking up with learners at the Jodrell Bank Radio Telescope in the United Kingdom to express their support for the SKA.



Did you know that satellites can travel at speeds of 28 000 km per hour? At that speed they can orbit the Earth about 16 times in one day!

Satellites are launched into space to do specific jobs such as monitoring our environment on Earth. The South African National Space Agency uses satellites to monitor:

- the Sun and space weather storms
- the Earth's magnetic field
- land usage and agriculture
- floods, drought and fires
- water and soil quality
- climate change

One lucky Science Spaza club member will win a SANSA hamper!

Answer this easy question:

Name one way in which SANSA uses satellites to improve people's lives.

SMS or WhatsApp your answer to 076 173 7130

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Isabella Rammala

Junior Commissioning Scientist, Square Kilometre Array

Agent Zee: Could you please tell me a little about your life background?

Isabella: I grew up in a small rural village called Ga-Makata in Limpopo. I attended Makata Primary School, then I went to Chakga Junior Secondary School. However, these schools were not the best. At the time in primary school, we even had limited access to water. At high school it was even worse. We had no access to labs, the library or the internet. We only read about how to perform experiments but never actually performed the experiments because we had no apparatus.

Agent Zee: Which university/ universities did you attend?

Isabella: After high school I went to the University of the Free State and obtained a BSc degree in physics. I then enrolled for an Honours degree (BSc Hons Astrophysics). Currently I am registered with Rhodes University for an MSc degree in Astrophysics part-time and working for SKA SA.

Agent Zee: Why did you choose this field of study?

Isabella: When I was in Grade 11 our teacher pointed at me and asked what I wanted to do after completing school. I stood up and told the whole class that I wanted to become an astronaut – and everyone laughed at me. I was just dreaming a dream too big to achieve because of my environment. I was in a poor school, it just seemed impossible, but not for me.

Agent Zee: Which institution do you work for currently, and what is your role there?

Isabella: I am currently with the Square Kilometre Array South Africa (SKA SA) as a Junior Commissioning Scientist under the Young Professionals Development Programme (YPDP). I am with the Science Commissioning Team for Pulsar Astronomy, working with a team of astronomers.

Agent Zee: What inspires you most about your career?

Isabella: My inspiration is my curiosity. When I was a kid I had questions that I asked but never got answers to. I love the fact that I'm in a field that provides clues to the questions that I have been asking.

Agent Zee: What is your view regarding the future of women in science in SA?

Isabella: I honestly think that South African women have the potential to make a great impact in the science field. Women have already shown that they can make a great contribution. There are not enough women in these fields, but I believe that if we target girls that are still in school, give them support and keep them motivated to have an interest in these fields, we can build a South Africa where gender doesn't dictate what you can achieve.

Agent Zee: What advice would you give to young women in South Africa wanting to enter into a STEM field?

Isabella: Follow your dreams even if they look impossible to achieve and do not allow anyone else to tell you otherwise. South Africa is constantly growing in these fields and the sooner you join in the more you will reap the benefits. You can still be a woman and pursue a career in Science and Technology, and we're living in an era that is making that change.

Audrey Dikgale

Telescope Operator, Square Kilometre Array

Agent Zee: Could you please tell me more about yourself, your life background?

Audrey: I am Audrey Dikgale from Ga-Dikgale, Limpopo. I attended primary and high school at Taxila Secondary School. After matric, I took a gap year and went to work in Rustenburg Platinum Mines as a strata control trainee. I then enrolled for my undergraduate degree. I completed my internship in radio frequency planning at the Department of Communications, I then went to the Department of Rural Development and Land Reform as a cadastral pupil surveyor.

Agent Zee: Which university/ universities did you attend?

Audrey: I completed my Bachelor of Science (Applied Mathematics and Physics) at the University of Limpopo.

Agent Zee: Why did you choose this field of study?

Audrey: I've always loved science. I understood the whole subject and performed well in it. It seemed to answer everyday questions and I loved that it made me question how things work. I enjoyed Maths, so going to University I enrolled for a BSc degree that allowed me to study what I was good in, which was Maths and Science.

Agent Zee: Which institution do you work for currently, and what is your role there?

Audrey: I work for Square Kilometre Array South Africa, at the Engineering Office in Pinelands, and the telescope site in the Karoo in the Northern Cape. I use the radio telescope to observe any given targets in the sky for however long, monitor the system's health, fix problems, troubleshoot faults and report problems that I cannot fix. I also do proper logging of system activities.

Agent Zee: What inspires you most about your career?

Audrey: We are building the biggest radio telescope in the world, using mostly cutting-edge technology and tools; that in itself is inspiring. With this instrument, we want to understand as much as we can of the unknown in our Universe, and maybe make discoveries in the process. My job serves as a link between all engineering and commissioning activities; every day is a learning experience. All this is enough to inspire anyone to get out of bed every morning.

Agent Zee: What is your view regarding the future of women in science in SA?

Audrey: I see a bright future for women in general in South Africa. I see now that women are being taken seriously in their respective fields. My wish is for women to have more confidence in themselves and their abilities, to not be afraid and just go for it. We are natural born leaders, and with education, we can take this country to a better economic and social standing.

Agent Zee: What advice would you give young women in South Africa wanting to enter into a STEM field?

Audrey: It is through research and innovation that our country will grow and prosper. We will never have enough scientists, there is always a gap to be filled. As a woman, you can become all you want to be - a mother, a wife and a career woman. Let our country's challenges inspire you to want to achieve and make a difference in your own space.

NEWS FROM THE CLUBS

This is where you, the members of the Science Spaza clubs, get to share your news and have your say about science issues.

Testing our water for E coli

Mrs DBH Gamede, Ozone Club, Riverdale Primary School, Estcourt

We went on a field trip to Esigodlweni to test the river water. Everyone was so keen – they all wanted to be the ones to fill the containers.

This was our first time to be engaged in such a project. We learned to appreciate nature. The river flows along a rocky valley, but we noticed that it is dirty and needs to be cleaned up.

We followed all the steps to collect and label the bottles of river water safely. We also took pictures as proof of every step. When we got back to school we tested the water, and also tested water from the tap and the tank to check for E coli bacteria.

This was really an exciting project. We would love to do more hands-on activities in science.

Singing to learn science

Sphelele Madonda, The Travellers, Mlungisi Secondary School, KZN

Our class has learnt to sing about science. Other learners ask: "Science Spaza has made a difference to you guys. Tell us, what's your secret?" and we say: "No. there's no secret, but the Science Spaza crew taught us to create a song and practice it until it sticks in our minds. That way we go the extra mile – more than what the teacher gives us."

Then they ask: "Will Science Spaza come back again?" We were like: "Mmmm ... maybe."

Scorpions – dangerous but fascinating

Taxonomist Science Club Thohoyandou, Venda

Everything around us is all about science. That's a fact we can't argue about, right?! That's what The Taxonomists discovered when the village called Tshivhilwi had a plague of scorpions and lots of people were stung. We decided to do some research into these dangerous "insects".

We learnt that scorpions are not insects – they're Arachnids. A scorpion has eight legs, two pincers for grasping its prey, and a tail curved over its back ending in a venomous stinger.

Scorpions number about 1750 species, divided into 13 families. Only a few species have venom that can kill a human, but the sting is very painful. If a child or elderly person is stung they should get medical care.

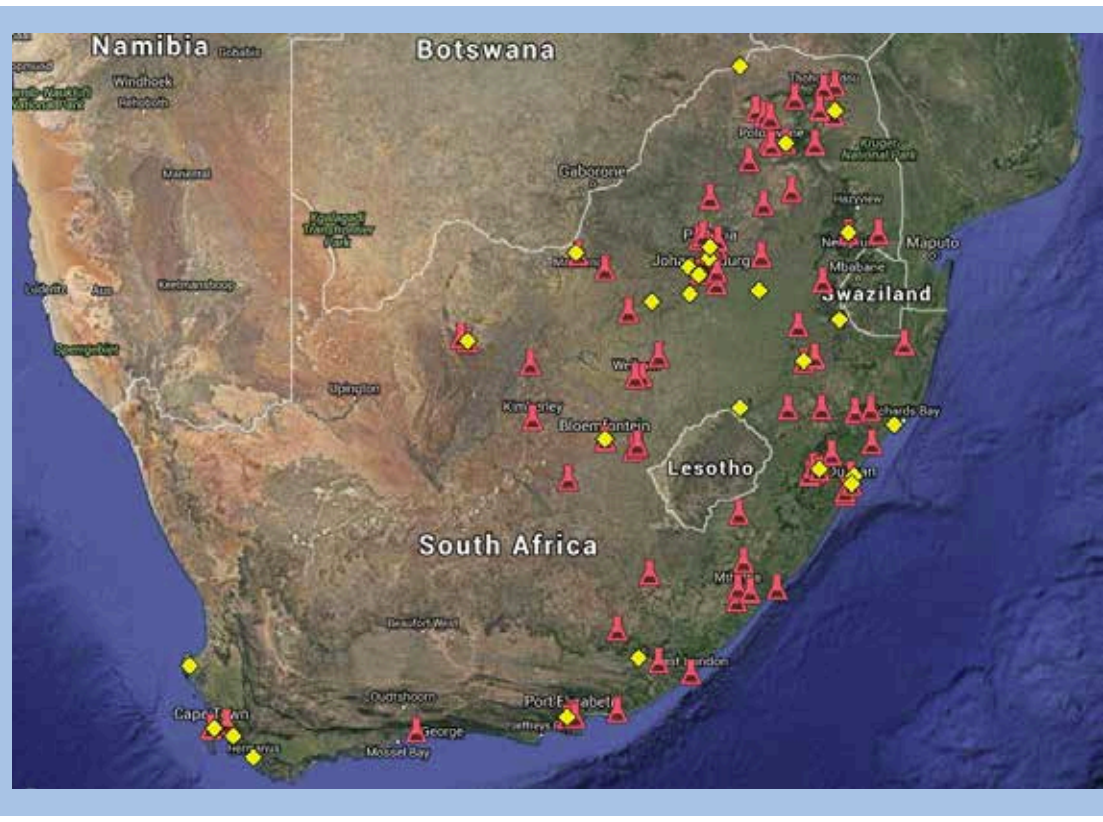
As The Taxonomists we are really into science. That's why we could share our scientific knowledge with the Chief and other people in the community who had no knowledge about scorpions.

Science is Ncah!

Distribution of Science Spaza clubs in South Africa

There are more than 130 Science Spaza clubs in all provinces that receive Science Spaza products. Science Spaza prints and distributes 10 000 copies of *Spaza Space* quarterly, which includes activity worksheets, *Spaza Space* newspaper, Hip Hop Science Spaza CDs and other learning materials.

These are also sent to more than 30 Science Centres across the country. This initiative targets learners from disadvantaged backgrounds where learners do not have functional laboratories.



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