

Radio astronomy and Remote sensing: A journey in Geoinformatics

A concise walk through my background at DARA, how astronomy and remote sensing interact and the transferable skills that bridge both fields





DEVELOPMENT IN AFRICA WITH RADIO ASTRONOMY

Key Aspects of the DARA Mission:

- **Capacity Building:** Training in radio astronomy, space technologies, and data science for science and engineering graduates.
- **Target Countries:** The program operates in the eight SKA partner countries in Africa.
- **Skill Transfer:** Focuses on developing STEM skills that are transferable to sectors like telecommunications, computing, and agriculture.
- **Strategic Collaboration:** A partnership involving UK and South African institutions, including the South African Radio Astronomy Observatory (SARAO).
- **Impact:** Aims to create a sustainable, knowledge-based economy and foster innovation in Africa.

contents

1. Introducing myself :

- brief background, research focus

2. My journey with DARA:

- Internship, collaborations and projects

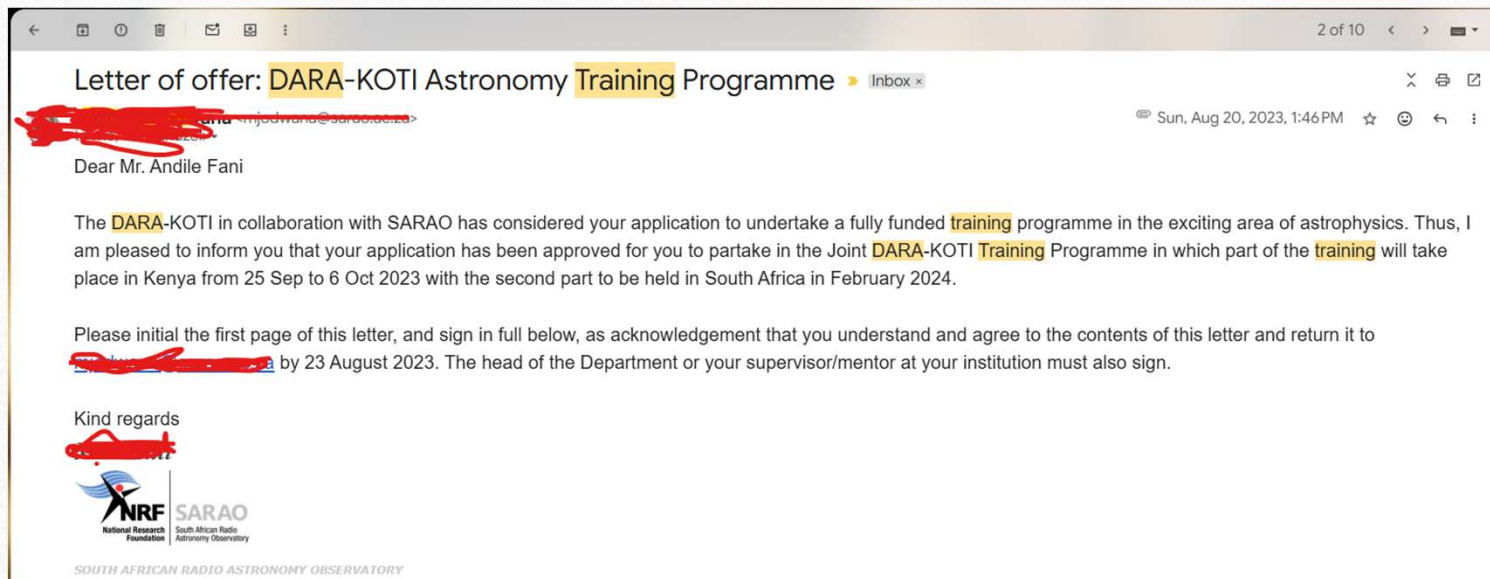
3. Remote sensing meets astronomy

- Shared instruments, signal, Technology, transferability of skills, statistics, data science, AI, and ML

4. Opportunities out there

5. Motivation

Did anyone get it ?



1. Get to know me

- Andile H Fani
- PhD student (2nd year)
- Geoinformatics (UP)
- Remote sensing, Spatial analysis



PhD topic: Use of drones, AI, and ML in precision Agriculture (yield prediction, irrigation scheduling, crop monitoring).

- DARA Intern, Young Farmer, Supervisor, part time Junior lecture. Trainer











The reality is, we need to find other ways to survive. Our degrees are not enough

Where it all started



Remote Sensing

- Remote sensing is the technique of observing and measuring Earth's surface and atmosphere from a distance using satellites, aircraft, or drones.
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How ?

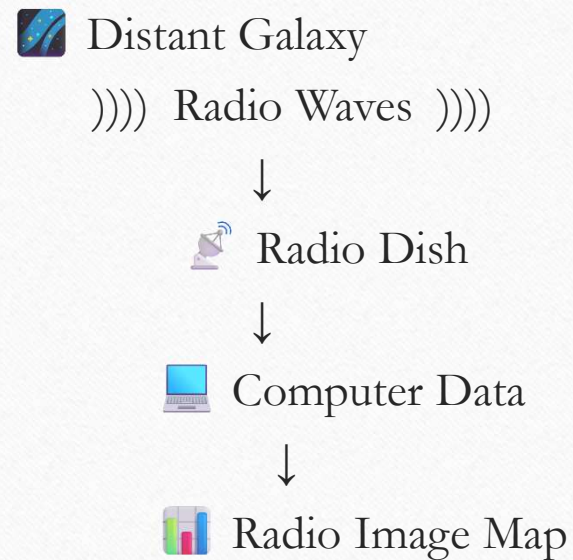
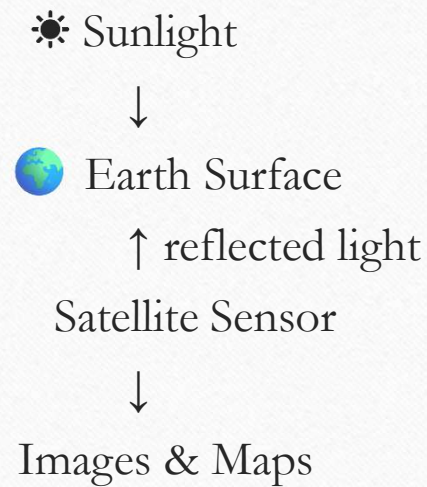
- A source of energy (usually the Sun or an active sensor like radar) sends electromagnetic waves.
- These waves interact with the Earth's surface (land, water, vegetation, buildings).
- Sensors record the reflected or emitted energy.
- Data is processed into images and maps.

Applied Science

Surveying
Military, Defence, Combat
Navigation
Agriculture
Mining
Environmental Science
Health



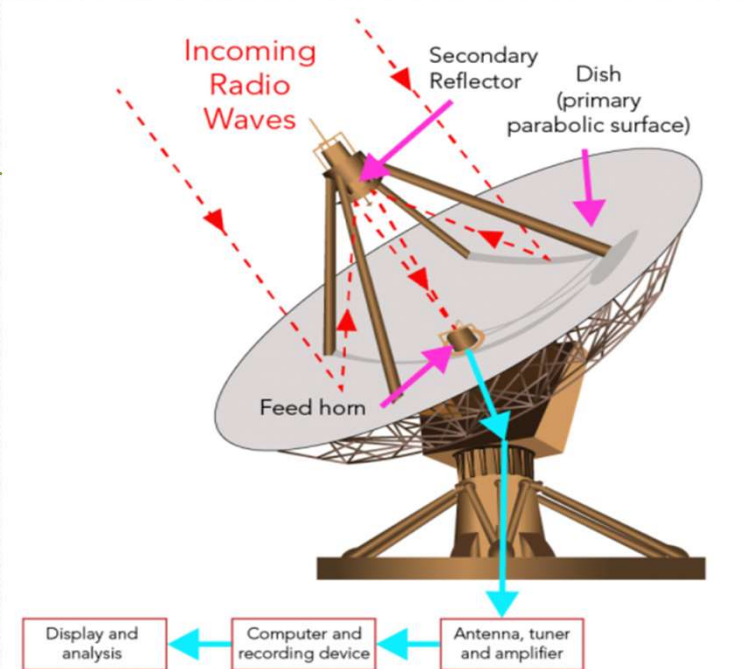
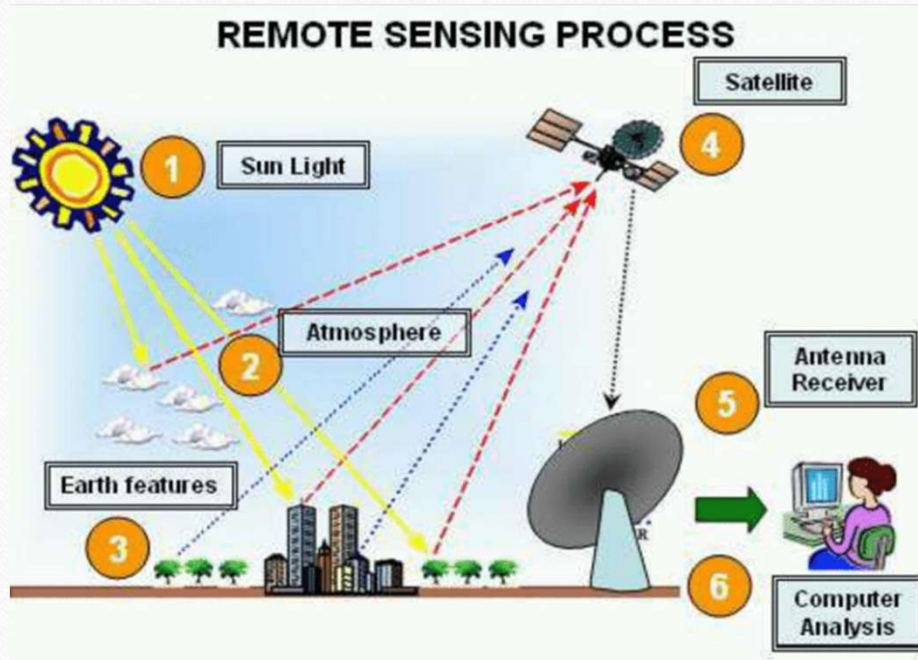
Most basic



What are the relationships? You get it.
If you don't get it, then



Remote sensing process and Radio astronomy



These images illustrate instrument setups and intermediate products. Note how calibration, noise mitigation, and imaging algorithms are shared concerns. Visual pipelines inform both scientific interpretation and downstream ML models.

Connecting Earth Observation and Space Observation

Common hardware

Antennae, receivers, spectrometers, and imaging arrays — design and signal-conditioning principles overlap.

Data characteristics

Spectral, spatial, radiometric, and temporal resolution are central to analysis and model design.

Practical takeaway: techniques developed in one domain (e.g., deconvolution, denoising) can accelerate progress in the other.

Connecting Earth Observation and Space Observation

Shared physics

- Both study electromagnetic radiation—different bands but same fundamental laws (propagation, scattering, absorption).

Shared challenges

Interference, calibration drift, and limited SNR (signal to noise ratio) require robust preprocessing and statistical rigor.

Transferable skills between of skills RA and RS (think about your field)

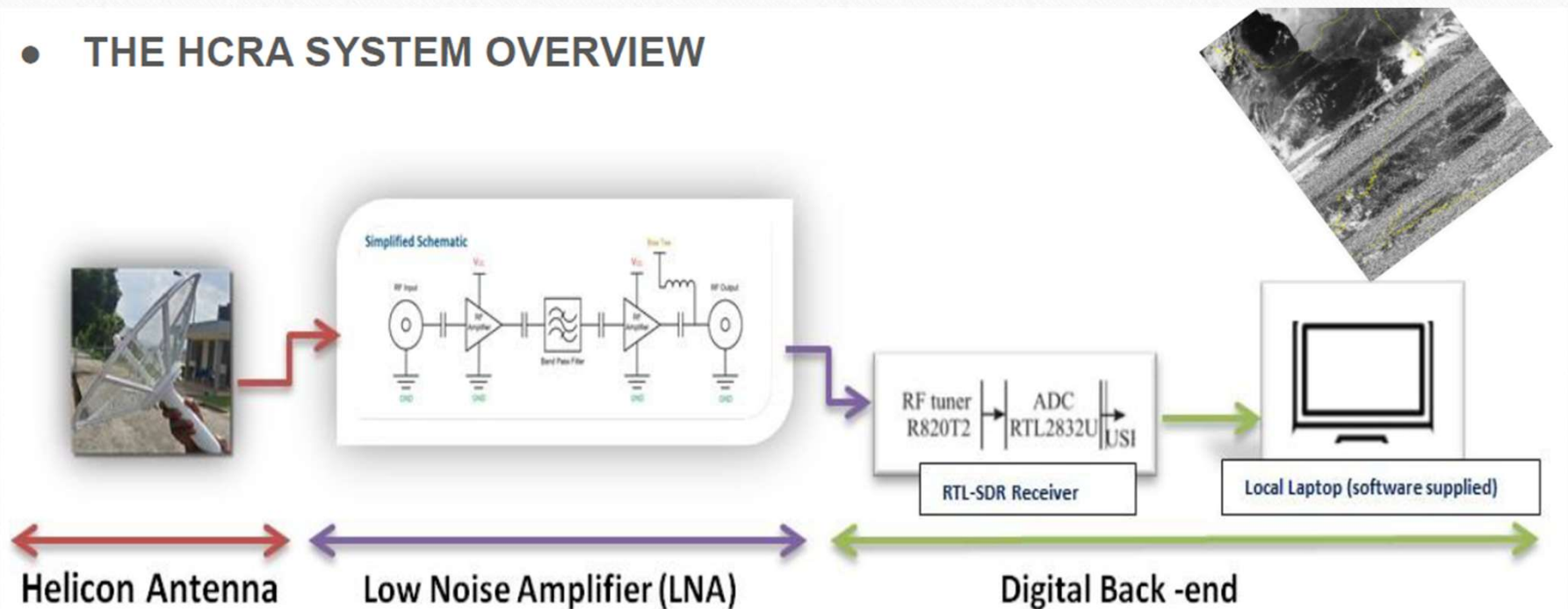
- EMS - Understanding bands (visible, IR, microwave, radio) and their interactions with targets is foundational.
- RS – visible, infrared, micro wave to study Earth
- RA - radio waves, to study space
- measure radiation without physical contact with the phenomenon.
- similar instruments used (Antennas, sensors, receivers, and signal chains, hardware).
- Imaging & signal processing

Transferable skills between of skills RA and RS (think about your field)

- processing (Calibration, filtering, Fourier methods, and image reconstruction apply to both radio and optical datasets)
- Statistics/math
- Imaging techniques,
- Data analysis techniques

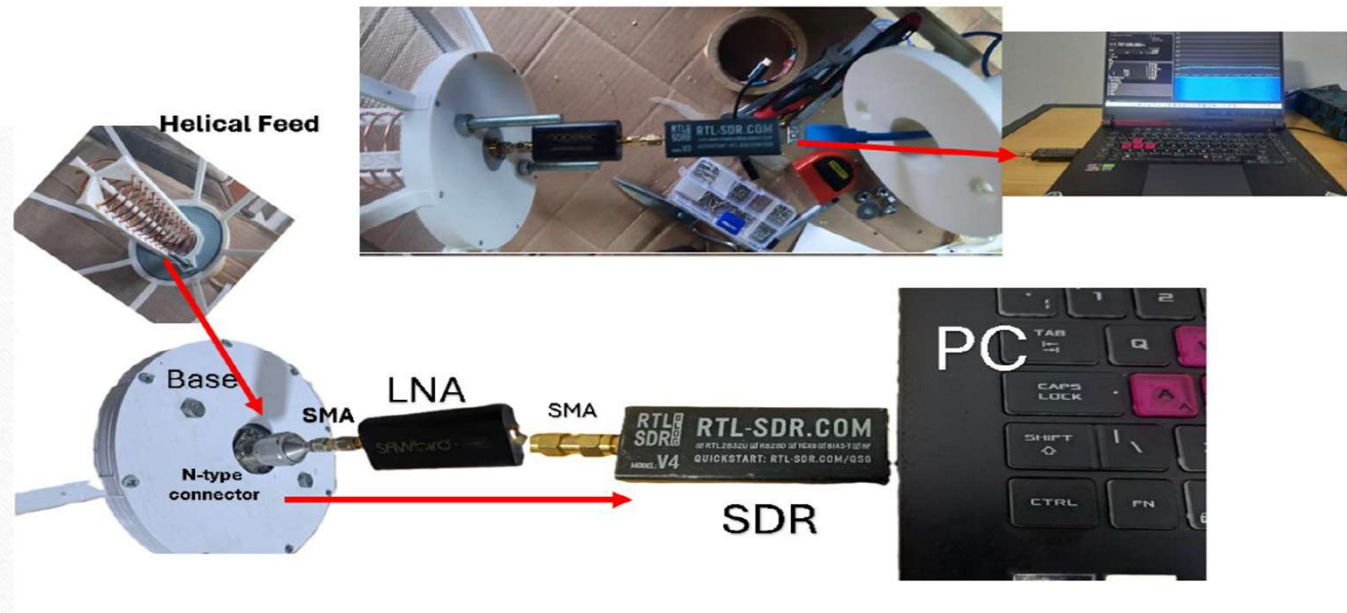
The Helicon Antenna Project

- THE HCRA SYSTEM OVERVIEW



HCRA Specifications

- HCRA diameter: 60cm
- Operating Frequency: 1.4 - 1.7GHz
- Hand tracking
- Type of Satellites: Weather
- Name of Satellites:
 - NOAA 15,18,&19,
 - Meteo MN2-3 & MN2-4



Application of radio astronomy in your field

- Radio astronomy is not a foreign field
- Telecommunications
- Weather forecasting
- Seismology
- LiDAR(point cloud, 3D)
- Radar
- Geodesy
- ISPs
- Agriculture
- Entertainment.
- Multispectral application
- Hyperspectral imaging

2. Opportunities

Further training, skills, mentorship.

Open Data for Social Impact Challenge



Twenty-five postgraduate students from the University of Fort Hare participated in the first Open Data for Social Impact Challenge, which was hosted close to SARAO's Hartebeesthoek Radio Astronomy Observatory (HartRAO) in Muldersdrift,

Gauteng



<https://www.sarao.ac.za/news/innovating-for-impact-fort-hare-students-harness-open-data-and-ai-to-uplift-communities-in-the-eastern-cape/>

1st Open Data for Social Impact Challenge 2025

Theme:

The 1st Open data for Social Impact Challenge will introduce participants to Earth Observation (EO), Open data, and Artificial Intelligence (AI) for addressing social challenges in agriculture, rural development, and community welfare. Practical activities will cover building a low-cost Helicone antenna, exploring Digital Earth Africa datasets, and basic AI concepts. The challenge aims to develop innovative use cases like drought alerts and flood mapping for South African communities. It includes the visits to HartRAO and SANSA as well as informal evening discussions. Participants will have the opportunity to present their solutions to experts.

Who Can Apply:

1. Registered students / recent graduates (2024) from the University of Fort Hare
2. M.Sc / Hon / PhD in: Science / Earth Observation/ Environmental Science / Geographical Information Systems/ Remote Sensing/ Physics/ Computer Science students.
3. Anyone with an introductory understanding of programming and data analysis

Deadline: 16 June 2025
More Details and Online Applications: [Click Here](#)

Scan for QR code

26 Degrees Bush House, Muldersdrift South Africa
3 - 6th November 2025
opendata@ufa.ac.za

Logos: SARAO, science & innovation, DARA, LIST, DIG, University of Fort Hare, Digital Earth Africa

Big Data Africa Schools

- <https://www.sarao.ac.za/news/saraos-big-data-africa-school/>
- <https://scm.sarao.ac.za/researchandstudy/5th-big-data-africa-school/>



- Cloud computing
- AWS

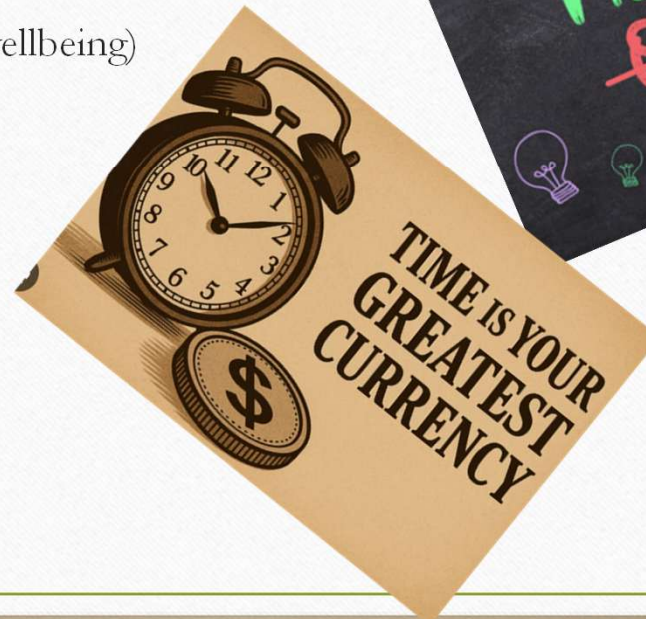


Reflection

- Change of environment
- Discovering yourself
- Personal results (distress, motivation).
- Internal fulfilment
- Walking away better
- Long-term friendships, network,
- Realising this field is for you
- Realising some of the aspects of this are for you.

3. Motivation

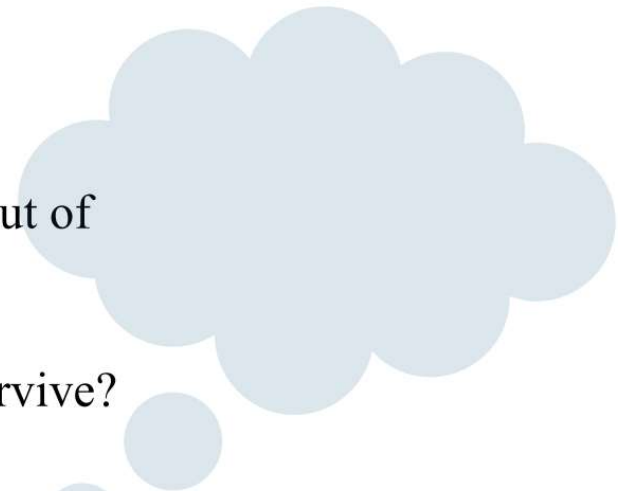
- As the year starts.
- New Habits (mental and physical wellbeing)
- New routines
- Lose bad routines and habits
- Be productive
- Account for your time
- Be consistent
- Go out there and win
- I wish you well.



Outside your degree/degrees,
what do you know ?.



- What skills do you have
- Have you tried to make a living out of that skill
- If they were to strip you of your qualifications, how would you survive?
- Unemployment is real.
- As we work on our academics lets also work on other skills that we might need.
- We need to create a different middle class or wealth class.



Go out there and win advise to your fellow
colleauge

**EVERY TIME I GO
OUT THERE I EXPECT
TO WIN**

ROY OSWALT