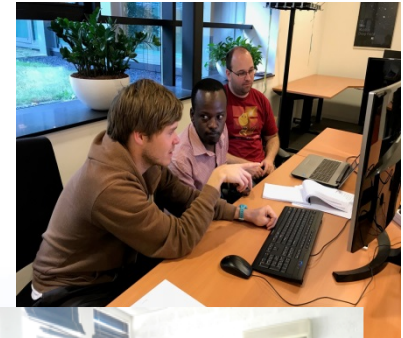




WP9 – Capacity for VLBI in Africa





Motivations, objectives & actions

VLBI & JIVE:

Growing and strengthening global communities and facilities:

- New research user communities
- New facilities

Strategic links:

- EU (inc JIVE) links to AVN/SKA partner countries
- Increase profile in new communities

Support UNSDGs via human capital development across multiple sub-Saharan countries



- Extensive graduate level training in astronomy and specifically VLBI techniques
- New training opportunities to support Postgraduate researcher development
- New training technical and operational training opportunities
- Supporting new networks & people
- Lecture tours and supporting new initiatives - Outreach and inspiration
- Raising the profile of VLBI (& astronomy)

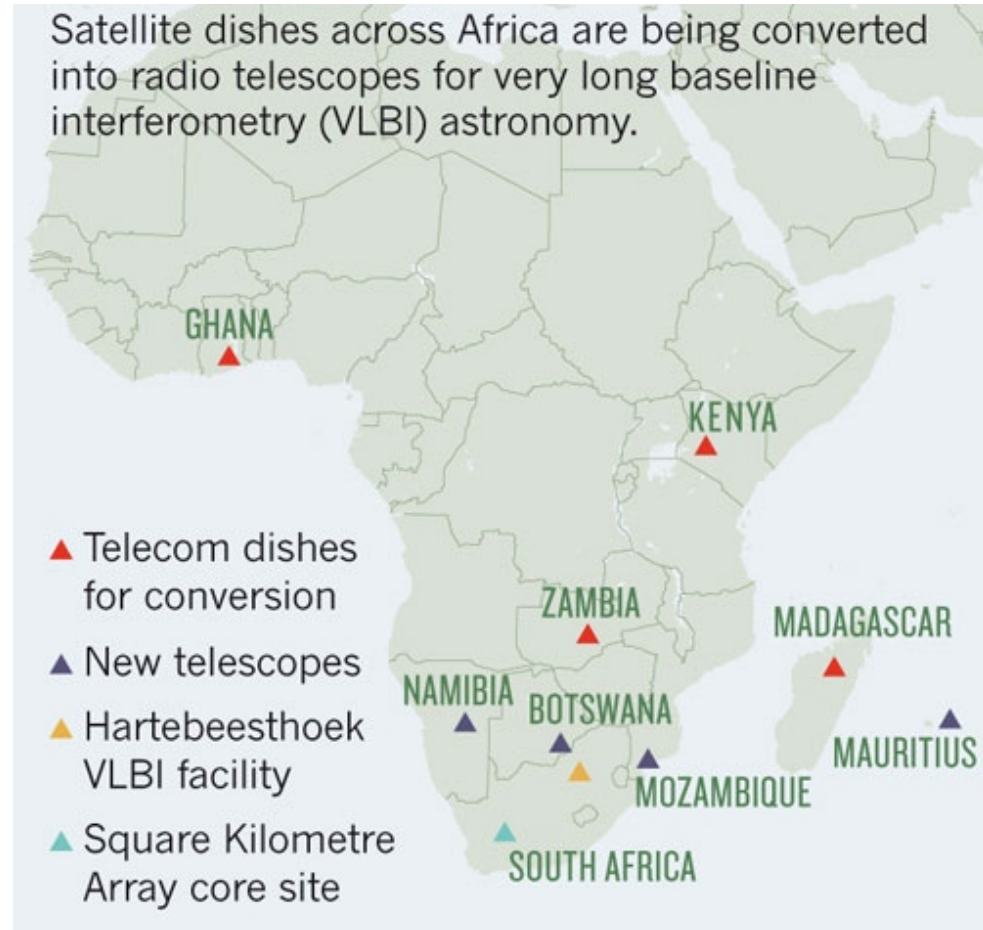
...Creating a conveyor belt of talent, enabled by more equal opportunities...



Context: African VLBI Network (AVN)

- Prior to the SKA, a network of dishes is being established in the partner countries by SKA-SA
- This will form a very long baseline interferometer (VLBI) network in Africa
- Constructed by SKA-SA funded by the African Renaissance Fund
- Toward SKA (phase 2) - stations in all of these countries
- AVN key to linking SKA with VLBI (EVN+)

... success /sustainability of the AVN (& SKA-phase2) requires skilled local scientist and engineers in the host countries → this is the biggest challenge



Nordling (2012) Nature 488, 571





Activities - DARA & JUMPING JIVE

Strong coordination (via shared leadership Hoare/Beswick)

... compliment and support each other – Shared goals and efficient resourcing

Combined - DARA/JJ programme – structure (& limitations)*

1. Inspiration/outreach

- Outreach lecture tours across partner countries (beyond capitals)

2. Basic training programme – 7 countries, ~70-100 students/yr

- An introduction to radio astronomy (& programming/STEM) for graduates

3. Training missions (Africa → EU or Africa)

- Opportunities for ‘basic training graduates’ to get new skills/build contacts

4. Advanced training programme

- PhD and MScR positions in UK (limited numbers)

5. Facilitating future network coordination

- Build links for future AVN(-EVN) technical activities





COVID impacts to sustainable futures

- [March 2020] the global COVID pandemic forced a pause of all f-2-f training and travel. Most WP9 activities paused
 - Impacting 2019/20 & 2020/21 cohort (>100 enrolled students)
- [April 2021] - restarted program, pivoted training to COVID-safe hybrid/remote mode:
 - Two-week long schools ran simultaneously in 7 African countries
 - Only possible due to EC-JJ no-cost extensions
 - Required a larger cohort of remote and local lecturers and tutors
 - NEW material, fully recorded suite of lectures & data tutorials
- Long term legacy of training materials and recorded lectures for beyond JUMPING JIVE.
- Increased local logistics and organisation

DARA DEVELOPMENT IN AFRICA WITH RADIO ASTRONOMY

All countries (2021-)

In 2021, DARA went virtual just like everything else. Luckily, many willing volunteers put together the following lectures for this iteration.

- Lecture 01** - Introduction and course overview

Lecturers - Dr Rob Beswick (U. Manchester) and Dr Jack Radcliffe (U. Pretoria/ U. Manchester)

L1 - Introduction & course overview
Watch on

[SLIDES \(PDF\)](#)

- Lecture 02** - Introduction to CASA and the measurement set
- Lecture 03** - Introduction to radio interferometry

Lecturer - Dr Joe Callingham (U. Leiden)



WP9 actions & outputs # 1

A. Graduate basic trainees

B. Extensive training (>8weeks f-2-2 per trainee)

C. Jumping JIVE trainers involved from across the EU

D. New sustainable initiatives supported



A. Over 280 graduate trainees (plus 70 more enrolled for 2021/22 – post JJ period)

B. Each trainee received >8weeks intensive training – including:

- Physics Astronomy
- STEM training
- Programming /computing
- VLBI data processing
- Telescope operations and observing
- Outreach
- Science policy advocacy
- Soft skills (inc. CV writing, applications etc)

C. >> 30 individual JJ-supported/affiliated lecturers/tutors involved from Lecturers from >8 different countries and >20 different institutes

D. Supported the set-up of new sustainable initiatives e.g.

- African Winter School in Radio Interferometry - African version of ERIS
- ‘ASTRON/JIVE Traineeship programme in operations of arrays’



WP9 actions & outputs #2

- A. Supporting new research groups, new users
- B. JJ/DARA basic training graduates
- C. Opportunities for graduate students and staff
- D. Legacy of training material
- E. Outreach and Profile



- A. New research communities and groups (e.g. TUK, Kenya; GSSTI, Ghana..)
- B. Multiple 'graduates' working toward PhDs across the world including in UK, SA, The Netherlands, Sweden, Mauritius, Kenya and so on. Some graduated and returned to home countries
- C. Supporting researcher and new groups via visits to EU. New collaboration, training via support to specialist schools (e.g. ERIS)
- D. 10s of hours of pre-recorded lectures, tutorials and teaching material
 - providing a legacy training sets for continued impact beyond Jumping JIVE.
- E. Lecture tours reaching 1000s in Ghana, Zambia, Madagascar
 - Schools (primary to secondary) and Universities, policy makers



Evidence of impacts

“I want to make sure our science is reaching young people, especially girls. Girls are not really pursuing the higher sciences, and I dream of encouraging them to understand what interesting and cool science is happening in Ghana” SOURCE: Dr Naomi Asabre Frimpong, DARA/JJ graduate and participant in JUMPING JIVE training at ASTRON/JIVE 2017, and JJ-sponsored lecture tour of Ghana. She is now working on the operations of 32-m Kutunse Radio Telescope in Ghana - Writing in 2018 NatureJobs about her training and ambitions.

Graduates Receive ***“high-quality training helping to develop the first generation of astronomers and operational scientists within these developing nations”*** and ***“The success shows that the concept of development for astronomy and the DARA [& JJ] projects, has managed to capture the imagination of policy makers and funders, and created a pipeline of interest in Africa and beyond”***. SOURCE: 2018 Independent Thematic Impact Evaluation report Commission by the UK Gov. Dept. of Business, Education, Innovation and Science.

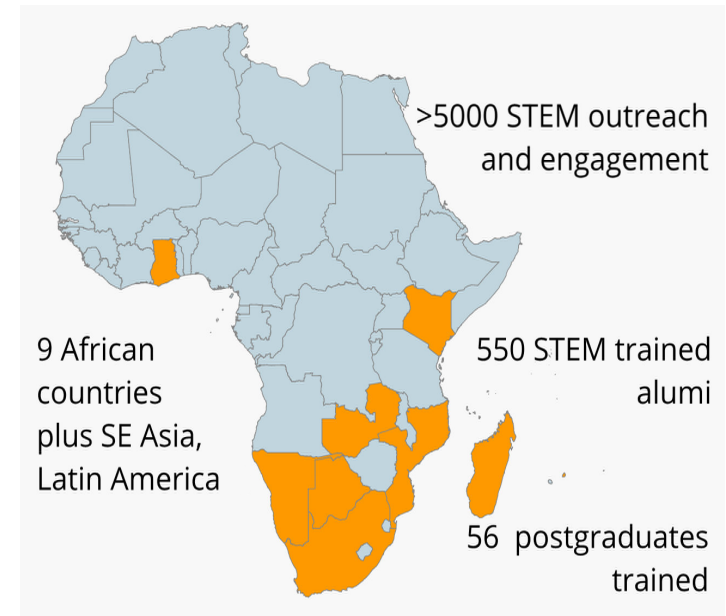
These programmes have provided “significant advances in (a) human capacity development initiatives, (b) the strengthening of relevant institutional capacities, (c) the formulation of new academic programmes around physics and astronomy, (d) the roll-out of high-performance computing capability and big data training interventions and (e) science engagement and outreach.” - SOURCE: 2019 Joint Government Ministerial SKA Partner county meeting



Stimulating wide impacts

DARA & JJ-WP9 have (and continue to have) wider impacts well beyond project goals e.g.

- Spun out many similar activities around the world including
 - e.g. Sister DARA-BIG DATA, ThaiCapacity, RadioAstronomy in the Americas (RADA) programmes
 - increasing global reach and impact.
- *From...* training alumni as entrepreneurs
 - e.g. multiple alumni company start-ups e.g. eco-Astro-safari companies
- *...to* addressing education gender inequalities
 - e.g. Project Elimisha Msichana, Elimisha Jamii Founded by a VLBI PhD research student and alumni that is using astronomy and mentorship to support girls education in rural Kenya (IAU-OAD supported)



Including JJ & DARA, as well as global sister programmes from Thailand, to Latin America



Returning to Isaac's story*

From a farm in rural Kenya to postgraduate position in the EU → now PhD studentship at TUK Kenya

(all with EU-JJ help along the way)



PROBING THE CONSEQUENCES OF ACTIVE GALACTIC NUCLEI (AGN) OUTFLOW ON DENSE MOLECULAR GAS

BY

Isaac M. Mutie

REG NO. SPPZ/05187P/2020

A PROPOSAL SUBMITTED IN PARTIAL FULFILMENT OF APPLICATION REQUIREMENTS FOR DEGREE OF DOCTOR OF PHILOSOPHY IN ASTRONOMY AND ASTROPHYSICS

DEPARTMENT OF ASTRONOMY AND SPACE SCIENCE
SCHOOL OF PHYSICS AND EARTH SCIENCES
FACULTY OF APPLIED SCIENCES AND TECHNOLOGY

TECHNICAL UNIVERSITY OF KENYA

* Progress update from Mid-Term Review presentation

October 4, 2021

12/10/2021

Final review/remote

10