Ghana Reaps the Fruits of Science Investment

Emmanuel Proven Adzri shares how refurbishing the Ghana Radio Astronomy Observatory has driven economic growth in his country.

By **Rachel Berkowitz**

Astrophysicist Emmanuel Proven Adzri knows better than most what goes into building a national research program from scratch—and the wide-reaching benefits that can come from doing so. In addition to his research at the Ghana Space Science and Technology Institute on methanol masers, astrophysical objects that produce and amplify microwaves from methanol molecules, and on pulsars, rapidly rotating neutron stars that emit beams of radiation, Proven Adzri manages the Ghana Radio Astronomy Observatory (GRAO). He's been involved with the 32-m telescope since its earliest days, and he continues to spearhead efforts to turn it into a hub for astronomy research, education, and—his favorite part—science outreach. In addition, he makes time to direct a foundation that helps disadvantaged kids develop math and science skills through astronomy. "In my free time I do outreach, at work I do outreach, and at home I try to teach my kids about robotics and programming," he says.

Credit: E. Proven Adzri/GSSTI

Physics Magazine caught up with Proven Adzri to learn how he built his astrophysics career while he participated in the development of Africa's largest radio telescope and in Ghana's push to develop a comprehensive space and astronomy program.

All interviews are edited for brevity and clarity.

When did you first get involved with the GRAO?

The project to refurbish the GRAO's dish into a new telescope began in 2010, and I've been part of the project since 2012. The GRAO used to be a telecommunications station, but it and many other dishes had been abandoned, going unused for more than a decade. The building of the Square Kilometer Array (SKA)—an array of radio telescopes being built in Australia and South Africa that communicate with each other and together have a collecting area of a square kilometer—highlighted the possibility of bringing these old dishes back into use. The dishes became the focus of a collaboration to develop an Africa-wide network of radio telescopes, to build capacity and optimize African participation in the SKA.

I worked on science commissioning after my master's degree in computational engineering. I thought my simulation and modeling skills could be useful for working on the science aspects of the telescope.

Why were you inspired to get into astrophysics in general?

Studying the Universe and space exploration has been my childhood dream. After my master's degree, I joined the newly created Ghana Space Science and Technology Institute as a

research assistant. While at an astronomy workshop, I met my future PhD supervisor over coffee, and we just clicked. He used single-dish and interferometry radio-telescope data to look for methanol masers. I was one of the few people who was trained in the science of the telescope setup.

What are methanol masers, and why are they interesting?

They're populations of methanol gas molecules with bright, single-frequency microwave emissions that arise from molecular excitations. They're like the lasers that we have on Earth. But the signals come from far away, where new stars are forming. They're still mind-boggling because we don't understand how they come about.

But you can now detect them at the GRAO?

Yes. We're currently monitoring more than 20 methanol masers.

What other observations are performed at the GRAO?

The idea is to build research groups in different areas. For methanol masers, we have a collaboration with the University of California Santa Cruz, which is funding a master's student who is using data from the GRAO to try to detect periodic methanol masers.

Other researchers are looking at the physical conditions and kinematics of the gas surrounding active galactic nuclei, and others are studying the long-term behavior of pulsars and what makes them glitch—suddenly increase their rotational frequency.

Besides specific research results, what impact has the GRAO had?

It's brought an influx of scientists and engineers into Ghana. South Africa and the UK have invested in building human capital here, and it has paid off. There were no astronomers in Ghana before the GRAO was built. Now we have more than 10 Ghanaian PhDs and 60 master's students trained in astronomy.

Has the GRAO lived up to your expectations as an educational and outreach tool?

Yes! About 200 students in Ghana and Africa have been trained in astronomy using the GRAO telescope. The GRAO is now an astronomy training center in Africa. More than 3000 students have visited the GRAO as part of science outreach.

What's next for the observatory?

The GRAO is going to be part of the Very Long Baseline Interferometer (VLBI) Network, which is a network of radio telescopes spread across Europe, Africa, and Asia. These telescopes will all observe the same astronomical source at the same time in order to get a more detailed picture of that source. The more telescopes there are in such a network, the better the image quality. Spacing of the telescopes also matters—when they are spaced farther apart, the longer baselines enable better angular resolution. We've done some tests with the rest of the European VLBI Network in 2017, and we're hoping to get another test in this year. We are hoping to build the GRAO into a center of excellence in astronomy training in Africa.

What is Ghana's outlook for astronomy, beyond this telescope?

The government announced a National Space Policy in 2024. We're just waiting for the new government to approve the formation of the Ghana Space Agency and upgrade our status so we have more resources. We want to launch satellites next.

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