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A Report on Astronomy Activities in West Africa

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1. Introduction

Prior to IHY and IYA 2009, Astronomy activities in West Africa were limited only to research in the universities, though quite a few universities were involved. People used to wonder what the benefits of astronomy study entails. The public and primary/secondary schools were only exposed to astronomy and space science after these two events. Recently, we can boast of students studying astronomy at MSc and PhD levels both within the region and outside the region. Due to the establishment of IAU OAD in Cape Town in 2011, with the aim of using astronomy to stimulate development at all levels including primary, secondary and tertiary education, science research and the public understanding of science, to consolidate the gain of IYA 2009, Astronomy and Space Science activities are on the rise. The West African Regional Office of Astronomy for Development (WAROAD) has been assisting the IAU OAD in achieving its goal of using astronomy as a tool for development. In this report, we present astronomy activities in the region as monitored by WAROAD.

Inauguration of WAROAD

The West African Regional Office was launched in November 2015 in Enugu, Nigeria. The launch was witnessed by the former General Secretary of IAU Piero Benvenuti and the Director of OAD Kevin Govender. The host institution is the Centre for Basic Space Sciences (CBSS), National Space Research and Development Agency (NASRDA) at the University of Nigeria, and the Regional Coordinator is Bonaventure Okere. Countries under the office include Nigeria, Benin, Burkina Faso, Cape Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Senegal, Sierra Leone, Togo, Sao Tome and Principe.

Oversight Committee members: Dr Francis Chizea (Chairman), Emeritus Prof. Pius Okeke, Dr Peter Obiakor, Prof Adomako, Prof. (Mrs) Francisca Okeke. Country Coordinators: Kam Zacharie (Burkina Faso), Eric Aggrey (Ghana), Patrice Okouma (Gabon), Komeni Zacharie (Côte d'Ivoire), James Chibueze (Nigeria)

2. Activities

(*a*) **Formation of Astronomy Clubs**: Since the inauguration of WAROAD, Astronomy clubs have been established in many institutions across the region including Burkina Faso, Ghana, Nigeria and Senegal, among others.

(*b*) **Hands-on Basic Space Science Workshop for primary and secondary school science teachers** This is a workshop designed to promote astronomy understanding for primary schools and junior secondary school science teachers in Nigeria and to bring the basic observational tools of Astronomy and space science closer to them. This project was partly funded by IAU through OAD.

(*c*) **Public Outreach Activities** In Africa, especially West Africa, we have myths, superstitious beliefs, anxiety, fear, misconception etc relating to many astronomical events, and to eradicate all these misconceptions, we need a strong science movement through Astronomical popularization/workshops at the public level. Hence the intensity of public outreach activities especially the AstroBus activity by Senegal among others, such as eclipse observations.

(*d*) **West African International Secondary School for young Astronomers, 2017** The West African International Summer School for Young Astronomers (WAISSYA) is a program held every two years in West Africa. At each summer school, there were approximately 80 participants, mainly undergraduates, from across West Africa. It is organized and taught by a collaboration of international astronomers, the main goals of WAISSYA is to build critical mass of Astronomers in the region. Some WAISSYA alumni are now attending graduate programs across the globe including in countries such as Canada, Portugal and Cameroon, as well as serving as teachers, scientists and engineers at home.

(*e*) **AstroCamp for Girls**: This project is partly funded by IAU through OAD. It is aimed at achieving gender balance in astronomy. The activity includes observation with telescopes and lectures.

3. Challenges

The challenges being faced by the Regional Office include among others, lack of exposure of West African students to astronomy facilities, no introduction of astronomy programmes in schools curriculum, funding, and French-English language dichotomy.

4. Facilities

In 2009, Nigeria, among other countries in West Africa, participated actively in the International Year of Astronomy (IYA 2009) which won a Hunters Optical Telescope as the best organized group. Between these periods and now, West Africa has witnessed tremendous growth in Astronomy and Space Science. This growth can be seen in the acquisition of a 1 m optical telescope by Burkina Faso, the launching of a 32 m Radio Telescope by Ghana, increase in the number of universities offering Astronomy and Space Science programmes and the numerous outreach, workshops and summer schools in different parts of West Africa.

References

Nat Gopalswany, Joseph Davila, Barbara Thompson and Hans Haubold, The UN Basic Space Science Initiative for IHY 2007, IAU Special Session No. 5 2006.

http://iaucomm4646.frm.utn.edu.ar/newsletter/

Strubbe, L.E. anf Okere B., West African International Summer School for Young Astronomers, Proceedings of IAU, Vol 11, GA A29A 2014.

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Southeast Asia Regional Office of Astronomy for Development (SEA-ROAD)

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(*c*) Prof. Khin Swe Myint (Mandalay University), Myanmar
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(*e*) Prof. Hasan Abu Kassim – UM, Malaysia
(*f*) Prof. Boonrucksar Soonthornthum (NARIT), Thailand
(*g*) Dr. Utane Sawangwit (NARIT), Thailand

1. Main Goals

(*a*) Strengthen the already existing Southeast Asia Astronomy Network (SEAAN)'s ties among the active national members (Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam) and pursue emerging collaborative efforts with new national members such as Brunei Darussalam, Cambodia, Laos PDR, Singapore and Timor Leste, as one of the driving forces behind SEA-ROAD

(*b*) Integrate SEA-ROAD with International Training Centre in Astonomy under the auspices of UNESCO (ITCA) to further expand collaborative horizons from Southeast Asia to other regions of the world. As a result, OAD and ROADs shall be empowered with human resources development via trainings such as winter and summer schools in all levels covering schoolteachers, young researchers, university students, university lecturers, etc.

(*c*) Develop SEA-ROAD to be the ultimate human resources database and excellence centre in Astronomy of the entire Southeast Asian region where astronomical activities and information together with manpower development are easily accessed in a one-stop service fashion.

(*d*) More aggressively tap on valued chains of astronomy and related sciences in the region to play more concrete role in supporting regional astronomy especially from the private sector.

(*e*) Create effective portal for cooperation and collaborations such as a regional research centre for researchers in Southeast Asia to work more closely with less restrictions where researchers can pool their research work with matching funds.

2. Challenges

(*a*) More collaborative efforts in bilateral and multilateral manners among the national members to create an ever better channel of collaborations based upon the MoU, leading to more concretely strengthened SEAAN.

(*b*) Significantly increasing number of both Capacity Building trainings such as Astronomical Research Techniques, Post-graduate trainings with Knowledge Transfer trainings such as Basic-intermediate trainings for schoolteachers and school students. Furthermore, number of students pursuing astronomy at the university level shall be elevated.

(*c*) Escalating number of IAU national members from Southeast Asian region soars with more visibility of astronomy in the region through active rising numbers of public outreach activities.

(*d*) More funding agencies from the private sector are pouring in to participate more in astronomical activities either in cash or in kind. Proliferating number of volunteers associated with SEA-ROAD and its affiliated ITCA under the Auspices of UNESCO shall be significantly on the rise.

(*e*) Number of research projects is considerably endowed with effectively matched funds from regional governments and private sector.

(*f*) Visibility of astronomy in the region is, currently, considerably very low. In 2015, Association of Southeast Asian Nations Committee on Science and Technology (ASEAN COST) adopted SEAAN as a partner of Sub Committee on Space Technology and Application (SCOSA), after decades of the establishment of ASEAN. Therefore, the main task of SEA-ROAD ahead is to put astronomy at the forefront of STEM Education agenda in the region.

(*g*) Discrepancies in the development of facilities and infrastructure in astronomy in the region are high. Sufficient and appropriate facilities and infrastructure for each member country shall be encouraged and felt through the existence of SEA-ROAD.

(*h*) Main mechanisms to drive the regional astronomical community are currently attributed to SEAAN and Southeast Asia Young Astronomer Collaboration (SEAYAC), which are seen as driving forces for sustainable development of astronomy for the entire region. The sustainability of SEA-ROAD is also a challenging task to the empowerment of the aforementioned SEAAN and SEAYAC.

(*i*) SEA-ROAD, other ROADs and LOADs in the next challenging chapters in the years to come, shall work more closely with overlapping interests with high impacts. These inter-regional collaborations will bring in an influx of human resources and funding from major sponsors from both public and private sectors alike.

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Lessons learned by the Andean ROAD

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Abstract. The Andean Regional Office of Astronomy for Development is now three years old. The structure of the Office replicates the target groups in the Central Office into three groups: Universities (Task Force 1), Schools (Task Force 2) and the General Public (Task Force 3). In 2013 we gathered with the potential stakeholders in the region to define a work plan 2015-2020 on these fronts. Here we summarize our sucesses and biggest challenges.

Keywords. Developement, Post-Development

1. Introduction

The Andean Regional Office of Astronomy for Development (ROAD) started its activities in 2013 and was officially signed into existence in 2015. After three years of official operations we have deployed different activities first outlined in our original proposal †. Here we present our structure, successes, challenges and outlook for the next two years.

2. The Andean ROAD structure

The Andean ROAD coordination is a shared responsibility between Los Andes University (Colombia), Parque Explora (Colombia) and the Chilean Astronomical Society. The structure of the office defined its strategy with three different targets: Universities, Schools and the General Public.

3. Successes

The most important success has been keeping a conversation with the central OAD office and the IAU members interested on development activities. The networks created in such conversations have helped us to keep motivated and define new strategies.

Some other succesful initiatives include:

• Organizing two regional schools aimed at advanced undegraduate and graduate students. The first one was held in Quito (2014) with a emphasis on astroparticle physics. The second one was held in Bogotá (2015) with a focus on cosmology.

† https://github.com/AndeanROAD/ProposalROAD

• Organizing two regional meetings aimed at defining the structure and projects to be developed by the Andean ROAD. The two meetings have been held in Bogotá (in 2013 and 2015).

• Developing didactic material for visually impaired people (project *Astronomía con todos los sentidos*). This material is currently being used across Colombia and Chile.

• Obtaining funding for two PhD positions for Colombian Students in Universidad Chile through the Radio Astronomy Working Group of the Andean ROAD.

4. Challenges

The main challenge has been running the activities through volunteers and without permanent funding. Another challenge across all our lines of work has been finding better ways to share across institutions the lessons learned and produced materials. We have experienced communication issues with OAD Task Forces, which hampers our ability to follow up on OAD-financed projects. This has a non-negligible effect on the replicability and sustainability of such projects.

We also lost the coordinator for the General Public activities, this has left us with only two active lines of work: Universities and Schools.

Another meta-challenge has been trying to define what development means for us in our region. The mainstream development concept used by the OAD is still very much influenced by ideologies from the global north. Postdevelopment concepts (based on a decolonial and more balanced conversation) although more interesting and relevant to our realities (Grosfoguel (2002)), are harder to bring into the conversation of hierarchical organizations (IAU, OAD, ROADs).

5. Outlook

In the next two years the Andean ROAD will continue working with two important goals in mind: organizing two more regional meetings (Perú and Bolivia) to discuss strategies to establish astronomy (at the research, teaching and outreach level) as a tool for development and consolidating the production of materials for the *Astronomía con todos los sentidos* program. We seek to expand the scope of activities for the Radio Astronomy and Astroparticles Working groups by setting working sessions along regional meetings that will take place in the next couple of years.

References

Grosfoguel, R. (2002), Colonial Difference, Geopolitics of Knowledge and Global Coloniality in the Modern/Colonial Capitalist World System, *Review* 19, 2, pp. 131-154.

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IAU South West and Central Asian ROAD: regional collaboration in research, education and public outreach

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Abstract. Since 2015, Armenia hosts one of the regional offices, IAU South West and Central Asian (SWCA) ROAD. At present, already 6 countries have officially joined (Armenia, Georgia, Iran, Kazakhstan, Tajikistan, and Turkey), but the Office serves for a rather broad region, from Eastern Europe to Central Asia. We run activities in 3 directions, so-called Task Forces (TF): TF1 *Universities and Research*, TF2 *Children and Schools* and TF3 *Public Outreach*. We present our projects (including 2 grants from the IAU OAD) and all other accomplishments and discuss the role of our ROAD in maintaining contacts between the regional countries. Namely, we have initiated Astro Tourism project that perfectly fits to the IAU Strategic Plan's goals as a tool for development of the society. Most up-to-date information about the IAU SWCA ROAD is available on its webpage at http://iau-swa-road.aras.am/eng/index.php.

Keywords. IAU, OAD, ROAD, astronomical research, astronomical education, public outreach, astronomy for development.

The objective of the IAU's Strategic Plan (SP) is to use Astronomy to stimulate development in all regions of the world. Crucial to the implementation of the SP was the creation of a global "Office of Astronomy for Development" (OAD). The OAD was tasked with establishing and strategically coordinating Regional Offices (ROADs) and Language Expertise Centres (LOADs) across the world as well as three Task Forces, namely (i) *Astronomy for Universities and Research*, (ii) *Astronomy for Children and Schools*, and (iii) *Astronomy for the Public*.

Armenia's proposal to host a ROAD was approved on 10 June, 2015 and an agreement was signed between the IAU and the Byurakan Astrophysical Observatory (BAO) on 6 August 2015. The office was formally established on 1 September 2015 and was called **IAU South West Asian (SWA) ROAD**. SWA Regional Steering Committee was created in September 2015, as well as SWA webpage was opened also in September 2015 (http://iau-swa-road.aras.am). The Inauguration Ceremony was held on 13 October 2015. IAU OAD / SWA ROAD Workshop was also attached to this event.

Georgia and Iran were the first countries along with Armenia to officially join the SWA ROAD. During many years and centuries, these countries have had numerous relations in all areas, including science and Astronomy. A number of meetings and schools were organized and a number of other projects were accomplished. Especially successful were the activities related to Scientific Tourism in Armenia and in the region. We were awarded two grants in 2016: OAD grant for the development of Astro Tourism in the South West Asia and Swiss SDC grant for the development of Scientific Tourism in Armenia.

In June 2016, Kazakhstan and Tajikistan with official letters also joined our ROAD. Due to the involvement of Kazakhstan and Tajikistan, our regional centre was renamed to **IAU South West and Central Asian (SWCA) ROAD**. On November 17, 2017,

Turkey officially joined the South West and Central Asian ROAD office and expressed its desire to carry out its activities for the development of Astronomy.

It is a rule that both senior and young scientists from regional countries (especially Georgia and Iran) most often participate in our meetings, schools and other events. We also have many missions to the regional countries, again most often Georgia and Iran.

Armenia is rather active in organizing astronomical meetings, schools and other events. Among the most important meetings and schools held in Armenia, we would like to mention the **IAU Symposia and Colloquia:** IAU S029, S129, S137, S194, C184, and S304. Another large event was the all-European annual astronomical meeting in 2007, **JENAM-2007** (Joint European and National Astronomical Meeting), held in Yerevan, Armenia. It was the biggest ever scientific event in Armenia. Out of other meetings, one may mention joint meetings with a given country, namely Byurakan-Abastumani (Armenian-Georgian) Colloquia in 1974-2013, Armenian-French Workshops in 1995 and 2009, and the Armenian-Iranian Astronomical Workshop in 2015, as well as many meetings dedicated to the anniversaries of BAO and Armenian astronomers. Our office has been awarded an OAD grant for organization of a **Regional Summer School and Workshop** in September 2018.

Among the summer schools, **Byurakan International Summer Schools (BISS)** are already very famous. **Byurakan Summer Schools for YSU students (BSS)** are our local schools. For the school students, we organize **BAO Science Camps (BSC)**. **ArAS School Astronomical Lectures** program was started in 2012. In addition, in 2016 and 2017, we had "My Universe" contest and the winners visited BAO.

The International Conference *"Astronomical Heritage of the Middle East"* approved by UNESCO Director General within UNESCO Participation Program for 2016-2017 was devoted to the role of Astronomy in Culture and other fields of human activities was held on 13-17 November, 2017 in Armenia.

Among our future plans, we envisage to enlarge the number of participating countries (involving more Central Asian and maybe some other ones), work harder for fundraising for implementation of various projects (in all three task forces), organize regional meetings, workshops, schools and camps.

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Using VPython in the Cloud as a Mode of Learning in Higher Education

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Abstract. Given a choice at a maze entrance, rats can decide whether or not to enter the maze, showing metacognition. If rats cannot remember the maze route that leads to the hoard of food, rats tend to opt for a route that leads to a small reward of food. To test whether general education Astronomy students would make similar decisions, students are given visual python numerical coding assignments. Of 131 participants, 31 opt out of this mode of learning. All freshmen opted-in whereas 42.9% of the seniors opted-out, suggesting that class rank affects decision making. Of the remaining 100, 40 earned perfect scores, with the average being 78%. The most significant reason for not participating was no prior exposure to numerical coding (i.e., no metamemory). Thus, we find that intimidation contributes to decision making. Those that overcame intimidation report they would try another numerical coding assignment in the future, thus showing metamemory contributes to future student decision making. Although most students did not like the assignment, 70% felt they learned the inverse square law after having completed the assignment. We find that all general education astronomy students have the ability to learn via the mode of computational modeling.

Keywords. Keyword1, keyword2, keyword3, etc.

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1. Introduction

Known is that humans and primates have the capability of reflecting on what they do and do not know. Not known is whether rats have similar metacognition. In 2007, Foote & Crystal (2007) set up smell maze tests where end of routes led to a hoard, a small amount, or to no food. Foote & Crystal (2007) find that if a rat is uncertain of the route to the hoard, the rat opts for a guaranteed small morsel of food. Besides metacognition, Fletch & Carruthers (2012) find that humans combine other skills like reasoning, prior personal experiences, and cultural learning in decision-making. Besides these meta-reasonings, Sutton & Shettleworth (2008)] find that the strength of memories (i.e., metamemories), which accumulate over time, also aid in decision-making.

In this work, we study metacognition, meta-reasonings, and metamemory of undergraduate general education astronomy students in decision making to compare with that of the rat studies. We assign a visual python numerical coding homework assignment, assuming most students lack metamemory in numerical coding. In §2, we discuss student demographics and goals of the study. In §3, we discuss the findings, and our conclusions.

2. Student Demographics, Goals, and the Study

University of Central Florida (UCF) is one of the largest universities in the United States, with more than 66,000 students. UCF is culturally diverse. Many non-science undergraduate students take Astronomy with class sizes numbering more than 150. The Fall 2017 online class had 12 freshmen, 28 seniors, 31 juniors, and 61 sophomores.

One goal of this study is to determine whether numerical coding is a viable mode of learning for the general education astronomy student. Another is to better understand student decision making regarding learning.

Students are given on paper a working code in vpython to help learn the inverse square law as applied to gravitational force. All computation is done in the cloud at https://trinket.io to ensure equal access to all students. A fully commented version of the freeware code, with directions, is provided at https://trinket.io/library/trinkets/ca923197a7. Once a student types in this code, saves to his/her personal account, and runs, students then are required to modify this code for an exoplanet - star system of their choosing from e.g., https://exoplanetarchive.ipac.caltech.edu/. We do this second coding assignment to provide additional metamemory and to promote personal learning. In the directions, we provide sample modifications to the code using GJ9827b as an example. Students are given several weeks to submit the assignments; no numerical modeling is covered within any of the lecture material. Also part of the submission are student free responses to short-answer questions for determining, in part, whether the student did the assignment, whether the student understood the physics concept conveyed, and to obtain student opinions, perceptions, and statistical data. We follow up the assignment with examination to test student memory and retention.

3. Findings and Conclusions

Of the 131 in this study, 31 students opted out of the assignment, earning zero points. All freshmen opted-in whereas 42.9% of the seniors opted-out. As anticipated, a majority (i.e., 63%) of the students did not like the assignment; however, 70% of the students felt they learned the inverse square law after having completed the assignment. Of the 100 participants, 68 students has earned at least a C- grade, of which 40 earned maximum points. The average grade for all participants is 78%. Based on these, we find that students of all majors could learn difficult physics concepts by this mode.

Of the 31 students, two did not take the follow-up exam. Of the 29 remaining, 82.8% opted for a guaranteed small reward (i.e., 1/4 of the points, the same fraction given to the rats in the maze studies) for not answering a question due to lack of metamemory. Of the 111 that did complete the assignment, 8.1% did not remember, opting out for the guaranteed small reward. Thus, those with some metamemory felt confident enough to risk earning no points; we find that these student decisions are unlike the rats. We also find that *all*— freshman opted in to the assignment and follow-up testing, thus suggesting that student rank affects decision making. Of the students that overcame intimidation of learning by a new mode, most report they would try another numerical coding assignment in the future. Thus, metamemory contributes to decision making.

As for standardized test questions on inverse square law on the exam and the follow-up final exam, 90.4% answered correctly on the exam; however only 58.1% remembered in the final exam. Comprehension and retention are not shown for about 40% of the students using the standard test bank question on inverse square law.

References

Fletch, L. & Carruthers, P., 2012, *Philosophical Transactions of the Royal Society B: Biological Sciences*, 367, 1594

Foote, A. L. & Crystal, J. D. 2007, *Current Biology*, 17, 6

Sutton, J. E. & Shettleworth, S. J. 2008, *Journal of Experimental Psychology-Animal Behavior Processes*, 34, 2

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In the Pursuit of Astronomy Education and Outreach in India

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Abstract. I shall discuss various efforts being made at the level of citizens, school and college students and university researchers as an individual, team as well as part of the Public Outreach and Education Committee of the Astronomical Society of India. I shall discuss the Lunar Eclipse Campaign, aimed at confronting superstitions and false beliefs in people regarding eclipses. I shall talk about the Zero Shadow Day Campaign as well as the different simple experiments done in schools with minimum tools to explain important concepts about the Sun and the Moon's movements. The Astronomy Olympiad program in India will also be discussed. We are organising an Astro-Expt themed workshop to set up a repository of experiments that can be adopted by Physics Departments in the country to address the lack of experiments in our education system. I shall also talk about 'Shrishti Astronomy' and various activities conducted in Hyderabad, India to reach out to people. I shall also discuss the pitfalls and challenges and suggest working models that may prove more effective.

Keywords. GENERAL:sociology of astronomy, eclipses

1. Introduction

The Astronomical Society of India (ASI) constituted its Public Outreach and Education Committee (POEC) in 2014. Since then, the POEC has been organising many astronomy campaigns on a national scale, in collaboration with local groups.

Other than the POEC, we also work with local resource persons and bodies to plan outreach programs for the public. The aim of this work is firstly to expose students to astronomy at various levels and more importantly to build a scientific temper. We make special efforts to involve people from under-privileged and deprived sections of society.

2. Activities

As an individual, team, as well as part of the ASI-POEC, we have conducted various national campaigns with the purpose of involving people all over the country in these activities and to give a basic exposure to Astronomy†(Pattnaik et al. 2014). We had a Lunar Eclipse Campaign planned before and around 31 Jan 2018. The POEC crowd-sourced an interactive map of more than 600 locations hosting eclipse parties, setup a website with resource material, contacted schools and colleges across India to see the eclipse, and organised an anti-superstition social media campaign (see http://bit.ly/eclipse31jan). We had talks, demonstrations to explain why the eclipsed moon looks red, sky blue and color of the rising and setting Sun. In India, people are superstitious about eating during the eclipse or even seeing the eclipse, so we did various eclipse-eating and photography programs.

† Details of our campaigns and activities are available at http://astron-soc.in/outreach/

The Zero Shadow Day (ZSD) can be experienced by people living between +23.5 and -23.5 degrees latitude where the Sun's declination is equal to their latitude twice a year. On these two days, the Sun will be exactly overhead at local noon and will not cast a shadow of an object placed perpendicular to the ground. The ZSD Campaign is a very successful campaign we have been doing where we use simple experiments in schools with minimum tools to explain important concepts about the Sun's movement and explain the occurrence of ZSD. A mobile app was also developed by a volunteer to be used to determine dates and timings of the ZSD for different regions.

We also train students for the Olympiad program which focuses on concepts.

In the month of June 2018, we conducted a workshop on Astronomy Themed Experiments that can be developed in Physics Departments with under-graduate and graduate programs at the Inter-University Center for Astronomy and Astrophysics, Pune, India. We hope to build a repository of these experiments very soon.

We also run a facebook page 'Shrishti Astronomy' (https://www.facebook.com/shristi.astro/) to communicate with the public. Interested students are mentored and encouraged to do projects of which some have chosen to become professional astronomers.

3. Lessons Learnt

More than 15 years of work has taught us some interesting lessons. Special attention is needed to seek out and identify active stakeholders in each region or school that we plan to work with. Working only with easy accessible groups may cause regional and social biases and hence it is necessary to reach out (physically) to those who are most inaccessible. We need to make our attempts as inclusive as possible and reach out as much as possible. Direct involvement with schools is the best way to ensure participation and follow-up activities with the same groups of students. Short handouts are good take-home material to motivate and encourage the learning process. These can be made preferably in vernacular medium, specially when it caters to young students not proficient in English.

A variety of tools and options need to be made developed for a given activity (e.g. for accessing material, sending in feedback etc), to continue the interaction with students and the general public.

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References

Pattnaik, B.K., & Sahoo, S. 2014, Communicating Science in India through People's Science Movements, *Journal of Scientific Temper*, 2, 33

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Exploring the Universe from West Africa Senegal

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Abstract. In Senegal astronomy is only known through outreach activities organized by local amateurs, even if the university sometimes hosts guest lectures in astronomy.My PhD thesis fits into the framework of setting up professional astronomy in Senegal, and it is part of a continent-wide Initiative for Planetary and Space Sciences. A partnership has been established for this project between the University of Cadi Ayyad in Morocco, the University Cheikh Anta Diop in Senegal, the Observatories of Paris and Midi-Pyrenees in France, and the University of Antwerp in Belgium. In the course of my PhD, I will also follow the developments of the setup of a local observatory in Senegal, in collaboration with the Ministry for Research, Higher Education and Innovation of Senegal, and the Senegalese Association for the Promotion of Astronomy. Solar system research, exoplanets characterization, survey of variable starts are possible research topics where high-level contributions are possible with modest telescopes.

Keywords. Meteoroid, Impact, Jupiter, Monitoring.

1. Meteoroid Impact flashes on Jupiter

The present impact flux in the solar system is poorly known. This represents a severe limitation to determine the ages of icy satellites of Jupiter and Saturn. In my PhD thesis, I will investigate the occurrence of meteoroid impact flashes on Jupiter, with the goal of constraining the present flux of meteoritic impacts in the outer solar system. We will monitor impact events on Jupiter from ground observations conducted at first in Morocco and then in Senegal. This flux may then be directly compared to the flux of impacts in the inner solar system using a similar technique to monitor impact flashes on the Moon Larbi et al. (2015).

Currently and in the coming years, at the latitudes of Europe, Jupiter is very low on the horizon, which limits the available observation time of the planet from stations in

Europe or other locations at similar latitudes. The conditions for observations of Jupiter are much more favorable in Africa. This situation will persist until 2022.

2. Method

We intend to monitor both small events (impacts of objects between a few meters and 50m) and large events (bolides penetrating the atmosphere of Jupiter with a diameter bigger than 50m).

Small Events. A 355 mm C14 telescope equipped with a fast camera that can detect flashes corresponding to a few meters range of diameters. (Fig. 1). The images will be processed by the Detect software, which detects a potential flash by subtraction of images.

Large Events (monitoring of impact traces). This involves observing the aerosols deposited by the impactors in the upper layers of the atmosphere that remain observable (reflected sunlight) until about ten days after the collision. The same device as above will be used with the addition of a methane filter. Without a filter, Jupiter is almost uniformly bright, so small features due to impacts are not very contrasted and can go unnoticed. With a methane filter, the planet is very dark since 99% of the sunlight is absorbed by the methane gas in Jupiter's atmosphere. The aerosols of the impactors deposited above the methane layer appear with a high contrast and detection of traces of the entry in Jupiter's atmosphere is possible.

We will carry out a weekly mapping of Jupiter with the methane filter. Given the period of rotation of the planet that is around 10 hours one must have observations during two consecutive nights to have a complete coverage of the planet

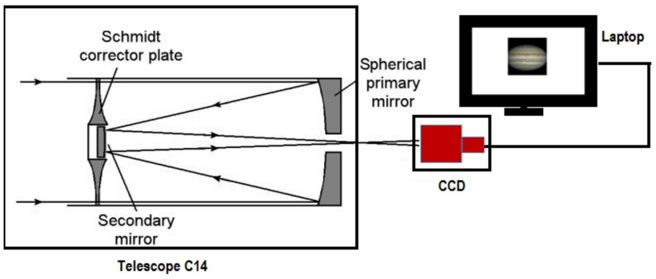

Figure 1. Experimental Setup.

I have spent the first year of my PhD in Belgium, and am currently based at the University of Cadi Ayyad in Morocco.

References

Larbi, M. A. M., Daassou A., Baratoux D.,Benkhaldoun Z., Lazrek M., Garcia R.,Bouley S., & Colas F. 2015, *First Lunar Flashes Observed from Morocco (ILIAD Network): Implications for Lunar Seismology*, 115, 1-4

Baratoux, D., Aoudjehane, H. C., Gibson, R., Lamali, A., Reimold, W. U., Sapah, M. S., Charaf, M., Habarulema, J. B., Jessell, M. W., Mogessie, A., Benkhaldoun, Z., Nkhonjera, E., Mukosi, N. C., Kaire, M., Rochette, P., Sickafoose, A., Fras, J. M., Hofmann, A., Folco, L., Rossi, A. P., Faye, G., Kolenberg, K., Tekle, K., Belhai, D., Elyajouri, M., Koeberl, C., & Abdeen, M. M. 2017, *The State of Planetary and Space Sciences in Africa*, 98, Eos

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PLOAD Action

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Abstract. The Portuguese Language Centre of the Office of Astronomy for Development (PLOAD) is a structure of the Office of Astronomy for Development (OAD) hosted by the International Astronomical Union (IAU). Our vision is to use astronomy as a tool for development in specific region and languages, namely in the Portuguese speaking countries and communities at a global level. PLOAD acts as a link between institutions with common objectives regarding Astronomy, in a concerted action following the three tasks forces: Astronomy for Universities and Research, Astronomy for Children and schools, Astronomy for the Public. PLOAD mission is to fulfil its vision by following the guidelines of the IAU strategic plan and to build on existing challenges and opportunities towards strong collaborative and active structures. This mission is being accomplished by several steps, starting from a careful research of resources and existing needs and the design of an effective implementation strategy of aid and support.

Keywords. miscellaneous, sociology of astronomy

1. Introduction

The Portuguese-speaking countries are the home for more than 240 million people located across the globe, having cultural similarities and a shared history. Currently PLOAD has representatives in 6 Portuguese-speaking countries: Brazil, Cape Verde, Mozambique, Portugal, São Tomé and Princípe and, more recently, Timor-Leste. In addition to consolidating existing partnerships, we continue to extend our network to other countries and to the Portuguese-speaking communities. PLOAD was officially announced at the IAU General Assembly in Honolulu, Hawaii on August 2015. Its goals were defined and an implementation plan consisting of three stages was planned: project design, implementation and finally, evaluation and sustainability. We are now at the implementation phase. During these three years our actions were focused under the mottos: Opening a new door to cross country collaboration, Bringing equality and equity, No borders, Innovating for the empowerment. Given the different levels of development of Astronomy in each of the countries represented at PLOAD, the strategies adopted have to be different. From one side we have countries that don't have astronomers or infrastructures on the other side we have countries like Brazil and Portugal with a very strong line of astrophysics research, infrastructures and an important effort in the field of astronomy education. As a consequence in some countries we have to start from the ground up, training teachers and creating general awareness for the importance of astronomy. Priority is often given to actions related to Girls in Science and Cultural Astronomy. In other countries astronomy is already emerging as a priority and as a capacity building trigger and there priority needs to be given on the use of astronomy as a trigger for development.

2. Implications

PLOAD action will continue to explore each different context in order to provide adequate answers to different realities, using shared experiences and already existing know-how within the network. Teacher training will continue to be a key point in order to create the necessary conditions to increase, in each generation, the levels of skills in the field of education with a vision of sustainability and autonomy.

Science outreach and science literacy will be an integral part across the whole program, promoting joint initiatives that can be perceived as relevant at a local level. One example of this is the active participation of the PLOAD in the celebration of the 100th anniversary of the observations of the solar eclipse, in 1919, the helped prove general relativity. In fact, directly and indirectly, three of the involved countries in this expedition are represented in PLOAD. Eddington at Sundy: 100 years later† is the result of a dedicated international collaboration devoted to celebrate this ephemeris.

The cultural diversity of the countries and Portuguese speaking communities is seen as an added value that helps recognize, value and enrich the PLOAD flag in terms of collaboration and mutual support. The promotion of the use of astronomy for development requires an interdisciplinary dialogue between education, science and society and technology from primary to university levels. In this sense, the next challenges for the PLOAD will be directed toward enabling the mobility of students to university studies within the PLOAD network of countries as well as establishing local contacts with industry and other local business enabling capacity building and careers related to astronomy and space exploration.

3. References

IAU Strategic plan 2010-2020. Retrieved from
https://www.iau.org/static/education/strategicplan-2010-2020.pdf on 9th October, 2018.
IAU Strategic plan 2020-2030. Retrieved from
https://www.iau.org/static/education/strategicplan-2020-2030.pdf on 9th October, 2018.

† https://global.esundy.tecnico.ulisboa.pt/pt/

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Fostering Astronomy in Ghana — The First ESO Astronomy Research Training

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Abstract. The European Southern Observatory Astronomy Research Training (ESO ART) is a newly established programme which was successfully conducted for the first time in Ghana in April 2018. ESO ART aims at providing undergraduate and graduate students from developing countries access to astronomy and bringing them into contact with the global astrophysical community via mentoring. During the workshop in Ghana, the students were taught basic analytical skills and knowledge to tackle open questions in modern astronomy. Proceeding from the workshop, students interested in pursuing astronomical research have the opportunity to create the basis for future research projects. We here provide an overview of this new initiative, summarize the experiences of the first ESO ART workshop, and discuss possible avenues for future collaborations.

Keywords. development, research training, teaching, mentorship programme

1. Motivation

In an era of globalization of knowledge and resources, ESO - with its ambitious telescopes and instrumentation, together with its multinational nature - is uniquely positioned to facilitate the dissemination of astronomical research worldwide. Currently, there are countries under-represented within the astronomical community despite their strong interest in developing the field, mainly due to a lack of available opportunities and resources. ESO ART aims at bridging this gap: it is conducted with the hope to encourage the growth not only of astronomy, but also to inspire youth to develop careers in science, technology, engineering, and mathematics.

2. The Training

The first ESO ART was conducted at the University of Cape Coast (UCC) in Ghana. It was attended by about 40 highly motivated participants, split in two groups of undergraduate and graduate students. We designed a two-day workshop for each group. In the first half, we were discussing the composition and evolution of stars as well as analysis techniques like spectroscopy. The second part focussed on galaxies introducing basic concepts like coordinate systems, our position in the local super-cluster, galaxy constituents, morphologies and spectra. The courses were interspersed by hands-on activities using

Jupyter Notebooks (jupiter.org) online written in Python (www.python.org) to facilitate programming skills. Furthermore, the students interactively explored the Virgo cluster using the galaxy database GOLDMine (goldmine.mib.infn.it).

3. Teaching Methods

The courses follow an enquiry-based approach as it is also used by the West African International Summer School for Young Astronomers (WAISSYA, www.astrowestafrica.org). Promoting critical thinking and motivating knowledge sharing, this approach is similar to the way we conduct research. In this collaborative atmosphere, the students are encouraged to be curious, to raise questions, to think critically, and to share their ideas, doubts or thoughts in lively discussions.

4. Goals of the ESO ART Program

The ESO ART aims at:

- engaging with students in countries that are under-represented in astronomy, disseminating astronomical knowledge;
- connecting ESO with educational institutions globally and promoting collaborations, and promoting visibility for ESO and its member states;
- facilitating the establishment of astronomy education in universities;
- encouraging motivated students to pursue an education in astronomy and introducing them to research;
- connecting motivated students with astronomy professionals for academic guidance and mentorship;

These benefits and the first successful run of the ART strongly supported the continuation of this project. It is important to emphasise the significant role of astronomy for the development of scientific institutions and of a local high-level science community. Thus, we are now strengthening the collaborations that were established to keep a vivid exchange of knowledge, to achieve the goals stated above, and to have a sustainable impact on the improvement of the situation for science and technology.

Figure 1. Group photo of the ESO ART participants together with the ESO instructors and the hosts, Dr. Nana Ama Browne Kluste (GSSTI) and Francis Kudjoe (UCC), and the head of the Physics Department at UCC, Dr. Benjamin Anderson.

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Strides of the Southern African Regional Office of Astronomy for Development

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Abstract. The Southern African regional office of Astronomy for Development (SAROAD), an office of the IAU Office of Astronomy for Development (OAD) came into being on the 14^{th} of August, 2014 after the signing of the memorandum of understanding between the Copperbelt University (CBU) and the International Astronomical Union (IAU) in Kitwe. In this presentation we highlight both the achievements made by the office and the challenges faced by the office to date. Among the notable activities of SAROAD are the hosting of the annual regional Astronomy workshops (AstroLab), outreach to Schools, public engagement and dissemination of information about new developments and upcoming events in astronomy and space science. Three AstroLab workshops have already been held and several outreach activities carried out. The regional office has been facilitating for the involvement of member states in most astronomy cornerstone projects.

Keywords. Development, workshops, regional.

1. Introduction

The Copperbelt University became a regional centre of reference for astronomy in the Southern Africa Development Community (SADC) region when it was offered to host the Southern African Regional Office of Astronomy for Development (SAROAD) from 14^{th} August 2014, overseeing and coordinating activities in 16 countries namely: Zambia (host), Malawi, Angola, Botswana, Namibia, Mozambique, Lesotho, Swaziland, Zimbabwe, Mauritius, Madagascar, Seychelles, South Africa, Congo DR, out of region Square Kilometre Array (SKA) project partner countries Kenya and Ghana. The mission of SAROAD is to coordinate the use of astronomy as a tool for development by mobilizing the human and financial resources necessary to realise its scientific, technological and cultural benefits to society, using as a guide, the Sustainable Development Goals [1] and other local and international development objectives. Since inception, CBU has been consistent in supporting the regional office by providing financial and administrative support and has opened a window for co-hosting the office with the University of Zambia (UNZA). The Southern African ROAD has been active in the dissemination of information about new developments and emerging issues in astronomy.

The SAROAD office has successfully completed its self assessment and an independent external reviewer has also concluded the review of the regional office.

2. Achievements

SAROAD was invited to contribute to a paper on the development of astronomy and space science in Africa, which was published in Nature Astronomy on 3^{rd} July 2018 [2] in addition to publications in conference proceedings of the International Astronomical Union's symposium of 2015/2018 and proceedings of the Communication Astronomy

with the Public conferences. SAROAD has also amassed collaborations with international organizations and institutes. The notable ones are Institut de Astrophysique de Paris, Indian Institute of Astrophysics (IIA), Centre for High Performance Computing (CHPC), Las Cumbres Observatory, National Astronomical Observatory of Japan, International Astronomical Union (IAU, Office of Astronomy for Development and Office for Astronomy Outreach), South African Astronomical Observatory (SAAO), National Optical Astronomical Observatory, Vrije Universiteit Brussels, University of Zululand, University of KwaZulu Natal, University of Witwatersrand, National University of Science and Technology (NUST), University of Namibia, University of Malawi, Botswana International University of Science and Technology (BIUST), University of Zambia (UNZA), Square Kilometre Array (SKA) and many others. SAROAD has organised regional astronomical workshops (AstroLab) in Zambia (2016), in Zimbabwe (2017) and in South Africa (2018).These workshops have been supported by the Office of Astronomy for Development (OAD), the Copperbelt University, the National University of Science and Technology and University of Zululand. The office has further done extensive outreach activities in Zambia and Malawi, encouraging Country Coordinators in member countries to do the same. Madagascar, Mauritius, South Africa and Zambia have all run projects endorsed by SAROAD and funded by the IAU through the OAD call for proposals [3].

SAROAD has also made it possible for some members to win IAU travel grants. Some of the recipients are Dr. Moola Mutondo, Prof. Jayant Murthy, Mr. Prospery Simpemba, Mr. Nchimunya Mwiinga, Mr Patrick Mzaza, Dr. Chika Onuchukwu, Dr. Michele Gerbardi, Dr. Zara Randraimanakoto, Ms. Lenganji Mutembo, Mr. Lubinda Nabiwa and many students who have attended the Astrolab training.

SAROAD, through its collaborating partner in the UK, Dr. Sohan Jheetah, has acquired two 8 inch NexStar Evolution Schmidt-Cassegrain optical telescopes, one for Malawi and another for Zambia which are currently being used for student projects and for outreach. We have also received several training kits for dark skies outreach, universe in a box among others.

3. Challenges

The main challenge has always been funding to meet most operational needs of the ROAD. The IAU provided a seed fund of 5000 Euro in the beginning and after that most funding has been coming from the host institution. It has not been possible to financially support the country nodes.The other challenge is the lack of commitment by some volunteers on whom we entrust the country astronomy activities.

4. Conclusion

The fours of SAROAD existence has been a learning process. The Southern African ROAD looks forward to another term where it will use the acquired experience to further the use of astronomy for development in the region and strengthen the existing collaborations while making new ones.

References

[1] *www.undp.org/content/undp/sustainable-development-goals.html*
[2] *http://adsabs.harvard.edu/abs/2018arXiv180701722*
[3] *www.astro4dev.org/cfp-stage2*

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The Regional Office of Astronomy for Development in the Arab world

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1. Background

Astronomy, Astrophysics and Space Sciences (AASS) play an effective role in Sciences, Technology and Community Development. Unfortunately, a small percentage of this knowledge is actually used in teaching at schools, universities and other academic institutions in Arab countries. The challenge is to provide effective professional development for AASS educators and researchers at all levels, from elementary school to university. There is an urgent need for better communication channels among Arab astronomers and space scientists nowadays. In this respect, the best choice is to identify in the vast cultural heritage of the Arab basin, particularly in astronomy. Building modern and good observatories, planetariums and research centers in the region jointly by Arab astronomers and space scientists is essential and will be an excellent step towards developing AASS. The Arab Union of Astronomy and Space Science (AUASS) has been rather active in proposing projects and submitting a proposal to host a regional office in the Arab World. IAU found the AUASS proposal rather strong and justified since it represents all of Arab countries. During the 11th Arab Conference on Astronomy and Space Science, which was held in Sharjah (United Arab Emirates) between the 5th and 8th of December 2014 under the patronage of Sheikh Sultan Bin Mohammed Al-Qasemi, the ruler Of Sharjah, the AUASS had discussed this issue with Mr. Kevin Govender (from the OAD) with the presence of the high council members of AUASS. Finally, they took a resolution of selecting the Hashemite Kingdom of Jordan to Host the IAU Office of Astronomy for Development in the Arab region. An agreement was signed in this regard at the IAU's General Assembly in Honolulu in August 2015.

2. Inauguration

The Arab Regional Office of Astronomy for Development (Arab-ROAD) and the Arabic Language Expertise Center (Arab-LOAD) had officially joined the IAU-Office of Astronomy for Development (OAD) network. The inauguration took place in Amman, the Capital of Jordan, on the 2nd and 3rd of December 2015. The inauguration was attended by the IAU General Secretary (Prof. Piero Benvenuti), the Director of the OAD (Mr. Kevin Govender), representatives of the host institution and from several Arab states in the region. Dr. Awni Al-Khasawneh, the General Secretary of the Arab Union for Astronomy and Space Sciences (AUASS), and the General Director of the Royal Jordanian Geographic Centre (RJGC), had delivered a welcome address. Prof. Hamid Al-Naimiy, President of the AUASS and Chancellor of the University of Sharjah, had read a statement, and Prof. Dia Eddin Arafa, President of Al al-Bayt University (AABU), had given the opening address. The meeting also included individual sessions focusing on Astronomy for Development, astronomical projects and capacity building in the Arab world, in

addition to a round table discussion. A meeting of the Regional Offices Steering Committee had also convened during this time. The Arab Regional Office (Arab-ROAD) and Arabic Language Expertise Center (Arabic-LOAD) is thus hosted by the Arab Union for Astronomy and Space Sciences (AUASS) which is currently located at the Royal Jordanian Geographical Centre (RJGC) in Amman, Jordan. In addition the RJGC hosts the Regional Centre for Space Science and Technology Education which is affiliated to the United Nations Office for Outer Space Affairs (UNOOSA).

3. Some of the Activities of the AW-ROAD

Since its official inauguration, the AW-ROAD has been organizing local and regional activities in collaboration with the Arab Union for Astronomy and Space Science (AUASS), the Jordanian Astronomical Society (JAS), the Syrian Astronomical Society (SAS), the Sharjah Center for Astronomy and Space Science (SCASS), the Oman Astronomical Society (OAS), the Sirius Astronomical Association (Algeria), Ibn al-Haytham Association for Science and Astronomy (Algeria), and the Tunisian Astronomical Society.

Weekly Activities at the JAS Cultural Forum:

Weekly Lectures at the JAS Cultural Forum (every Thursday evening, located at the AUASS Head Office in Amman) are organized on various topics related to astronomy, astrophysics and space science and its applications.

- Star Parties: for youth clubs, schools, universities and the public.
- Astronomy Workshops for Young Students.
- Astronomy Exhibitions.
- Astronomy Camps at the JAS's Hamza Astronomical Camp in al-Azraq, North-East of Jordan, or in Wadi Rum, South of Jordan.
- JAS Advanced Astronomy Courses.
- Observation of Special Events.
- Astronomy and space Science Conferences.
- An official visit to astronomy and space institutions in Kazakhstan, 24–27 May 2018.

Media:

- Official Webpage: http://aw-road.auass.com/
- AW ASTRONOMICAL JOURNALS:
  - The Universe (Al-Kawn) Magazine
  - Althorayya
  - Majarat Magazine
  - Howat Alfalak Magazine

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Astronomy for Development in East-Asia

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Abstract. Astronomy is the science that connects the world; it is the science that aims to answer the most fundamental questions of the Universe we live in. The benefits of astronomy to society extend far beyond those of scientific knowledge. Astronomy can be used to help achieving the Sustainable Development Goals outlined by the United Nations. The IAU East-Asia Regional Office of Astronomy for Development (EA-ROAD) and the Chinese Language Expertise Center (EA-LOAD) were established in 2012 to use astronomy as a tool for development in the East-Asia region, with the aim of utilising all aspects of astronomy to make the world a better place.

Keywords. History and philosophy of astronomy; miscellaneous; sociology of astronomy

1. Introduction

Astronomy aims to unravel the mysteries of the Universe. *Where does the Universe come from? How common are Earth-like planets? Are we alone in the Universe?* Throughout history, many philosophers and scientists have attempted to answer these questions. Enormous progress has been made in the recent century as a result of spectacular advances in instrumentation and computational facilities. Probably more than any other branch of sciences, astronomy and related fields (space science, astrobiology, ...) attracts the interest and awe across all groups in society. Astronomy is the science that places the human society and our planet Earth in the context of a hostile Universe in which life appears rare. When considering how much our governments invest in astronomy, and the relatively small number of professional astronomers in the world, per-scientist funding in astronomy is very high. Why do our societies spend tax money on astronomy, while there are so many more pressing challenges in the world that need to be solved? It is very interesting to constrain the initial mass function of the first stars in the Universe, but most people would argue that is more important to find a cure for cancer or Alzheimer's disease, to provide clean drinking water to a typhoon-struck city in a developing country, and to invest in mitigating the effects of global climate change. The reason that societies invest in astronomy is obvious: there are benefits of astronomy to society. Astronomy leads to new technology, it inspires young children to take up a career in science or engineering, it allows us to study the history and future of our planet Earth in this hostile Universe, and the impact that humanity has on the atmosphere. Astronomy, as a *Blue-Sky science*, also leads to discoveries and insights that have never been thought of before. Although professional scientists usually focus on their niche research (which is a productive attitude), it is important for the astronomical community as a whole to keep reminding society of why it is good to invest a tiny fraction of a country's GDP in astronomical research. Societies fund astronomy, because astronomy can contribute to making the world a better place for all of us.

2. Using astronomy as a tool for Development in the East-Asia region

The IAU East-Asia Regional Office of Astronomy for Development (EA-ROAD) and the Chinese Language Expertise Center (EA-LOAD) were established in 2012, as envisioned in the IAU *Astronomy for the Developing World* Strategic Plan 2010-2020 (e.g., Miley 2012). The mission is to use astronomy as a tool for development, in order to contribute to achieving the UN Sustainable Development Goals (United Nations 2015). The consortium is led by faculty at Xi'an Jiaotong-Liverpool University (XJTLU), Beijing Planetarium, and Yunnan Astronomical Observatories, in close collaboration with the National Astronomical Observatories of China, the National University of Mongolia, Pyongyang Astronomical Observatory, and Shanghai Astronomical Observatory. The consortium operates East-Asia, loosely defined the People's Republic of China, Mongolia, and the Democratic People's Republic of Korea, encompassing roughly 20% of the world's population. Consortium members have carried out a wide variety of projects, all focusing on different aspects of employing astronomy as a tool for development. The aspects of focus are as follows. *(i) Inspiration & education.* Astronomy is an excellent tool to enhance interest in science amongst the public (the taxpayers that fund our research), i.e., through teaching the strengths and limitations of the scientific method, and how science can help improve our daily lives. The "big questions", the excellent imagery, and the connection to space sciences make astronomy particularly useful in helping to overcome fear of mathematics/science amongst young students, and stimulate them to develop an interest, and perhaps a career, in science or engineering. This is efficiently achieved through educating teachers how to use astronomical concepts to teach science at all levels of education. *(ii) Interdisciplinary science.* Astronomy can be used in combination with other sciences to address the world's problems. Climate change, for example, is strongly related to the Earth's orbit and spin, while studying other planets (Venus, Mars, and exoplanets) can help us further understand our own world. Big data analysis used in large telescopes can provide an excellent tool for education as well. Finally, the future of humanity in space is an inspiring concept that helps developing creativity and help young students think about the technological and socio-economic challenges that lie ahead. *(iii) Regional development.* As one of the most inspiring sciences, astronomy can be used to stimulate the local economy surrounding observational facilities through tourism, science education, movie settings, and related activities, in collaboration with the local governments. *(iv) Translation.* Making existing available resources available to all corners of the world is possible through translation and dissemination. This includes translation between official languages, but also translation to local languages and dialects spoken by small ethnic groups in rural settings. *(v) Science diplomacy.* Astronomy can facilitate the collaborations between nations to address common problems and build constructive international partnerships, particularly in the context of Astronomy for Development. Astronomy can bring together all the world's nations to some degree, through conferences, student workshops, and exchange of researchers. *(vi) Society.* Many cultures have a history with a connection between astronomy and timekeeping, agriculture, and religion. Astronomy can thus be used to as a method to approach remote ethnic communities while at the same time inspiring young children. Implementation of astronomical concepts in various forms of art, such as astrophotography, drama, poetry, film, and literature can open up the world of science to many.

References

United Nations 2015, *Transforming our world: the 2030 Agenda for Sustainable Development.*

Miley, G. 2012, *The IAU Astronomy for Development Programme. Organizations, People and Strategies in Astronomy I, A. Heck (Ed.), Venngeist, Duttlenheim, 93*

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Astronomy education in Jordan

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Abstract. This paper presents a summary of the status of the Astronomy education in Jordan at different levels: primary schools, secondary schools, and universities. Several attempts from individual and collaborate potentials made to develop this field in Jordan, but it still needs more practical solutions. Therefore, we recommend awarding regional and international grants for a number of students annually. These grants will promote them to study the Astronomy in specialized way. In order to build up an astronomical society and astronomers who will be capable for competitive research activities in the future.

Keywords. Astronomy, Jordan, Education, Maragha Observatory

1. Levels of education

Most of educational subjects in both primary and secondary schools in Jordan reflect an interest in space science, but it lacks the practical applications and exploration tours (see Ministry of Education - Jordan http://www.moe.gov.jo/en). Although the amount of the material which is given very infirm in the schools, there is a significant drop in Astronomy education in the Jordanian universities. Whereas, out of 36 universities, there is no Astronomy department and it just follows the Physics departments. Only 7 Physics departments introduce a few Astronomy or Cosmology courses as optional but not mandatory, moreover these courses are rarely offered. But, some universities in Jordan give an introduction to Astronomy as elective courses for interested pupils.

2. Administrative background

One of the first steps adopted interest in Astronomy and space sciences is the Jordanian Astronomical Society (JAS), which was established in 1987 in Amman. After that, The Institute of Astronomy and Space Science (IASS) was established in 1994 at Al al-Bayt University (AABU) with the aim of preparing local expertise in the various branches of Astronomy and space sciences, the Maragha Observatory at the University campus was established, which contains a 16-inch (40-cm) Schmidt-Cassegrain reflector telescope, a CCD camera, one PC, Astronomy software, and accessories,Al-Naimiy *et al.* (2001), Fig.1.

Arab Union for Astronomy and Space Sciences (AUASS) was founded in 1998, by the Jordanian Astronomical Society and supported by Prince Hassan bin Talal and its headquarters in Amman,Al-Naimy *et al.* (2004). In addition, Islamic Crescent Observational Program (ICOP), which changed its name to the International Astronomical Center, it was established by several astronomers and amateurs.

Recently, the Regional Centre for Space Science and Technology Education for Western Asia / UN has been officially inaugurated under the Royal auspices in 2012. The last project was in September 2013, Sky Gate was unveiled to the public in Wadi Rum in

Jordan. Sky Gate a project that is designed not only to educate scientists, students and tourists on Astronomy but also helps alleviate poverty and stimulate tourism in the region, particularly in Jordan Fig.2.
Freshly, Jordan was selected as a member of the International Astronomical Union (IAU) during the Unions 100th Anniversary Open-source Exhibition which premiered in Vienna, Austria on August 20, 2018.

3. The main obstacles & Suggestions

The only way to get an official scientific degree in Astronomy and space science in Jordan is by IASS. But unfortunately, no graduate students at The Institute for Astronomy & Space Science since 2012, which is due to two main reasons; there are no grants to support students even excellent ones and there is a reluctance from the Physics and science graduates to pursue their studies in a field that lacks to future employment opportunities. This declines the number of applicants and also lessen the GPA level for them, which pushes the deanship of graduate studies at Al al-Bayt University to refuse to reopen the master program.
Our suggestions are summarized in giving annual grants for students who interest and desire to study Astronomy for both B.Sc. and M.Sc. degrees in the Institute for Astronomy & Space Science at Al al-Bayt University, train school teachers on observing the sky with naked eye and small telescopes and collaborate with Rum Sky Gate to serve school groups more practical support.

Figure 1. IASS - Maragha Observatory

Figure 2. Sky Gate - Wadi Rum

4. Benefits for the society

Beside the contribution of Astronomers in the area of science education, broadly conceived to include raising public awareness of science, the development of Astronomy could be influence in the investment in sundry fields.
There are several real and great examples of the changes and developments which effect on countries and societies by Astronomy; the construction and operation of the ALMA observatory in Chile is contributing to the development of Astronomy in the country by granting guaranteed observing time to Chilean astronomers, encouraging the training of specialized human resources, promoting innovations in engineering and software development, helping to improve the countrys telecommunications infrastructure, and supporting the social and economic development of ALMAs local and regional communities, (see https://www.almaobservatory.org/en/about-alma-at-first-glance/alma-in-chile/).

References

Al-Naimiy, Hamid MK, Konsul and Khalil 2001, *United Nations Programme on Space Applications*, 12, 55

Al-Naimy, HMK and Konsul, Khalil 2004, *Springer*, 273–289.

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Overview of Astronomy & Space Science Development in East African Region

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1. Introduction

In the past decade, astronomy and space science showed significant development in East African Region. The establishment of space agencies and institutes, formulation of space policies and the introduction of astronomy and astrophysics in the curriculum and as a specialty on both undergraduate and postgraduate levels in the universities of Ethiopia, Kenya, Uganda and Rwanda contributes to its success. Moreover, the establishment of East Africa Astronomical Society (EAAS), East African Astrophysics Research Network (EAARN) and East Africa Regional office of Astronomy for development (EAf-ROAD) played a role in development of the field in the region. EAf-ROAD is currently working to create a platform for regional member countries to have a common integration and developmental program in astronomy and space science in line with Sustainable Development Goals (SDGs). Its focus and work is on children and schools, universities and research to create links for research collaborations, exchange of expertise and university twining and public outreach. EAf-ROAD is striving to create partnerships with regional and international like-minded stakeholders for successful implementation of the regional plans. It supports the study of regional cultural astronomy and registration of astronomical heritages. Moreover, it uses volunteer experts as a pool of trained human resources for the region. It disseminates regional and IAU updates. In addition, it implements the IAU Strategic plan under the guidance of OAD.

2. Major Astronomy and Space Science Development Areas in the region

- Human Capacity Strengthening
  - Ethiopia: Entoto Observatory and Research Center (EORC), Addis Ababa University (AAU), Bahir Dar University (BDU), Mekelle University (MU)
  - Sudan: Institute of Space Research and Aerospace (ISRA) and Space Research Centre at University of Khartoum
  - Kenya: Kenyatta University, Technical University of Kenya, University of Nairobi
  - Rwanda: University of Rwanda – College of Education
  - Uganda: Mbarara University of Science and Technology (MUST)
  - Tanzania: University of Dodoma (UDOM),Open University of Tanzania
- Regional and International collaborations and networks on Research, Training and Education
  - EAARN, East African Astrophysics Research Network
  - DARA, Development in Africa with Radio Astronomy
  - NASSP, National Astrophysics and Space Science Program

  - ISP, International Science Program, Uppsala University
  - OAD, Office of Astronomy for Development
  - Overseas collaborators
- Infrastructure Developments
  - Entoto Observatory, Ethiopia
  - Potential international Optical Observatory Site at Lalibella Ethiopia and Mt. Nyiro and Mt. Kulal in Kenya
  - Tanzania observatory building initiation with Astronomers without Borders (AWB)
  - African Very Long Baseline Interferometry Network (AVLBI) Kenya.
- Space Policy & Agencies Development
  - Kenya Space Agency (KENSA)
  - Ethiopian Space Policy Formulation
  - The African Space Policy and Strategy adoption
- Regional & International Workshops and Events
  - The East African Astronomical Society Workshop (EAAS),5 times from 2009-2015, Kenya, Uganda, Ethiopia and Rwanda
  - Galileo Teachers Training (GTTP), 2015, Ethiopia
  - Middle East & Africa IAU Regional Meeting (MEARIM-IV),2017, Ethiopia
  - The 39th International School for Young Astronomers (ISYA),2017, Ethiopia
  - Space Awareness High Level Workshop, 2017, Ethiopia
  - NASE teachers training , 2018 and 2013, Ethiopia and Kenya respectively
- Public Outreaches
  - AstroBus Ethiopia
  - Public Lectures
- Untapped Potential areas of the region
  - Cultural astronomy and Astronomical Heritages
  - Astro-Tourism
  - Good Observational Sites and clear sky

3. Summary

There are promising and fertile opportunities for astronomy and space science to flourish in the East Africa Region. In addition, there are green lights that encourage investment and commitment at all levels. However, there are bottlenecks in coordinating and synergizing the region to reach to the point where astronomy should be. It needs a holistic approach that will engage government and policy makers, science educators, advocators and professional societies to be aware about the role of astronomy for development and to inspire and attract young people to the field. Thus, the regional Office of Astronomy for Development will take the lead and work to realize the aforementioned aspirations in the region in line with the SDGs and IAU 2020 – 2030 strategic plan.

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An Affordable Remotely Controlled Telescope for Research and Education

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Abstract. At Observatory Lustbühel in Graz (Austria) we successively developed a comparatively cheap infrastructure for the remote operation of our 50cm-telescope. Up to four different instruments can be mounted at the same time and switching between, e.g., imaging and spectroscopy only takes minutes. The telescope serves us well for our astrophysics research, plays an important role in the education of our students, and is a highlight of our public outreach events. Our concept of combining a small-size telescope with a low-cost infrastructure for remote access could be easily deployed on various sites, either with existing computer-controlled telescopes or with affordable new telescopes.

Keywords. instrumentation: miscellaneous, techniques: miscellaneous, telescopes

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The Observatory Lustbühel Graz (OLG) with its remarkable hexagonal design was inaugurated in 1976. It is located just at the city limit of Graz. This influences the sky quality, but the location on a hill at an elevation of 480 m within a park-like area shrouded by trees was carefully chosen to ensure a sufficiently dark sky for our astrophysical research. The Institute of Physics/IGAM of the University of Graz currently operates a 50 cm-Cassegrain-telescope (f/9) in the eastern dome and a 30 cm-astrograph ("Ballistische Messkammer", BMK) in the southern tower. The BMK was manufactured by Zeiss and provides a unique field-of-view with a diameter of about 19° at f/2.5. Next to the two telescopes a Solar radio antenna monitors the activity of the Sun. This antenna is part of the e-Callisto network. The Space Research Institute of the Austrian Academy of Sciences operates a satellite laser ranging station at the OLG. The Institute of Communication Networks and Satellite Communications of the Technical University Graz installed several antennas and experiments on the site.

The 50cm-telescope was manufactured by Astro Systeme Austria (ASA). It is attached to an equatorial mount and can be controlled with a computer. The telescope focus is changed by moving the secondary mirror. Also the dome manufactured by Baader is computer-controlled. Driven by our scientific needs we successively developed a comparatively cheap infrastructure for the remote operation of this facility. A prerequisite is that no manual interaction is required to change between the instruments. Our instrumentation currently consists of two imaging cameras, a video camera, and a spectrograph – all accessible due to the novel multiport (Fig. 1). The multiport is a unit with a rotatable flat 45°-mirror that guides the light towards the four ports. The precise positioning of the mirror using a spring-loaded detent roller allows a reproducible optical light path towards each instrument. The alignment and the calibration of each instrument is thus preserved. Any instrument mountable on a telescope can be attached to the multiport. Since remote operation is only reasonable when information about the weather and the

telescope status are continuously provided to the user, our observatory is equipped with a low resolution all-sky camera to monitor the cloud coverage, a sensitive all-sky camera to monitor the night sky, a set of sensors (temperature, sky temperature, sky brightness, humidity, rain, wind speed, etc.), and a camera to view the interior of the dome (as independent check of, e.g., the status of the mirror covers and the position of dome). The full remote control of the equipment is possible, since all USB ports, hardware switches, and electric power supplies were made accessible to the TCP/IP protocol. While students very often prefer to operate the telescope from the control room, scientific programs can be performed from any location with internet access. During public demonstrations, the instrument control software and the obtained data can be shown side by side with the moving telescope and the sky above the observatory.

Viewing with a telescope objects that remain invisible to the naked eye is a fascination that not only astrophysicists share. Telescopic work naturally sparks the interest in basic research, but also in engineering sciences and informatics. A major challenge for teachers and tutors is the access to telescopes that can be operated in a professional way and that can be used for experiments and demonstrations. Remote operation is an approach that has proven to be very efficient, but the number of telescopes is limited and the instruments (most often an imager) can not be changed. Our concept was recently adapted to our BMK. It can also be easily adapted to other small-scale telescopes. The size of the telescope and the number of instruments can be adapted to the requirements of the users and their financial budget. The sites can be chosen with respect to the observing conditions and the already available infrastructure. The local and especially the remote users will then benefit from a large freedom in developing scientific and educational programmes.

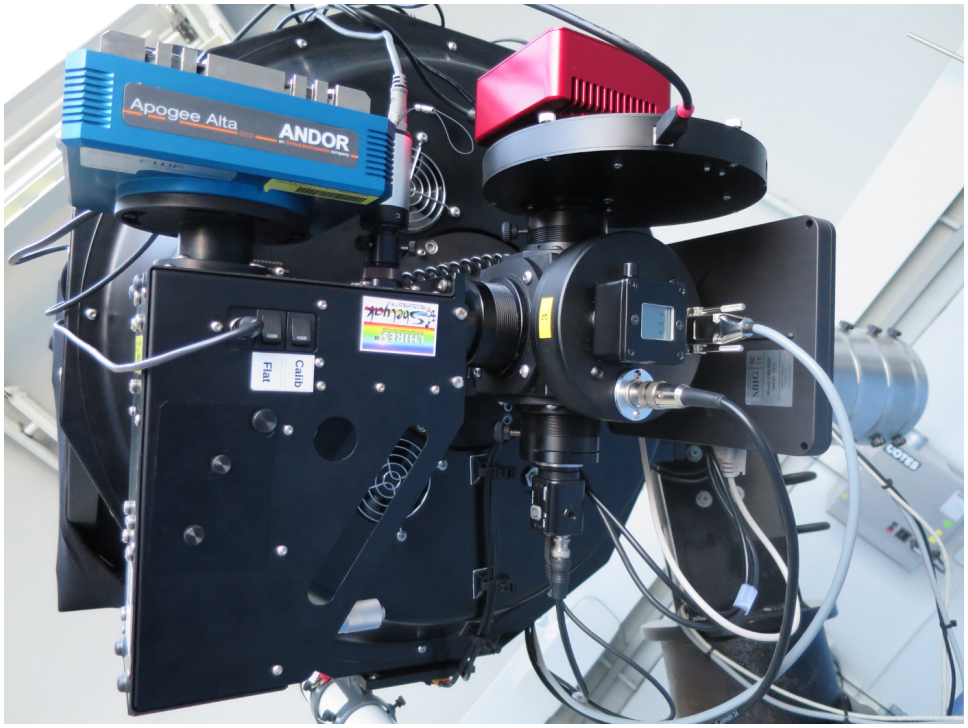

Figure 1. Multiport mounted at the rear of the 50cm-telescope at the Observatory Lustbühel Graz. The digital display shows the number of the outlet that is receiving light.

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Forty-four years of Revista Mexicana de Astronomía y Astrofísica: its impact on the Latin American astronomical community

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Abstract. After 44 years of continuously publishing the Revista Mexicana de Astronomía y Astrofísica, we cast a short retrospective view on its history, emphasizing its regional impact.

Keywords. history and philosophy of astronomy, sociology of astronomy

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The Revista Mexicana de Astronomía y Astrofísica (RMxAA) was founded in 1974. Founding editors were Paris Pişmiş, Eugenio Mendoza and Silvia Torres-Peimbert. The journal has published original research papers in all areas of astronomy, astrophysics and related fields, including instrumentation. The current editor of RMxAA is Christine Allen. Until 1994 RMxAA also published the proceedings of astronomical conferences held in Mexico and Latin America. Since 1995 a series devoted exclusively to such proceedings was founded, Revista Mexicana de Astronomía y Astrofísica Serie de Conferencias (RMxAC). The current editor of RMxAC is Silvia Torres-Peimbert. Both publications are fully integrated into the ADS. Their contents have always been freely available to the general public. This ensures a wide international visibility, comparable to that of the best astronomical journals.

All papers submitted to RMxAA are strictly peer-refereed. There have been over one thousand such papers published. RMxAA is included in the most important international indexes. The impact factor of RMxAA has varied over the years, mostly as a consequence of small number statistics. The average impact factor is about 2.4, greater than that of all but a few Latin American scientific journals. The editorial independence of RMxAA is valuable for scientifically sound papers outside the main prevailing trends. The fact that there are neither page nor submission charges for authors contributes to making RMxAA an attractive publishing option for authores, especially in times of economic hardship. The open and free availability of both journals and the fact that the printed version is distributed free of charge to astronomical libraries all over the world has contributed to the development of astronomy, especially in Latin America.

Early RMxAA and RMxAC have published the proceedings of 14 IAU Latin American Regional Meetings (LARIM), 3 IAU Colloquia, 4 Astronomy with Gran Tecan meetings, and 4 Astronomía Dinámica en Latino-América (ADeLA) meetings; altogehter 63 proceedings of various astronomical meetings in the region. Thus, both publications have been important for stimulating regional astronomical development and collaboration.

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European Regional Office of Astronomy for Development: The Initial Steps

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The International Astronomical Union's Office of Astronomy for Development (IAU OAD) has been working on using the skills and methodologies of astronomy as a tool for development since its establishment in 2011. The OAD functions as a coordinating body that mobilizes the human and financial resources necessary for projects that address an issue related to the socioeconomic development and specifically the Sustainable Development Goals (SDGs). There are 10 regional offices worldwide that focus this mission on a geographical or cultural area. Most recently, the European Regional Office of Astronomy for Development (E-ROAD) was established in February 2018 and this office is jointly hosted by Leiden University in the Netherlands and the European Astronomical Society.

Given the level of professional astronomy and the expertise in the field of development in Europe, the E-ROAD offers the unique opportunity to link both of these communities to initiate innovative and interdisciplinary astronomy for development initiatives. In the future, these could serve as a model for the global network of regional offices. Through the structure of the OAD, the European office could contribute meaningfully to global development by sharing the available resources and expertise in the region with the other offices.

Currently, the main focus of the E-ROAD is to secure the funds to hire a full-time project coordinator. After a coordinator has been appointed, the implementation plan for the office can be developed in more detail. One of the priorities is to build partnerships with key pan-European astronomy organisations, such as ESO, ESA and SKA, and development agencies in order to build support for the E-ROAD and to achieve the potential of connecting relevant disciplines. The E-ROAD will work towards a range of objectives. First of all, the main task of any regional office of astronomy for development is to carry out and coordinate relevant astronomy for development activities that contribute to the SDGs in the region. For the European context, the most relevant goals are: SDG 4: Quality lifelong education, SDG 5: Gender equality, SDG 13: Climate action, and SDG 16: Peaceful and inclusive societies. Preliminary ideas for projects include:

- Using astronomy to stimulate a sense of world citizenship and interest in technology and science amongst European children.
- Using the perspective of astronomy to increase knowledge about the vulnerability of our planet to threats such as those of climate change.
- Organising inspirational public lectures for non-ESO/EAS member countries in the region.
- Stimulating diversity and inclusiveness for staff and students in European universities and research institutes, with attention to gender balance.
- Emphasizing the use of astronomy for the education of children from migrant and other disadvantaged communities in Europe.

• Making educational resources and teacher training courses available that can be adapted and used throughout the world.

• Organisation of an annual Astronomy for Development Session for stakeholders (at the EAS European Week of Astronomy and Space Science meeting)

Care will be taken in order not to duplicate existing projects and efforts. The main challenges for the E-ROAD that we expect are acquiring sufficient human resources and fundraising. We might also encounter the perception that Europe is not in need of an office for development, which could potentially be an obstacle.

Besides sustainable development in Europe, another objective is to collaborate on a global scale with the sister ROADs. Traditional ways of collaboration are academic exchanges, mentorships, conference exchanges and student programs. But more specifically, we aim to work together on, for example, combatting the alienation of migrant and refugee communities and the consequent waste to our continent of potential talent. This is a relevant issue in several parts of the world.

Altogether, the E-ROAD strives to impact meaningfully on development in Europe, and especially to the SDGs. But moreover, it connects the global network of ROADs to the European astronomy community with its skills and expertise, and could also act as a gateway to other communities in Europe with relevant expertise regarding development.

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Astronomy for Africa: Student Support for Astronomy Modules via Distance Learning

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Abstract. In 2016, we obtained a grant from the Office of Astronomy for Development to support African students to register for online undergraduate courses in Astronomy at the University of South Africa (Unisa). The target audience were African students with no or limited access to astronomy studies in their own country. We describe the goals of the project, the challenges encountered and give recommendations for the future.

Keywords. sociology of astronomy

1. Motivation

In Africa most universities offer a standard BSc degree in physics, but well-taught astronomy courses are difficult to find due to the lack of a larger astronomy community. However, with the SKA coming to South Africa and to other African countries as well as the set-up of the African VLBI Network (AVN), it is important to offer the possibility of courses in astronomy to all African students. Members of East African Astronomical Society, in particular, are keen to expose more students to astronomy during their university studies.

2. The Project

African students could obtain a bursary and go to a university abroad to study astronomy, but it would be much more cost-effective and flexible to the student's circumstances if the student could stay at a university in their home country, attend all the physics and mathematics courses required, and register for the required astronomy courses at a university that offers distance learning. The University of South Africa, Unisa, is such a university. At several South African universities that do not offer astronomy, any undergrad astronomy modules passed through Unisa are counted as electives towards the student's BSc degree. While such a solution is cost-effective in itself, the university fees at Unisa, though reasonably cheap for South African standards, are still too high for most other African countries.

We therefore asked for and obtained a grant for a pilot project with the Office of Astronomy for Development (OAD) with the aim to establish the feasibility of such a project and to gather experiences for improved support in the future.

3. Goals of the project

The primary goals of our project were:

- To give African students access to a world-class undergrad astronomy education.

• To help AVN countries to educate students to become potential users of and/or support astronomers for the AVN.

In addition, the more far-reaching goals are:

• The successful student can continue with their studies to obtain a BSc degree in Natural Science with astronomy electives in their curriculum.

• Students with a BSc in astronomy can become teachers in their own country to pass on their knowledge as well as their interest in Astronomy. Such teaching will build the right environment to induce young people to participate in, e.g., the AVN project.

• Students interested in an Hons, MSc or PhD in astronomy can continue by entering the NASSP or SKA-SA bursary schemes in South Africa.

4. Challenges encountered

As with most projects that are based on little prior experience, we encountered a number of unexpected challenges. Knowing and understanding the underlying problems can help to refine the goals for future projects.

• We found that it was difficult to spread the word wide enough to get interested students without having the right connections to universities across the African continent.

• We emphasise the need to communicate with the local university officials with the aim to get modules officially enlisted abroad accepted as part of the local curriculum and to be added towards the degree.

• We discovered that the costs were higher than anticipated: (i) in addition to the application to become a student at Unisa and the registration for a module, the registration has to be paid in full, that is, it is not subsidised for foreign students; (ii) despite the full registration costs there is an additional foreign levy; (iii) the first-year course requires an expensive textbook (while other modules offer online study guides).†

• We note that the Unisa application system is difficult to navigate and communication regarding questions on required documentation for foreign students and other problems with registrations was barely adequate.

5. Results

The results of this pilot project were somewhat mixed: we had one very interested student from Zambia successfully registered at Unisa doing the astronomy modules of the first two years. Another highly motivated student from Mauritius was accepted by Unisa but for unknown reasons could not get registered (the only reply we ever got was 'missing documents' though all were sent twice by email as well as by postal mail). In addition, we had a number of Zambian students interested but most of them were not accepted by Unisa (likely due to missing documentation but also due to a slow application process). A few students from other African countries expressed interest but in the end did not apply for a bursary because their university was unlikely to accept such modules. The lessons learned and recommendation for future projects are thus:

• To negotiate on a higher level with the African universities to accept astronomy modules done at Unisa or other online universities;

• To find better means to spread the words to every interested African university that offers studies in Physics but not in Astronomy;

• To negotiate with Unisa a possible reduction in registration fees or foreign levy to support other African students.

† Unisa plans to use open source text instead, but internet access is still expensive and slow.

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'2017 Noche de las Estrellas', an outstanding star party in Mexico City

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Abstract. As it has been the practice since the celebration of the International Year of Astronomy 2009, simultaneous star parties have been organized in several sites in Mexico every year. Last year, on November 25th, there were 100 different sites that participated along the country; each site had its own astronomical activities, all of them were focused on astronomy outreach. In 2017 also five sites in Colombia and two more in Argentina joined this activity. Our estimate of the number of participants this year, in all sites involved, was of more than 200,000 persons.

Keywords. sociology of astronomy

Previous star parties at the main campus of the Universidad Nacional Autónoma de México in Mexico City have been very well attended, and the one held on November 25, 2017 was no exception. In this particular location the celebration has traditionally been well attended. It has become an expected affair that attracts visitors of all ages.

Once again in 2017 'Noche de las Estrellas' was organized as a daylong fair at the University main campus. On this particular party, 220 telescopes were installed, 59 thematic tents were set up, 395 public lectures were delivered, and a large number of activities that highlight astronomy took place. The sky gazing activities depend on the collaboration of amateur astronomers that bring their portable instruments to share the wonders of the sky with visitors. We are very much aware that sky brightness in Mexico City is not the best option to see the stars. However, it is clear that the accessibility of the site favors large attendance. The main focus is to show people the features on the Moon, any of the planets that are visible and the main features of the constellations. Many of the visitors have never seen the Moon through a telescope and have no knowledge of the constellations.

Public lectures were delivered in different formats, a few selected ones were offered to a large crowd on open space, and there were lectures of varied subjects for 30 to 40 people in several tents. In addition, there were exhibits on different astronomical topics; an exhibit for vision impaired visitors; live reception of gamma rays; space for advice on how to operate small telescopes; different activities focused on children like displays, drawing contests and games; etc. To carry out this program 850 volunteers participated. Altogether about 80,000 people attended this site to enjoy different aspects of the daylong activities.

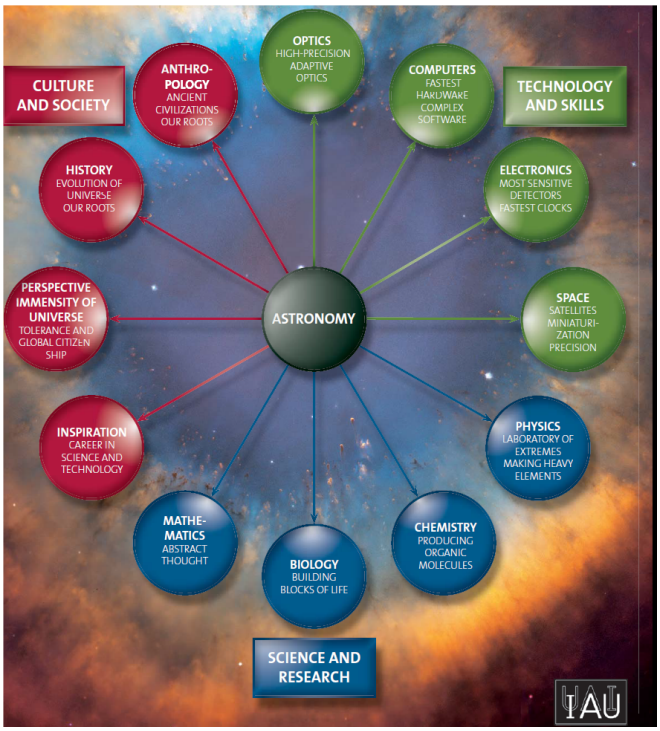

Figure 1. This diagram (Miley 2009: cover page) of the relation among astronomy and other disciplines is a good example of the misconceptions about social sciences in the astronomical community. There it can be observed that while mathematics, chemistry, physics and biology are located under the title "Science and Research"; anthropology and history are under the heading "Culture and Society". In fact, they are placed next to "Perspective immensity of universe" and 'Inspiration". But history and anthropology are sciences and carry out research. In any case society and culture could be proposed as their object of study, but in that case the other sciences should have been put under a label such as "living beings, matter, energy, patterns, etc." In fact, under anthropology, you can read: "Ancient civilizations. Our roots". But anthropology deals with human cultures and societies as a whole, not just those of the past. Moreover, its most characteristic methods, such as ethnographic fieldwork, are designed to study societies contemporary to the researcher. It is not about exploring only 'our roots", it is about understanding ourselves and the others with whom we live.

Astronomy	Social sciences
Science	Non-science?
Pure	Impure?
Nature	Culture (Arbitrary)?
Hard	Soft?
precise	Imprecise
Objetive	Subjetive?
Truth	Opinion?
Developed	Non developed?
"We"	"They"?
Future	Past?

Table 1. The asymmetries among academic disciplines are today part of our academic common sense, and imply strong preconceptions about the importance and hierarchy of the different kind of sciences. This type of considerations is very common and can be seen in much of the terminology we use to classify the disciplines in dichotomous terms. In the table, the left column contains terms that we use explicitly. The terms in the column on the right are their opposites and although, in general, they are not explicitly used; they are implicitly suggested when using the ones on the left.

References

Miley G. (Ed), 2009, *Astronomy for Development. Building from the IYA2009. Strategic Plan 2010-2020 with 2012 update on implementation. International Astronomical Union. Available in: https://www.iau.org/development/overview/strategic_plan/. Accessed: 27/09/2018.*

Belmonte Avilés, J. A. 2006. *La investigación arqueoastronómica. apuntes culturales, metodológicos y epistemológicos. In: J. Lull (Ed.), 2006. Trabajos de Arqueoastronomía. Ejemplos de África, América, Europa y Oceanía. Valencia: Agrupación Astronómica de La Safor.* 41-79.

Casumbal-Salazar, I. 2014, *Multicultural Settler Colonialism and Indigenous Struggle in Hawai'i: The Politics of Astronomy on Mauna a Wākea. Ph.D. Thesis. Mānoa: University of Hawai'i.*

Escobar, A., 2005. *El "postdesarrollo" como concepto y práctica social. In: D. Mato (Ed.), 2005. Políticas de economía, ambiente y sociedad en tiempos de globalización. Caracas: Facultad de Ciencias Económicas y Sociales, Universidad Central de Venezuela.* 17-31.

Herhold, A. S.] 2015, *Hawai'i's Thirty Meter Telescope: Construction of the Word's Largest Telescope on a Sacred Temple. M.A. Thesis. Oslo: Centre for Development and Environment, University of Oslo*

IAU Strategic Plan 2020 - 2030, 2018. *International Astronomical Union. Available in: https://www.iau.org/static/education/strategicplan-2020-2030.pdf. Accessed: 20/09/2018*

Iwaniszewski, S., 1991. *Astronomy as a Cultural System. Interdisciplinarni izsledvaniya,* 18, 282-288.

Leite Lopes, J. S., 2006. *Sobre processos de "ambientalização" dos conflitos e sobre dilemas da participação. Horizontes Antropológicos, ano 12 (25 jan./jun),* 31-64.

López, A. M., 2011. *Ethnoastronomy as an academic field: a framework for a South American program. In: C. L. N. Ruggles (Ed.), 2011. Archaeoastronomy and Ethnoastronomy: Building Bridges between Cultures, proceedings of the International Astronomical Union Symposium N° 278, Oxford IX International Symposium on Archaeoastronomy. Cambridge: Cambridge University Press.* 38-49

López, A. M., 2016. *Astronomical Heritage and Aboriginal People: Conflicts and Possibilities. In: Benvenuti, P. (Ed.), 2016. Astronomy in Focus. As presented at the IAU XXIX General Assembly 2015. Proceedings of the International Astronomical Union, Cambridge: Cambridge University Press.* 142-145.

Mizutani, Y. 2016. *Indigenous People and Research Facilities for Space Science in the U.S.: Some Ideas for Outreach, Conflict Resolution, and Prevention. Trans. JSASS Aerospace Tech. Japan, 14, ists30, Po 51-Po 56.*

Platt, T., 1991. *The anthropology of astronomy. Archaeoastronomy, supplement to Journal for the History of Astronomy, xxii,* 16, S76-S81.

Ruggles, C. & Saunders, N., 1993, *The study of cultural astronomy. In: C. Ruggles y N. Saunders (Eds.), 1990. Astronomies and Cultures. Niwot, Colorado: University Press of Colorado.* 1-31.

Swanner, L. A. 2013, *Mountains of Controversy: Narrative and the Making of Contested Landscapes in Post-war American Astronomy. Ph.D. Thesis. Cambridge: Harvard University.*

Swanner, L. A., 2015. *Contested Spiritual Landscapes in Modern American Astronomy. Journal of Religion & Society, Supplement* 11, 149-162.

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The Quality Lighting Teaching Kit: Utilizing Problem-Based Learning in Classrooms

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Abstract. The U.S. National Optical Astronomy Observatory's Education and Public Outreach group has produced a Quality Lighting Teaching Kit. The kits are designed around problem-based learning scenarios. The kit's six activities allow students to address real lighting problems that relate to wildlife, sky glow, ageing eyes, energy consumption, safety, and light trespass. The activities are optimized for 11–16 year olds. As part of the IAU100 celebration, the kits will be manufactured and made available to observatories and communities around the world.

Keywords. Light pollution, dark skies protection, dark skies awareness, dark skies education

1. Introduction

The goal of the Quality Lighting Teaching (QLT) Kit program is to raise awareness of the importance of preserving our dark, starry night skies and learn ways to mitigate light pollution. The kit is designed around problem-based learning scenarios. The kits six activities allow students to address real lighting problems that relate to wildlife, the night sky, aging eyes, energy consumption, safety, and light trespass. The activities are optimized for 11-16 year olds but are expandable to older and younger ages. They can be done within a few minutes except for the Energy Activity. The activities can be done during class or in an afterschool program and as stations that students rotate through or as stand-alones, one at a time. In the activities the instructor serves as the mayor of a fictitious city in which the students live. The mayor has been receiving complaints from citizens of the city, which have to do with lights in the city. The students are assembled into six different task force groups to determine the underlying problems, organizing themselves as one task force group per complaint category. Students read the information presented in their groups poster. The poster also gives instructions for a hands-on activity to gain more understanding of the problems, as well as key phrases to do more online research. They use the kits materials to complete the activity. Using what they have learned, they come up with feasible solutions.

2. Energy Poster and Activity

In this activity, students are given an aerial nighttime view of Houston, Texas, USA. The students determine how much energy, cost, and carbon footprint this city uses and wastes each night. These values accurately reflect the actual energy usage of Houston as well as the type of lights used. Then they determine a more energy efficient scenario by changing the types and/or wattages of the lights, by limiting the time used and/or by limiting the number of lights. How much energy, cost and carbon footprint is saved is determined from the difference between the before and after scenarios. A going further challenges the students to use an ISS image of their city to seek the same objectives.

3. Safety Poster and Activity

It is a common misconception that more light is safer; however, this is not always true. While light is needed to see and be safe at night, poorly designed or placed lights can actually be less safe. Poorly shielded or glaring lights provide areas for criminals to hide; criminals also exploit the false sense of security people feel in overly lit areas. In this activity, students will use a lux meter to measure light levels of different scenarios and compare their results to standardized lighting levels. They determine what minimum light levels are needed for a variety of environments to still be safe while conserving energy, cost and carbon footprint.

4. Animals Poster and Activity

Students in this group will explore how light pollution affects animals, specifically birds. They will play a game in which they are Kirtland's Warblers, which migrate from the Bahamas to the Great Lakes region of the United States and back again. Along the way, they fly through many major cities. Birds and other animals use the sun or stars to navigate, and the lights can confuse the animals causing them to crash into the building or circle it and collapse from exhaustion. In addition, lights can cause eggs to hatch earlier than they would otherwise. All these issues are explored in the game.

5. Glare Poster and Activity

As one of the three main types of light pollution, glare is caused by an exposed bulb. An overly bright bulb can severely impair vision, especially while driving at night. Glare is worse for older adults with ageing eyes. When a glaring light enters the pupil in an ageing eye, the pupil may not contract and can let too much light in. Therefore, glare can be a significant problem for ageing eyes. In this activity, the students will explore glare from a "headlight" (a capless Mini-Maglite) at night (in a darkened room). They will try to read the eye chart posted 20 feet (6 meters) away. Looking through layers of inkjet transparencies will simulate varying degrees of cataracts from very mild to severe. The students will then explore how cataracts (both with and without a glaring light) can impair their reading ability.

6. Night Sky Poster and Activity

As a second major type of light pollution, sky glow is caused by unshielded lights from a city shining up into the sky. This light scatters off of dust, water, smog, clouds, and other things in the atmosphere creating a light dome or glow over the city. Sky glow washes out the stars from view; as a result, most people in cities have never seen a dark night sky. In this activity, the students will use a star projector to determine how different kinds of lights and shields affect the number of stars that can seen. The students try different kinds of lights and shields to see the effects on the night sky and come up with possible solutions to mitigate the effect of light pollution.

7. Light Trespass Poster and Activity

The third type of light pollution is light trespass, where light goes where it is not needed, wanted, or intended. The most common example of light trespass is a streetlight shining into a window at night. This can make sleeping (even with curtains or blinds)

difficult. Light at night, in particular, can have health effects on humans. Blue light (common in most LEDs) when used at night inhibits the production of melatonin. Melatonin is a hormone, which is only replenished when asleep in the dark. In this activity, the students will have a 40:1 scale model of a street, complete with a house, a person, a streetlight with a slight drop-down Cobra lens (the book light) and a globe light (Mini-Maglight with the ping pong ball). Students try to recreate the problems voiced in the complaints poster and experiment with the position and angle of the light. They then come up with solutions to keep the light task-oriented.

8. Capstone

After students have completed their research and activities, they present this information to the mayor of the city and other task groups. Presentations can take many forms, such as oral (e.g. Powerpoint) presentations, posters, videos, skits, songs, or brochures. After all groups have presented, the instructor leads a discussion in which the groups meld their ideas. After the presentations and discussion have concluded a short assessment is given to evaluate student understanding and growth during the project. The instructor can include, adapt or omit as much or as little of the above steps as desired.

References

Walker, C.E. & Pompea, S.M. 2016, *NOAO Newsletter*, 113, 27
Walker, C.E. & Pompea, S.M. 2016, *NOAO Newsletter*, https://114, 22