



NoRCEL's Engagement in Africa: The AstroScience Exploration Network (ASEN)

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Abstract

The AstroScience Exploration Network (ASEN) is the latest innovative initiative from the Network of Researchers on the Chemical Emergence of Life (NoRCEL). Materializing on the vibrancy of the African continent, recognizing its people as a key asset, and building on specific strategic advantages, ASEN will funnel the appetite for scientific knowledge through an educational hub that paves the way for the Global South to come to the fore in new global endeavors and will eventually help build a variety of career paths in a diversifying economy. **Key Words:** Outreach—African continent—Sub-Saharan—Education—Astroscience—Astrobiology—Astrochemistry—Astrophysics. *Astrobiology* 23, 821–823.

Introduction

SCIENTIFIC RESEARCH CAPACITY across the globe does not follow the population distribution but has been strongly affected not only by economic power but also by long historic trends, cultural traditions, societal context, and governance priorities. It is a given fact that in the 20th century Western Europe, North America, and USSR/Russia had the largest visibility in science, whereas the Roman Empire, India, Greece, Egypt, China, and the Middle East were recognized as centers of knowledge and education in earlier times. Investing in people, their skills, and creativity has always paid off. The fundamental sciences, which inspirationally deliberate the “hows” and the “whys,” play a particularly powerful role in fostering a society that drives benefits from innovation and stands in a pivotal place between education and societal advancement. The fact that small countries, such as Mauritius, can become leaders in innovation demonstrates that leaping ahead is not primarily a question of

scale but of well-tailored strategic investment in areas where specific strengths and advantages can be built upon. In contrast, just copying the biggest players and then trying to seek competition is likely to be a recipe for always lagging behind.

The astrosciences are a field that particularly manages to fascinate and that also has a deep cultural rooting. This provides the opportunity to widely reach out and take people on a journey that connects with their experiences. The study of space science is no longer the sole domain of astronomy and physics but now also encompasses chemistry and biology, as well as computer science and modeling, geo-biochemistry, informatic studies, mathematics, and even philosophy and arts; all of these have more recently taken their platform in the scheme of astroscience. This means that we now see a more well-rounded view of nature, transcending boundaries of scientific “disciplines,” which also gives the study of astroscience a broader appeal.

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NoRCEL's Engagement in Africa

The AstroScience Exploration Network (ASEN), a pioneering innovative initiative of the Network of Researchers on the Chemical Emergence of Life (NoRCEL, <https://norcel.net>), is working to establish an educational hub to enable the Global South to take the lead on new global endeavors.

NoRCEL has been engaging in Africa since 2015, particularly in Ethiopia, Zambia, Tanzania, Zimbabwe, Malawi, and South Africa, and has more recently also reached out to Botswana, Egypt, Morocco, Nigeria, Rwanda, Sudan, and Uganda. Particular points to note that have emerged include the following:

- Africa is vast and diverse. It cannot be defined by the needs of one or even a few “typical” African countries;
- Funding is scarce for science in general and for astrophysics in particular;
- The education system suffers from a general lack of continuity, and astrophysics courses are not available;
- There are inadequate astrophysics employment opportunities available on the continent itself;
- Although gender bias is prevalent around the world, it is particularly a problem in Africa;
- Online events have become widely popular, but connection issues continue to be a deal-breaker for many participants from African countries, not only because of unstable or slow networks but also because of unreliable electricity supply.

Accounting for diversity of societal, cultural, and scientific environments across Africa is a key challenge, and ASEN can foster development at the specific level that meets this. While we will not succeed by copying recipes that were designed for the environments of highly developed countries, we must also not fall into the trap of making ASEN solely follow concepts that reflect the most advanced economies in Africa (*e.g.*, South Africa, Ethiopia, and Botswana). ASEN will be an innovative project that is driven from within Africa, not from outside Africa, and rather than being restricted to Africans, we envisage it evolving into a global endeavor where the spirit of Africa can inspire much beyond its borders such that the Global North can learn.

We will also need to keep the employment situation in mind. Development of scientific capacity and related skills must, essentially, go hand in hand with the opportunities to make good use of it. Unfortunately, though Africa is one of the places most in need of homegrown talent, those who could make a positive difference for their country frequently fail to see an adequate future there and consequently seek employment outside the African continent, with such a “brain drain” ultimately robbing Africa of its future—India is one country which already exemplifies huge levels of brain drain. Therefore, we need to be proactive in building career paths; otherwise, one could end up caught between “Does an astrophysics qualification help to ‘put food’ on the table?” and “Why should I stay here if the only bright future that I see is elsewhere?” It should also be noted that there is a risk of an inter-African “brain drain” toward the more developed economies; for example, talented astrophysicists, as well as astronomers from

elsewhere on the continent, are attracted toward South Africa because of their Square Kilometre Array initiative and related technologies.

ASEN needs to be developed gradually, and we would need to attract students and raise them up while building further capacity that enables them to further grow into future proactive and creative thinkers and leaders with international visibility; we can build on previously scientific collaboration in astrophysics by offering tailored hands-on training and mentoring.

As a result, skilled young people would provide the springboard for new industries, ultimately driving further economic diversification and specialized higher-level degree programs, requiring accomplished practitioners of African origin, thereby opening up further employment opportunities.

Africans have already excelled in mathematical and computational epidemiology, suggesting that theoretical aspects of astrophysics and astrobiology could be practical inroads toward rewarding careers.

The African continent also provides a unique landmass with a rich geology and many astrobiological features (*e.g.*, The Great Danakil Depression in Ethiopia or a natural nuclear reactor in Gabon), as well as vast desert areas (*e.g.*, Sahara and Namib Deserts), where meteorites could be easily discovered. Africa’s clear dark night skies and unpolluted air are ideal for optical astronomy, while large zones practically void of radio waves make Africa an excellent place for radio astronomy—the lead author has already established astronomy clubs at Chancellor College, University of Malawi and at Copperbelt University, Kitwe, Zambia. This is also exemplified by the Square Kilometre Array, part of which is under construction in South Africa, with additional nodes spread across the continent. “Astrotourism” has already developed, venturing into these dark spaces in anticipation of observing the sky in all its majestic glory. The possibilities are limitless, and we can now imagine young Africans becoming the curators of all these bountiful treasure troves on their own doorsteps.

What Next?

Any good development strategy needs to put people first and invest in fostering their skills. Expertise, rigor, and integrity are the key ingredients to high-quality research, some of which can be world-leading without requiring excessive amounts of funding to be poured into facilities. Neither theoretical work on the fundamental principles of nature, experimental work on the emergence of life, nor observational work on the marvels of the Universe need to be prohibitively expensive. The issue of lack of funding for education in these scientific disciplines needs to be addressed in order to at least begin to offer a serious level of provision for those who seek it. NoRCEL’s engagement in the sub-Saharan African region since 2015 has revealed that there is definite call for more astrophysics by those young Africans who have heard of astrophysics, astrochemistry, and astrobiology. The AstroScience Exploration Network (ASEN) can directly respond to this call and, thus, raise awareness among African institutions in order to enable them to take their aspirations forward to the benefit

of their country, the continent, and the wider world. Sadly, other pan-African issues that affect the prospects and outcomes for students will require a more protracted and complex solution—such as the gender bias in many countries that often leaves girls behind or ignored when it comes to scientific studies. In addition, the many disruptions in the electricity supply and consequent detrimental effect on interconnectivity put a strain on learning processes and result in many African students being at a distinct disadvantage compared to those elsewhere in the world.

As initial first steps, NoRCEL is establishing the publication of an astroscience curriculum that will be made available across the continent. This initiative is being carried out in conjunction with the National Space Research and Development Agency (NASRDA), the University of Nigeria, Nsukka and the Federal University of Lafia.

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