



RadioAstroTech (RAT) I Workshop

Report 2017

16th January, 2017 to 23rd January, 2017

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Concept

The whole idea borders around being an active contributor to the awareness of the Square Kilometre Array (SKA) research and also produce fine scientists to meet the primary focus and mission of the Ghana Space Science and Technology Institute (GSSTI). The name RadioAstroTech (RAT) workshop captures vividly what the focus of this workshop is; i.e. Radio Astronomy Techniques and Technology where we particularly expect to attract undergraduate and post-graduate students with a background in mathematics, statistics, physics, signal/image processing and computational science and engineering or even just exceptional software skills. By making this a yearly event, we hope to achieve the following:

- Solidify the understanding of the concepts of the facilitators whilst imparting new knowledge to those new to Radio Astronomy.
- Increase awareness of the Ghanaian academic community and the general public on the research being done in SKA and the prospects available thereof.
- Contribute to raising a community of Ghanaian radio astronomers which will in turn influence the overall contribution of Ghana to the SKA project as a partner country.

Goal

This maiden edition of the RAT workshop was aimed at creating a platform for skills transfer and an inclusive, productive dialogue between students and young researchers in the fields of Radio Astronomy and Interferometry. This platform would in turn make room for the students to have a lot of interactions with the researchers and help embed acquired skills through repetition, reiteration and discussions. Many of the ideas and skills that were taught in the first two days formed the basis for discussions and tutorials later during the workshop.

Proposed topics to be covered included:

- Introduction to Linux Commands
- Git & GitHub
- Scientific Computing using Python Programming Language
- Introduction to Radio Astronomy
- Introduction to Radio Interferometry
- Calibration and Imaging Techniques used in Analysing Astronomical Data such as Galactic Foregrounds, AGNs and Masers.

Goal (continued)

These were planned to have spanned two weeks, however, actual time spent was only a week mainly due to lack of funding. See table below for tentative schedule and actual schedule.

Tentative Schedule

	1/16/2017	1/17/2017	1/18/2017	1/19/2017	1/20/2017	1/23/2017	1/24/2017	1/25/2017	1/26/2017	1/27/2017
TIME	Location	Location	Location	Location	Location	Location	Location	Location	Location	Location
9:30-10:00	Welcome Address (Motivation, Objectives & Prospects) Director (GSSTI)	Practical Session (Programming in Python) Samuel Twum	Practical Session (NumPy & SciPy) Samuel Twum	Introductory Lecture Radio Astronomy Proven Adzri	Introductory Lecture (Fourier Transform & Convolution Techniques) Theophilus Ansah Narh	Practical Session (Interferometry Simulations) Theophilus Ansah Narh	Introductory Lecture (Galactic Foregrounds & PyGSM) Diana Klutse	Introductory Lecture (Calibration Techniques - CASA, AIPS) Alexander Akoto Danso	Visualization tools (tigger , kvis) Samuel Twum	Bursary Opportunities
10:00-11:00	Introductory Lecture (Linux OS & GitHub) Samuel Twum									Antenna Design Severin
11:00-11:15	Break	Break	Break	Break	Break	Break	Break	Break	Break	Break
11:15-12:15	Practical Session (Linux OS & GitHub) Samuel Twum	Introductory Lecture (Python OS module, Numpy, Scipy, PyLab) Samuel Twum	Practical Session (dictionary) Theophilus Ansah Narh	Introductory Lecture (Interpolation Techniques) Theophilus Ansah Narh	Practical Session (Fourier Transform & Convolution Techniques) Theophilus Ansah Narh	Practical Session (Pyrap) Theophilus Ansah Narh	Practical Session (PyGSM) Diana Klutse	Practical Session (CASA) Alexander Akoto Danso	MASERS Proven Adzri	SEMINAR
12:15-13:00		Practical Session (Python OS module) Theophilus Ansah N	Practical Session (PyLab) Samuel Twum							
13:00-14:00	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
14:00-14:45	Practical Session (Linux OS & GitHub) Samuel Twum	Practical Session (Python OS module) Theophilus Ansah N	Introductory Lecture (Handling FITS files) Theophilus Ansah Narh	Practical Session (Interpolation Techniques) Theophilus Ansah Narh	Fundamentals of Radio Interferometry Alexander Akoto Danso	Searching algorithms Theophilus Ansah Narh	Introductory Lecture (HEALPix Mapping) Theophilus Ansah Narh	Practical Session (AIPS) Alexander Akoto Danso	VLBI Alexander Akoto Danso	SEMINAR
14:45-15:15	Introductory Lecture (Python - data structures, functions) Samuel Twum	Practical Session (NumPy & SciPy) Samuel Twum	Practical Session (Handling FITS files) Theophilus Ansah Narh				Practical Session (HEALPix Mapping) Theophilus Ansah Narh			Concluding Remarks & Acknowledgement

Actual Schedule

	1/16/2017	1/17/2017	1/18/2017	1/19/2017	1/20/2017
TIME	Location	Location	Location	Location	Location
9:30-10:00	Welcome Address (Motivation, Objectives & Prospects) Director (GSSTI)	Practical Session (Programming in Python) Samuel Twum	Practical Session (NumPy & SciPy) Samuel Twum	Introductory Lecture Radio Astronomy Proven Adzri Antenna Design Severin Bursary Opportunities	Introductory Lecture (Fourier Transform & Convolution Techniques) Theophilus Ansah Narh
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14:45-15:15	Introductory Lecture (Python - data structures, functions) Samuel Twum	Practical Session (NumPy & SciPy) Samuel Twum	Practical Session (Handling FITS files) Theophilus Ansah Narh		

Location, Facilitators and Resources

The maiden edition was organized on 16th January, 2017 through to 20th January, 2017. Since this was the initial inception, we chose the Ghana Space Science Institute of the Ghana Atomic Energy Commission to host the workshop. The computer laboratory facility we used had about 15 working computers. An amount of GHS700.00 was budgeted to cater for the cost of lunch, water and tea break. This amount was raised from contributions by the facilitators of the program with support from Dr. Nana Ama Klutse and Dr. Bernard Asabre.

The key people involved in organising the workshop were the Ghanaian students from the Radio Astronomy Technology and Techniques (RATT) research group as well as one other Ghanaian student in Stellenbosch and another Ghana based PhD Radio Astronomy student studying with University of Ghana and Leeds University.

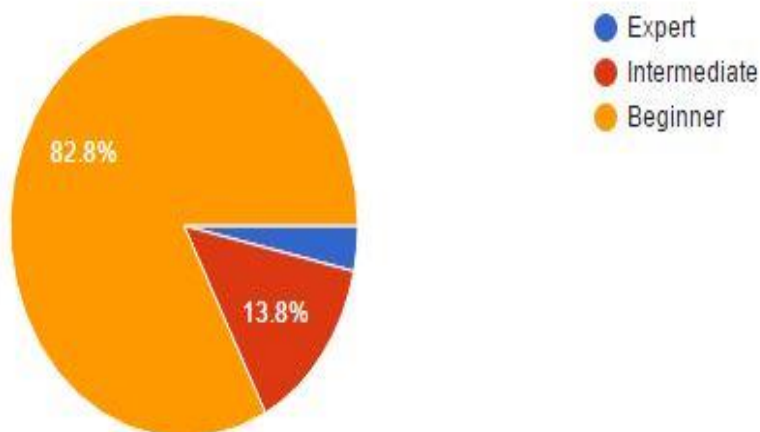
The list of names and the qualifications of the facilitators are as follows:

Proposed Speaker	Institution / Affiliation	Level of Study
Samuel Twum	Rhodes University	MSc
Theophilus Ansah Narh	Rhodes University	PhD
Diana Klutse	Rhodes University	MSc
Alexander Akoto-Danso	Rhodes University	PhD
Proven Adzri	Leeds University / University of Ghana	PhD
Severin	Stellenbosch University	MSc

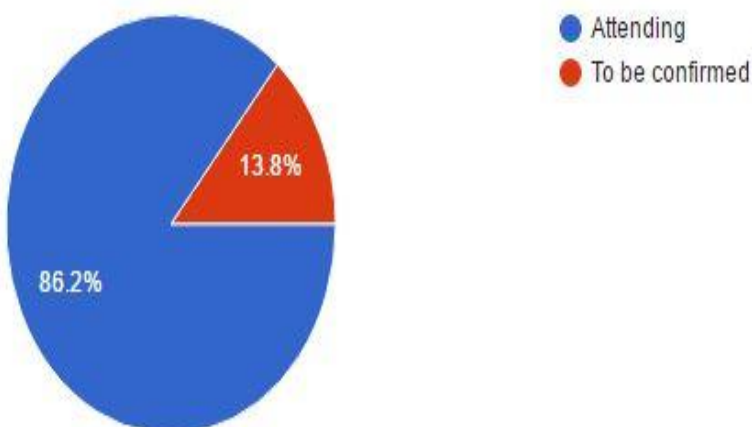
Attendance

Registration was open on 18th November, 2016 and closed 9th January, 2017. By the close of registration, we recorded a total of twenty-nine responses to our registration form. Information collected from interested participants aside biographic details included institution affiliation, background knowledge in radio astronomy and programming language proficiency. The minimum educational requirement of the participants was an undergraduate university degree. We had an average of 23 participants in attendance every day for the entire week that the program was organised. Below is a chart showing the representation of the background of the participants.

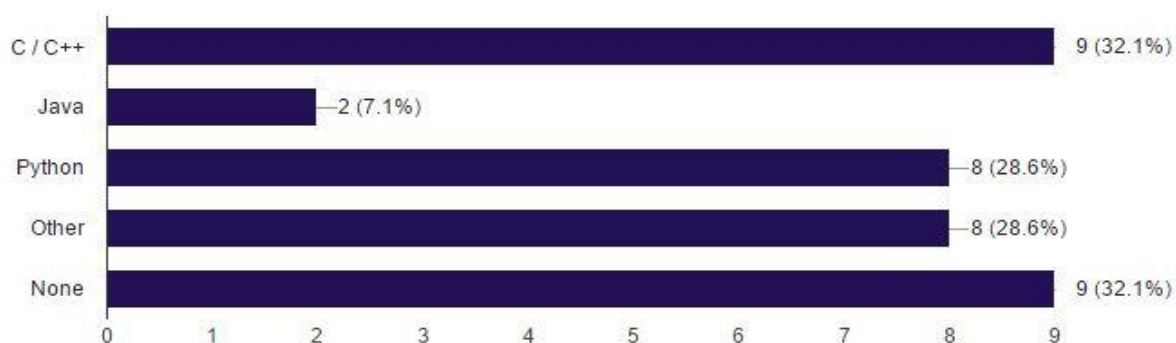
Background in Radio Astronomy & Interferometry (29 responses)



Attendance Status (29 responses)



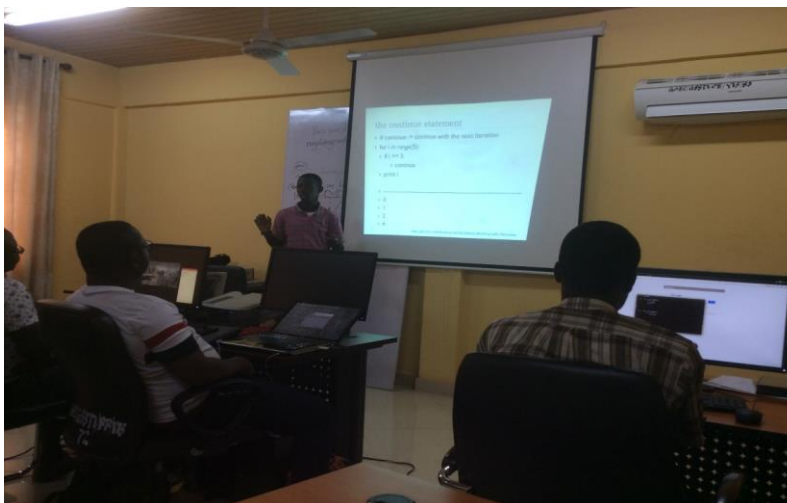
Which of the programming languages do you know? (28 responses)

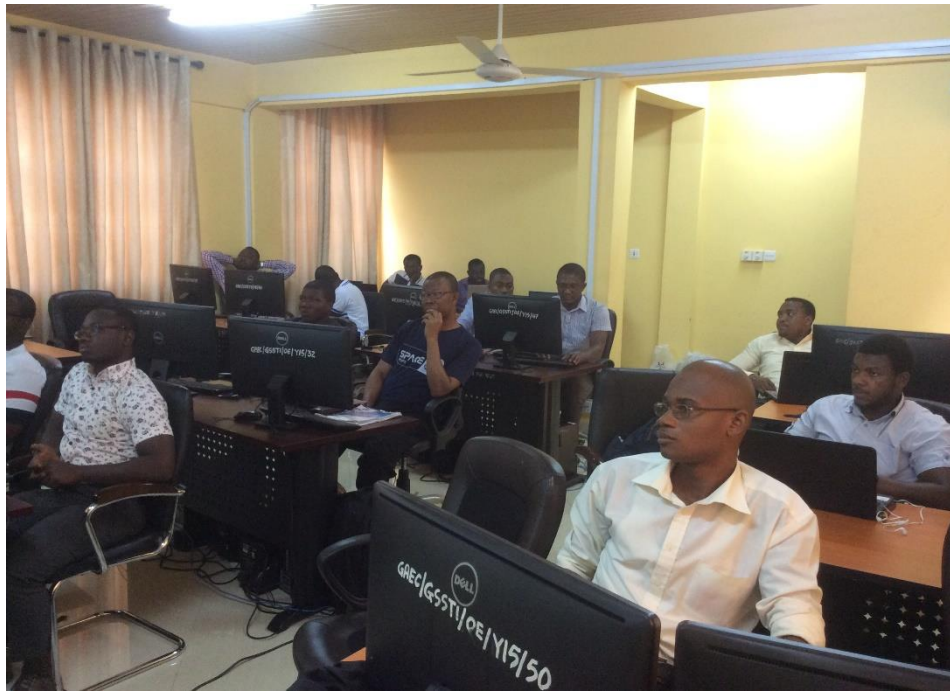


The participants were engaged in hands-on tutorials and taken through basic concepts in Radio Astronomy and Interferometry. The students were very enthusiastic about each material being delivered and appreciated it a lot.

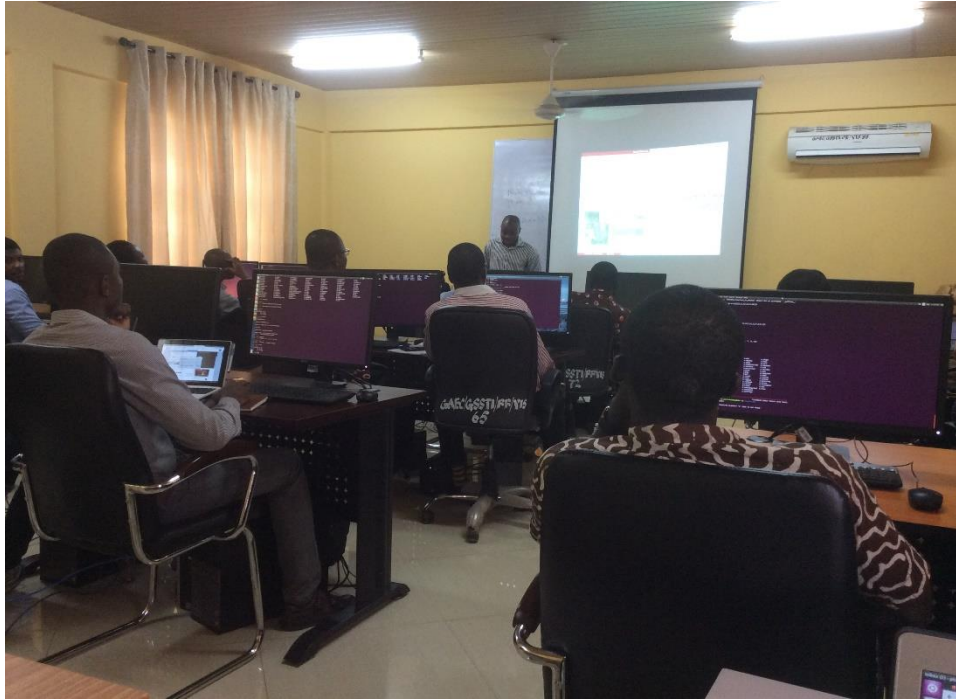
Results

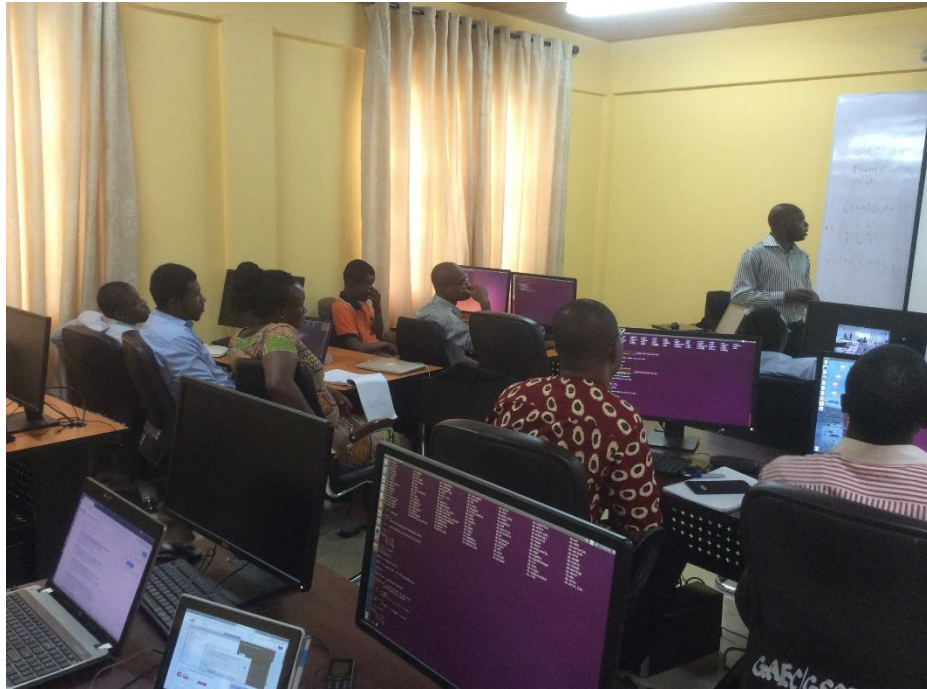
The goals set out were achieved considering the feedback and evaluation responses from the participants. Participants appreciated the hands on sessions and the short talk on antenna structure and bursary opportunities a lot. There were even suggestions to have the workshop run twice or more a year and with collaboration from tertiary institutions. There have been other programs sponsored by the Royal Society and the newly introduced Newton's fund targeted at introducing students to Astronomy. Comparing this to other events, we strongly believe that this maiden edition of RAT workshop is fulfilling its purpose by equipping students with the necessary tools and bridging the gap for communication between young researchers and students.

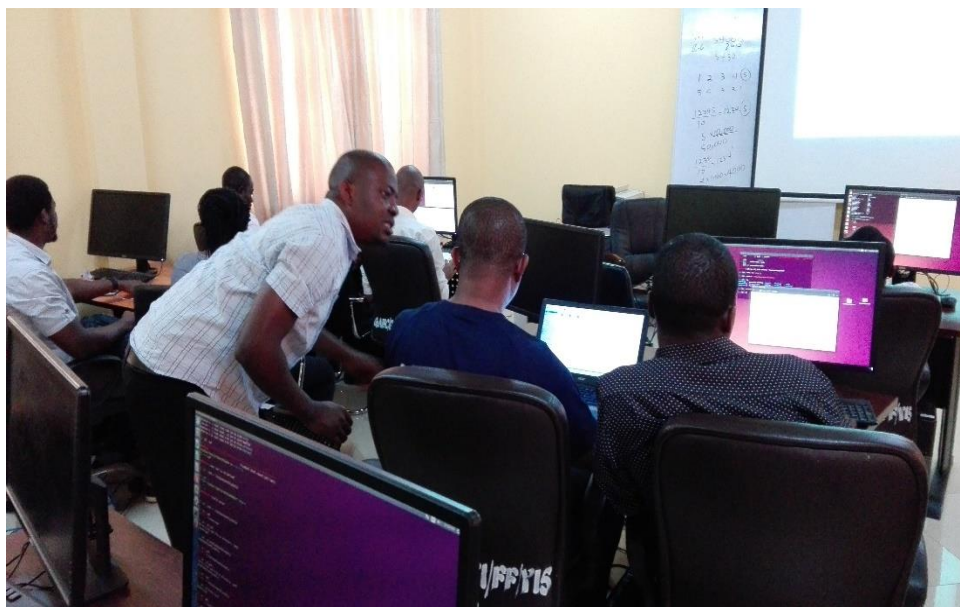


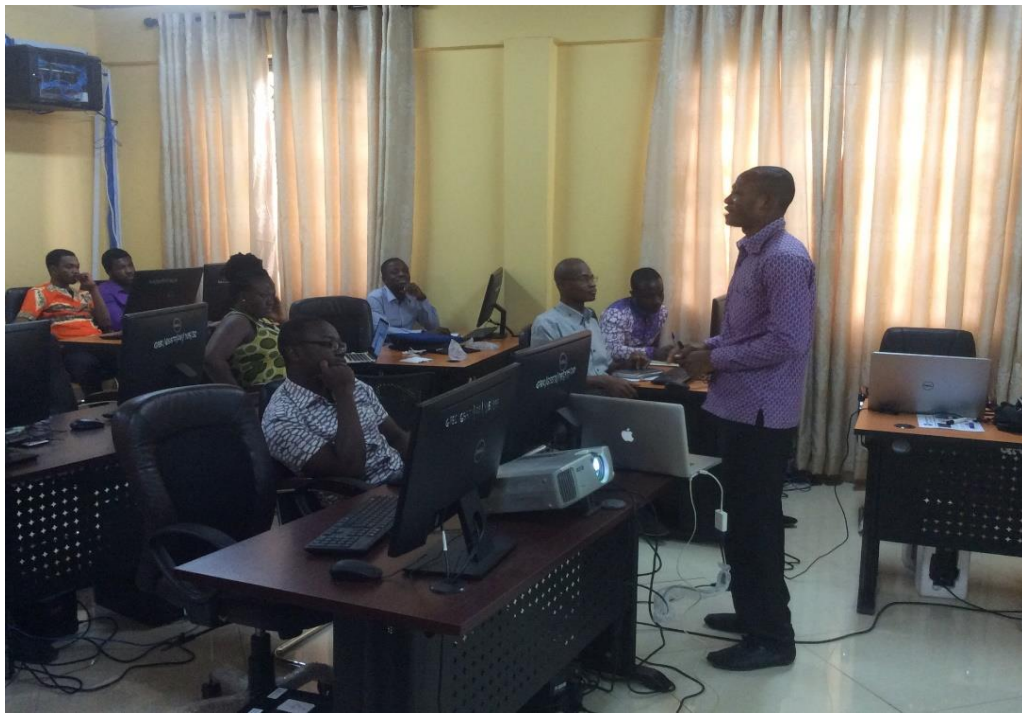












Learning Points

The hands-on sessions were the most interesting parts of the workshop for the participants. The level of involvement was really motivating. We thus, conclude to make the sessions more pragmatic and involving than taking a lecture format. Being able to provide food, water and tea was also a really good idea. It saved a lot of time and avoided participants from having to go look for their own food. If funding had been secured, we could have given a better diet.

Despite the overall success of the program, we had a couple of challenges. We also made no provision for certain things which would have helped if they were noted. Some of the challenges we encountered include commuting to the workshop venue on time and having to close early. This was mainly due to the fact that both facilitators and students were staying far from the workshop venue. Another challenge was the issue of raising enough funds to provide better meals and certificates as well. Finally, much ground as planned in the schedule couldn't be covered since we had to spend much more time than planned to teach the fundamental concepts for the students to understand.

Future Developments

Moving ahead, we hope to run this program on a much wider scale involving more universities and creating awareness about Radio Astronomy. We also would be happy to have some of the senior scientists come along during the workshop. We also include more practical sessions in the series to impart the principles much better.