REPORT ON TASK FORCE 1, GHANA 2013

EVENT: A five-day Astronomy workshop.

WHEN: From Monday 12th to Friday 16th August 2013.

WHERE: Ghana Planetarium, 12 Osu Avenue Extension, Cantonments, Accra.

SPONSORED BY: The International Astronomical Union (IAU) Office for Astronomy Development (OAD).

WORKSHOP PARTICIPANTS: University Students and Teachers.

VISITING LECTURERS:

Katrien Kolenberg, who travelled from the USA via her home country Belgium, and works at the Harvard-Smithsonian Center for Astrophysics.

Bonaventure Okere, who agreed to step in when Edward Guinan was unable to come, and travelled from Nigeria, where he is Chief Scientific Officer at the Centre for Basic Space Science, National Space Research and Development Agency, Nsukka.

David Weinrich, from USA, re-routed his European trip to come to Ghana, although not funded by the Task Force. He is the Planetarium Director at Minnesota State University, Moorhead, USA, and once worked in Ghana as a Peace Corps Volunteer.

David is a Past President of the International Planetarium Society (IPS) and was instrumental in coordinating people in America to donate the digital projector and get it refurbished for installation in the dome that Dr Ashong was building, thereby creating Ghana Planetarium.

Further details about the presenters are below under **Brief Bios of the Presenters**

LOCAL ORGANISERS:

Dr Jacob Ashong and Jane Ashong, Ghana Planetarium Directors, who host school visits to the planetarium on weekdays; and Sarah Abotsi-Masters, our locally-based volunteer and project coordinator, who organises family events and last year ran workshops for school teachers at the planetarium.

ASSISTED BY: Ghana Planetarium part-time staff: Rustom Amartey, Godfred Amartey, Kelvin Amartey, Charles Mensah and Adwoa Odame-Darkwa.

ALSO ASSISTED BY A VOLUNTEER: Esther Lamptey, a beneficiary of our charity 'Girls School Africa', which paid her Secondary School Fees, who is now studying Physics at Kwame Nkumah University of Science and Technology in Kumasi. During the workshop Esther was delighted to find out that she had been selected for a scholarship to study online astronomy with the University of Central Lancashire in collaboration with the Office for Astronomy Development.

THE PRE-REGISTERED PARTICIPANTS INCLUDED THE FOLLOWING:

Two 4th year university students, three 3rd year student; one 1st year university student, four Teaching Assistants, three Research Scientists, four Assistant Research Scientists, two Senior Research Assistants, one Research Scientist/Lecturer, one Senior Lab Technologist, one Technologist Researcher, one Principal Technologist, one Physics Teacher who is also a PhD candidate, two School Teachers (one in a public school, one in a private school), one School Science Tutor, one Student Science Teacher, two National Service Persons, one Claims Officer, one Junior Exploration Geologist who was previously a volunteer at Ghana Planetarium; and two government officials from the Ministry of Environment, Science and Technology.

Seven people who had registered in advance did not attend, including two university lecturers. Eleven who had not pre-registered turned up on Monday and Tuesday, some after hearing about the workshop through the media, and were allowed to join the workshop. The final number of participants was 43 plus two officials from the Ministry of Environment, Science and Technology.

INSTITUTIONS WHERE THE REGISTERED PARTICIPANTS WORK OR STUDY

University of Cape Coast, Physics Dept: 8;

Kwame Nkrumah University of Science and Technology, Kumasi, Physics Dept: 5;

University of Ghana, Legon, Physics Department, 4;

Ghana Atomic Energy Commission, Space Science Technology Institute: 9;

University for Development Studies: 3;

Ashesi University, Social Sciences and IT students: 7;

Senior High School Teacher: 2;

Grammar School Science Tutor: 1;

Education service: 1;

Health Insurance Officer: 1;

Geology exploration company employee: 1;

Survey Dept: 1;

Ghana Institute of Management and Public Administration: 1;

Ghana School of Management: 1.

PRE-REGISTERED PARTICIPANTS' STATED LEVEL OF KNOWLEDGE:

Basic/Beginner: 31

Intermediate: 8

Did not answer: 2

BACKGROUND – THE IMPORTANCE OF THE WORKSHOP

The study of Astronomy is very much in its infancy in Ghana, as is the case in much of the West Africa region. Currently in Ghana it features as a minor part of one university Physics course, and at another university it features as an introductory course that has only recently been started. There is a large gap between the development of astronomy education in this region and that in countries where it is highly developed.

Our hope is that Ghana can begin to catch up and start to close the gap, since modern astronomy is now an international activity. Modern technology makes it possible for professional collaboration in astronomical research to take place between different regions of the world without needing to travel, so that astronomers no longer need to work in isolation or feel disconnected from the mainstream.

There is consequently much scope for development of the field of astronomy, in the country and the region, as well as for using it as an inspirational link to other subject areas. It can inspire students to study related fields of maths, science, technology and cultural studies, all of which are important in enhancing the socio-economic development of the region.

The Ghana Space Science and Technology Centre (GSSTC), hosted by the Ghana Atomic Energy Commission (GAEC), was opened just over a year ago, and together with the Ghana Space Agency, is intended to become a centre of excellence for space science and technology. It will also facilitate research into natural resource management, weather forecasting, agriculture, security and other areas. The day after our visit, the Ghana Space Science and Technology Institute became a separate institution in its own right. For the achievement of success in this project, local staff will need to be involved and inspired to achieve the necessary training and education for participation at all levels. The space agency's first project is the Ghana Radio Astronomy Project, involving the conversion of the Vodafone earth satellite station at Nkuntunse into a radio astronomy telescope.

In line with the vision of the IAU's Strategic Plan for 2010-2020, with its particular focus on regions where astronomy is not yet well developed, the workshop was intended to raise the level of knowledge of astronomy among the participants, to inspire enthusiasm to learn more about astronomy, to promote the higher level study of astronomy, and to highlight its importance and relevance to everyday life and the development of the country and the region. It is hoped that eventually more university level courses will be created in the country's educational institutions, enabling students to progress to higher level studies.

SUMMARY

A 5-day astronomy workshop was held at Ghana Planetarium in August 2013 for University Students, Lecturers, and Teachers. The workshop brought International Astronomy Educators together with Ghanaian students, lecturers and teachers.

Feedback from participants showed that the workshop was successful in increasing the astronomy knowledge of the participants, in inspiring greater enthusiasm for astronomy, and in enlightening them about how astronomy and space science research has led to technological innovations that we all benefit from in everyday life.

Participants became more aware of the importance and relevance of astronomy and became aware of the possibility of further studies and related careers. They were shown some activities that can be used in the classroom; had experience of viewing the night sky with telescopes; and learnt about SKA and the Radio Telescope project by means of a conducted tour at Nkuntunse and a visit to the Ghana Space Science and Technology Institute.

The variety of workshop presentations raised the participants' interest and inspiration. Presentations included cultural astronomy, stellar sounds, the search for life in the universe, citizen science, and a talk about the National Space Research and Development Agency in Nigeria.

Many students recommended that a similar workshop should be held for Junior High School and Senior High School children.

DIARY OF THE WORKSHOP:

We realised that in order to make an impact we needed to get the participation of the local media (newspaper journalists and TV). We also wanted recognition by government ministries, particularly the Ministry of Information and Media Relations who had previously shown interest in Ghana Planetarium's plans and activities. This Ministry was the link that could ensure media coverage for the workshop. They also helped with accommodation for participants at the National Teachers Association Hostel in Accra and transport from the hostel to the workshop.

The Ministry of Information agreed to host an official 'Launch' of the Workshop at the Ministry Press Room, with members of the press invited for Friday 9th August before the workshop. Invitations were delivered and transport costs paid for the press, and everything was in place for the launch to happen on the Friday, with the

Minister and Chief Director in attendance. However, unfortunately, the press did not turn up, and so it had to be re-scheduled for Monday 12th, the first day of the workshop.

Consequently the workshop actually began with the launch at the Ministry of Information on Monday 12th, by which time the visiting astronomy lecturers had all arrived and were all able to speak at the launch, and participants who had arrived were brought to the launch. The launch was attended by a number of press reporters and photographers, Ministry officials and those workshop participants who had arrived on time. Members of the press interviewed some of the participants outside the main press room.

After the launch we returned to Ghana Planetarium, and started with an interactive Astronomy quiz and discussion, conducted by Dr Kolenberg, with the participation of the other lecturers and the participants, to find out what level of astronomy knowledge the participants had. This proved very successful due to its interactive nature, being a way of getting people involved, and providing a baseline to assess different levels of knowledge.

Professor Borte-Doku, a local Chief (who opened the planetarium in 2009, and also a retired mathematician and amateur astronomer) was present, and talked about a star chart which had been given to the planetarium by a member of the City's Survey Department, who was also in attendance.

On Tuesday all the astronomy professionals – Dr Kolenberg, Dr Okere and David Weinrich, provided presentations and teaching sessions in the planetarium. We tried to cover as much as possible of the Monday sessions that had been missed due to the launch ceremony and the quiz discussions. In the evening it was possible to view the night sky with telescopes in the garden, a new experience for the majority of the participants.

On Wednesday a trip to Nkuntunse Earth Satellite Station took place. In the coach that took us there, we were able to enjoy watching educational astronomy videos on a screen at the front of the coach. After the conducted tour at the Nkuntunse Earth Station we went to the Ghana Atomic Energy Commission guest house site where we had lunch and later were given an interesting lecture on radio astronomy by Eric Aggrey, Project Manager at Nkuntunse, followed by speeches and discussions with Professor Nyarko, the Director General of the Ghana Atomic Energy Commission, and Dr Ashilevi, the Director of the Ghana Space Science and Technology Institute.

On Thursday further sessions were held at Ghana Planetarium in the summer hut and inside the planetarium by Dr Kolenberg, David Weinrich, Dr Okere and Sarah Abotsi-Masters. Bonaventure spoke about Astronomy, Radio Astronomy and Space Science at Nsukka. David Weinrich spoke about Technological innovations from Space Science research, about how we know what we know, and some simple hands-on activities. Katrien spoke on Exoplanets, on working with live data, Music of the Stars, and Cultural Astronomy. Sarah talked about online Citizen Science projects and programmes such as Stellarium.

Dr Ashong was invited in the morning to Ghana Broadcasting Company's 'Unique Radio' to be interviewed live. Later that day there was a request from Metro TV to

answer questions on solar flares and to talk about the workshop. Dr Ashong went there with Dr Kolenberg and Sarah Abotsi-Masters, and Dr Kolenberg was interviewed (video attached). Sarah took photographs.

On Friday Dr Kolenberg spoke about the Office for Astronomy Development and the Strategic Plan. Dr Okere gave a talk about Amateur Astronomy and Dr Ashong spoke about the African Astronomical Society and the Astronomical Society of Ghana. As a break from astronomy, staff member Charles 'Gyamfi' Mensah performed some hands-on science demonstrations and presented some puzzles for participants to solve.

Discussions were held about what participants had learnt, and future actions, with the aim of not losing contact with each other. Sarah proposed setting up an online chat group to keep the group active and cohesive, which she has since done. Evaluation sheets were completed and participants were given certificates to certify their participation in the workshop.

Acknowledgements: Assistance throughout the workshop was provided by Godfred Amartey and Rustom Amartey in operating the planetarium equipment, by Rustom Amartey in facilitating communications with members of the media professions, and in organising transport to and from the hostel accommodation. Kelvin Amartey was involved in various errands including taking lunch orders and bringing lunches to the participants each day. Esther Lamptey was in charge of the signing-in desk and issuing notebooks, pens and name-badges, and also assisted Kelvin in serving drinks and snacks.

WHICH PRESENTATIONS WERE RATED MOST HIGHLY BY PARTICIPANTS

The most highly rated sessions were: The trip to Nkuntunse; the Planetarium show "Astronaut"; Stellar Sounds; The Electromagnetic Spectrum; The Astronomy Quiz; The Sun and Solar System; The Talk about Telescopes; Innovations and Spin-offs from Space Science Research; Nigerian Astronomy, Radio Astronomy and Space Science; Exoplanets: "Are we alone?"; and the Visit to Ghana Atomic Energy Commission Space Science and Technology Institute.

CHANGES FROM THE ORIGINAL PROPOSAL

Originally Dr Edward Guinan was scheduled to come with Dr Katrien Kolenberg to run the workshop. Unfortunately, due to unforeseen medical issues, Edward was not able to come, but Dr Bonaventure Okere very kindly stepped in to assist Katrien in place of Edward.

Shortly after this we received a message from David Weinrich, offering to come to Ghana and run teaching sessions at the planetarium in early August, and so we asked him to schedule his visit to take place during the workshop week. Thus we were very lucky to have three international astronomy professionals.

The original proposed date for the workshop was March. In consultation it was decided that to get the largest number of participants, the workshop should be held during the long vacation, thus avoiding exam preparation periods and exams. We felt that this strategy worked in respect of the participants.

However, some of the local lecturers we hoped to get were unable to participate due to it being the holiday period, and also for reasons of ill health and other engagements. In the event, we had so many first class presentations from our three visiting lecturers from abroad that it was hard to fit everything in, and we would have had difficulty fitting in any other lectures.

We changed the timetable by starting with the astronomy quiz to find out what people knew already and discussing the answers. This actually took quite a bit of time on Monday and part of Tuesday. The launch at the Ministry also took part of our workshop time on Monday. We had planned a number of full-dome video shows to be interspersed with the lectures throughout the week, but in fact there were so many rich and informative presentations that we only showed one pre-recorded full-dome video show.

The number of participants was somewhat lower than we originally anticipated. All those who requested to be part of the workshop were registered and were provided with accommodation (if requested), and lunches and snacks. The number was manageable, and due to some who had registered not turning up, we were able to admit some to the workshop who had not previously registered. Due to the lower than expected numbers we did not have to divide the participants into smaller groups for presentations in the dome and in the summer hut.

The realisation of the importance of the media coverage resulted in our incurring additional expenses that we had not fully budgeted for. From the advice we got at the Ministry of Information and Media Relations we learnt a great deal about how to involve the media and get their full cooperation, although at the same time incurring some expenses in covering their transport and meals.

Due to the costs for everything, that were likely to go over budget, we decided to curtail the plans to provide evening meals in nearby restaurants for participants.

HOW THE OBJECTIVES/DELIVERABLES THAT WERE ORIGINALLY PROPOSED HAVE BEEN ACHIEVED

The objective of raising the profile of astronomy in Ghana, and educating people as to the benefits of studying astronomy were met through the workshop itself and the newspaper reports, radio programme and interviews with Dr Kolenberg and Dr Ashong shown on television news and repeated again. Through discussions during the week, we could gauge from the inputs of the participants that they did learn about various aspects they had not previously thought about, and by the end of the course they appeared to be genuinely inspired.

However, the objective to promote the higher study of astronomy in tertiary institutions was not directly advanced as those in a position to implement the courses were not in attendance. Nevertheless the demand for such courses will have been stimulated.

Participants reported that they had learnt a great deal (generally starting from a

rather low or basic level of knowledge) so this objective appears to have been achieved. Those who already had some intermediate knowledge also benefitted from the lectures, due to the presentations of different and varied aspects of astronomy.

LESSONS LEARNED / WHAT SHOULD BE DONE DIFFERENTLY NEXT TIME

Most participants seem to have been satisfied with the structure of the workshop. However, one person commented that it would have been nice to have a planetarium show right at the beginning. This was in fact in the original plan which we deviated from due to the launch.

An alternative suggestion for a future event is to change the structure so that the mornings are talks and lectures, and afternoons are more discussion, hands-on, group work, etc. This would entail giving the participants tasks to show what they had learned, for example, presentations to give, or a practical demonstration to show.

We learnt the importance of getting publicity and managing relations with the media. In future we would like to make sure that interviews took place outside timetabled workshop events.

Some of the media people got a number of facts mixed up, for example calling "astronomy" "astrology" and giving inaccurate information about the planetarium's function, and when it was built. Perhaps next time we might anticipate some of these errors, and we could provide them with fact-sheets beforehand. A series of short articles or fact-sheets in the papers is another idea that might help clear up some basic common misconceptions.

SUGGESTIONS/RECOMMENDATIONS TO THE OAD FOR EXPANDING THE PROJECT BOTH LOCALLY AND TO OTHER PARTS OF THE WORLD (IF APPLICABLE)

The participants reported that the course was very valuable and felt it should be expanded for teachers and also JHS/SHS students.
For a course for the teachers we could include material to help them teach astronomy in a more practical way - and get them all to do that during the course.
For students we would want to inspire them, teach them critical thinking and how to do research, find out information for themselves, etc.

CHALLENGES

Challenges included keeping within the allocated budget, and keeping to the allotted timetable. As it happened it was sometimes necessary to be away from the workshop to be interviewed, and the opening launch event encroached on the workshop timetable. Another challenge was to get the participation of more university

lecturers. Some lecturers who said they would come did not turn up and others did not acknowledge or respond to the invitation.

WHAT DID PARTICIPANTS HOPE TO GET FROM THE WORKSHOP?

- ⊡ So I can identify research areas I can work on for my postgraduate program.
- ⊡ I aim at reading Astronomy, Space science and related Atmospheric sciences for my MSc /MPhil . By participating in this conference, I aim at updating myself with the current direction, trends and areas of research in Astronomy. I also aim at meeting people who are already in the field to either work on a research topic or be guided to come out with one.
- ⊡ I will learn new techniques and gain general knowledge in astronomy. I can therefore support the showcasing of the brilliant use of astronomy and enlighten the general public of Ghana. I am also looking forward to meet experts among diversity of people attending the conference for future collaboration.
- ⊡ I would want to participate to gain much knowledge and learn new skills in the field of astronomy and again to enjoy the added advantage of networking with scholars in the field of astronomy, to be inspired and challenged to undertake studies in astronomy in an intimate and welcoming atmosphere.
- ⊡ To acquire knowledge and techniques in astronomy. And also meet some experts in this field for future collaboration.
- ⊡ Broaden my Knowledge in Astronomical Physics.
- ⊡ To acquire knowledge in the applications of astronomy in our modern day life and the skills in educating the public about its importance.
- ⊡ I have the highest interest in Astrophysics and plan to dedicate my time to an observatory project after my sixties.
- ⊡ With Environmental science as my bachelor's degree programme, it will enable me to know how astronomy is important in the field of environmental science since questions will be asked, and this will help me in my future studies.
- ⊡ I am a personnel at the Ghana Space Science and Technology Institute. One of the aims of the institute is to train personnel in the useful application of space technology and astronomy for socio-economic development in Ghana and beyond. I hope this workshop will help me acquire and exploit advanced knowledge in this field thereby achieving some of the goals of the institute.
- ⊡ I wish to learn more about astronomy and establish research/teaching and learning relationship with experts and other participants.
- ⊡ I hope to learn to be able to teach astronomy.
- ⊡ To learn more about astronomy to be able to carry out research in the field of astronomy. The Ghana Space Science and Technology Institute is a new one, which needs personnel to be trained to be able to do research. I believe I will get to add to my knowledge if I participate in this workshop.

- ⊡ Since I work with the Ghana Space Science & Technology Institute, and particularly with the radio astronomy group, I believe the knowledge that I will gain at the workshop will be beneficial in my daily work at the institute.

- ⊡ Space science activities are new to the country and staffs are being prepared to take up the space science needs of the country. Astronomy is a big part of this new program of the country and as a staff of GSSTI I know participation in this will train me and give me the right perspective of astronomy.

- ⊡ To actively participate in the workshop and help publicize Astronomy.

- ⊡ I want to learn more about Astronomy for the sake of knowledge.

- ⊡ I am a Physics student who is interested in science researches. I wish to know more about astronomy and its effects on the world and modern society.

- ⊡ As a Physics student I believe this workshop will offer me the opportunity to better appreciate certain theories and gain a deeper understanding of the universe.

- ⊡ To practically understand the evolution, present status and the future of the universe.

- ⊡ To practically understand what the universe is about and how I can help others with the knowledge I will acquire.

EVALUATION

Participants were asked to evaluate the workshop. Most responses were overwhelmingly positive that the workshop had met their expectations.

Participants' Responses to: "HAS THE WORKSHOP MET YOUR EXPECTATIONS?"

1	Yes it has. The workshop has really educated me a lot, both about the progress of science and Astronomy worldwide.
2	Yes.
3	No answer
4	Yes, over and above.
5	Yes it has.
6	Yes, because I was expecting to relate astronomy to my field of study.
7	Yes.
8	Yes, and even exceeded them.
9	YES, GREAT START!
10	Yes, I expected it to be fun and educating and it was even more than that.
11	YES.
12 *	Not actually.
13	The workshop has exceeded my expectations. I have gained a wealth of knowledge that I have not had from all my science education.
14	Yes, it has.
15	Yes, because I have understood some things.

16	This workshop has exceeded my expectations, my mind has been opened to many possibilities.
17	The workshop met my expectations and has added more to my little knowledge of what I know before and has now pointed the way out for me to follow to improve on my knowledge in learning more about the Universe.
18	Yes.
19 *	Yes, but the beginning was anticlimaxed. We could have started with a video in the planetarium to drive passion and curiosity.
20	Yes.
21	Yes, it has.
22	Yes, it has. I attended to learn more about Astronomy and I know a lot of new things.
23	Yes.
24	Yes.
25	Yes
26	No answer

Comments on two less positive responses:

12* This person may not have had any expectations, as their answer to "What did you learn?" was "I learnt what astronomy is".

19 * This is a valid point. Our original plan was to start with a video in the planetarium, but due to the launch at the Ministry we departed from the original programme.

Responses of participants

d) "WHAT SHOULD WE DO DIFFERENTLY NEXT TIME?" and suggestions about e) "HOW CAN WE TAKE THINGS FORWARD?"

1	e) A workshop should be organised from time to time targeting Senior High School and Junior High School. Also effort must be made to add Basic Astronomy to the integrated sciences curricula in SHS and JHS and introductory Astronomy for the Universities in Ghana. I can help create awareness with families, friends and course mates through the wonderful website that Mrs Sarah showed us teaching us how to use the internet to see the world.
2	d) n.a. e) Create more awareness for astronomical issues and its importance to the country. Organise workshops for 2nd cycle institutions.
3	d) Organise it at larger area. e) By creating awareness.
4	d) Time it so that SHS students can participate. e) Form Astronomy Clubs in all schools. Talk about it at social clubs.
5	d) Create groups to research topics to present and communicate. e) Organise workshops for Senior High School (SHS) and JHS. * Adding basic astronomy to JHS curricula among others

6	d) I think next time it should be made known publicly, that is the "workshop". e) By bringing on board new ideas and new people to the workshop.
7	d) Invite more young people to attend the conference. e) More publicity of the Planetarium and Ghana Astronomical Society.
8	d) We could factor in the Senior High School Students too, such that it could be organised during their vacations. e) Beginning on a very small scale, university students can form clubs or small associations. Also we, the beneficiaries of this workshop can meet often to display and demonstrate any science spinoffs.
9	d) and e) Add a few more experts, and shorter sessions (1hr max).
10	d) Maybe it should last longer for about a month (if possible) for there to be effective training. e) Increasing the number of skilled teachers to teach to our level of understanding.
11	d) We should do good publicity. e) By taking initiatives in enhancing the knowledge of astronomy at all educational levels, especially the basic levels.
12	d) We should emphasize the positive effects of astronomy on mankind. e) i)To create the awareness in the public; ii) To publish article; iii) Build a radio station and create awareness of the local people.
13	d) I would like to see more participants. e) We need to introduce astronomy to children. This will spark the interest in astronomy and space sciences in the hearts of the rising generation. Workshops such as this will do just that.
14	d) 3 days. When teachers are free. e) Involve university people in the project. Find scholarships for active persons to attend sandwich programme.
15	d) I think there should be a uniform (T-shirts). e) We need to involve the secondary schools and forming of clubs.
16	d) I recommend that steps should be taken to significantly increase participation the next time this happens. Of course we will do our part by spreading the good news.
17	d) Increase publicity. e) Train more people who can hold workshops at different locations in Ghana.
18	d) Announce via the media, start with a climax, include practical field works, less theory. e) Announce via the media, use the coming eclipse as an opportunity to sell astronomy, engage with high school students.
19	d) The time span for a day's workshop. e) Involving the participation of more educational institutions in the astronomical workshops.
20	d) It should be done when teachers and students are less busy. e) Advertising a summary of what could be learnt and done at the planetarium.
21	d) n.a. e) Target youths who are interested in Astronomy and hold similar workshop.
22	d) Make it an international workshop. e) By reading wide and sharing knowledge.
23	d) Invite more of the Junior and Senior High School students. e) By publicising Astronomy.

24	d) There should be a handout on each presentation for further reading. e) Seeking funds from government, companies, factories, etc. to organise conference at least twice a year.
25	d) More practicals should be involved, e.g. the telescope viewing should be done more often. e) I think we should place emphasis on creating more awareness especially at the grassroots and rural areas.

Note on Comment 5 e) : It is on the Junior High School curriculum already.

MEDIA COVERAGE

Articles were printed in the National Newspapers: "The Daily Graphic" (largest circulation national daily), "The Daily Guide" and "The Times".

"TV3" (Ghana National Broadcasting company) covered the launch of the workshop as well as a live interview with Dr Kolenberg on the midday news on Monday.

"Multi TV for kids" interviewed Dr Kolenberg and filmed at the workshop on Tuesday.

"Metro TV" filmed the launch on Monday and ran a live interview with Dr Kolenberg on the 1.00 o'clock news on Thursday.

"Unique Radio" (Ghana Broadcasting Company) interviewed Dr Ashong live on Thursday morning.

An Internet Newspaper Report was published on GhanaFilla.net on 14/08/2013 **: "Government urged to invest in astronomy"** at http://www.ghanafilla.net/government-urged-to-invest-in-astronomy/

The same article was in the online Daily Graphic at: http://graphic.com.gh/General-News/government-urged-to-invest-in-astronomy.html

Brief Bios of the Presenters

Dr. Katrien Kolenberg

Katrien was born in Belgium and currently works at the Harvard-Smithsonian Center for Astrophysics, in Cambridge MA, USA. She studied Physics at the University of Leuven, followed by a PhD in astrophysics. Her research took her first to Vienna, Austria, where she worked at the Astronomical Institute for several years. Katrien has obtained several grants and fellowships to pursue her research in stellar astrophysics, more specifically asteroseismology ("stellar sounds").

Her professional career outside of academia includes work in astronomy outreach, astronomy development, cultural astronomy and linking astronomy/art projects, in the hope of increasing the impact of astronomy (and the knowledge thereof) on our daily lives. Since 2006 Katrien has been actively involved with several IAU (International Astronomical Union) programs regarding astronomy outreach worldwide, particularly in Mongolia and several West African countries (Senegal, Burkina Faso and now Ghana!). She currently serves as vice-chair of the Office of

Astronomy for Developments's Task Force 1, focused on Astronomy for Universities and Research.

Dr. Bonaventure Okere

Bonaventure is currently the Chief Scientific Officer at the Centre for Basic Space Science, National Space Research and Development Agency, at Nsukka. He holds a PhD in Astronomy & Astrophysics from the University of Nigeria, Nsukka.

His work experience includes Research in Stellar evolution, Astronomy Education/outreach, and being an IAU-OAD volunteer.

David Weinrich

David is currently the Planetarium Director at Minnesota State University, Moorhead,USA. He has a B.A. in Physics from Luther College, Decorah, Iowa. He also works as an Astronomy Instructor at North Dakota State University, Fargo, North Dakota.

David has been active in astronomy education and outreach for many years, teaching introductory astronomy to college students, training portable planetarium operators and school teachers in the US and presenting astronomy lectures to secondary school students in Sri Lanka. He served as the President of the International Planetarium Society from 2011 to 2012.

David's "love affair" with Ghana began in 1981 when he served with the Peace Corps teaching Science at St. Augustine's High School in Cape Coast and has continued to the present day. In 2008 he was instrumental in the project which saw the Ghana Planetarium being built and equipped in Accra.

THE FOLLOWING FEEDBACK WAS WRITTEN BY A PARTICIPANT:

Gagakuma Bertelsen

University of Ghana

Legon

I am glad to have been part of this five-day workshop. A lot of knowledge – about the universe, and particularly our existence – has been shared; knowledge I have not gained in all my education as a science student. I have learned that all the other elements come from the fusion reactions of hydrogen in the stars. Also I now understand more clearly some of the technologies scientists employ in carrying out research on the known universe. More practical is the fact that almost all technological innovations which the everyday consumer enjoys – in treatment, medicine, communication, computers and many more – are spin-offs of astronomy and space research. It would therefore be prudent for any nation (Ghana) to encourage and invest heavily in space research if it hopes to realise meaningful development. Our West-African neighbour Nigeria realised this not too long ago and have taken the necessary steps to set up a space program. I am

truly impressed with their progress, and it is my hope that Ghana can learn from their example.

It is also gratifying to know that GAEC has a space research center with support from the South African government. Their focus right now is on Radio Astronomy and with the SKA (Square Kilometre Array) project to begin operations in 2017, jobs will be created and those communities affected will see great development in economy and infrastructure.

This workshop has exceeded my expectations; my mind has been opened to many possibilities. I am a better problem-solver. The task now is to spark an interest in space science in the hearts of the rising generation. Workshops such as this will do just that.

The only regret I have is that participation was low. I recommend that steps should be taken to significantly increase participation the next time this happens. Of course we will do our part by spreading the good news.

To Dr Ashong and his team of professionals I am particularly impressed with your dedication to this cause. Let me say that your efforts will definitely yield positive results in the near future. This is the beginning of a great work in Ghana. Thank you for taking time out of your busy schedules to do this.

ATTACHMENTS AND APPENDICES:

- ⊡ Slide show of photos
- ⊡ Movie clips of TV interviews
- ⊡ Scans of newspaper articles

APPENDIX: SAMPLES OF THE REVISED TIMETABLES

Re-drafted Timetable for IAU Workshop at Ghana Planetarium

Day 2, Tuesday 13th August

Time	**Presenter**	**Topic**
9:00 – 9:30am	**Katrien**	Revision / Completion of Astronomy Quiz
9:30 – 10:30am	**Bonaventure**	The Sun and the Solar System
10:30 – 11:00am		**Break**
11:00 – 12:00pm	**David**	The Electromagnetic Spectrum
12:00 – 1:00pm		**Discussion: Raising the Profile of Astronomy in Ghana**
1:00 – 2:00pm		**Lunch**

2:00 – 3:00pm	**David**	Simple Hands-On Activities: Star Counting: Solar System Model, etc
3:00 – 3:30pm		**Break**
3:30 – 4:30pm	**Katrien**	Telescopes (may include the Planetarium show "Two Small Pieces of Glass")
4:30 – 5:00pm	**Bonaventure**	Overview of radio astronomy and SKA
6:30pm onwards		Telescope viewing and star counting (weather permitting)

Revised Timetable for IAU Workshop at Ghana Planetarium

Days 4 and 5

Thu 15th Aug	9:00 – 10:00am	**David**	Technological Innovations from Space Science Research + Q&A.
	10:00 – 10:30am	**Bonaven-ture**	Astronomy, radio astronomy and space science in Nigeria.
	10:30		**Break**
	11:00 – 12:00pm	**Katrien**	Exoplanets "Are we alone?"
	12:00 – 1:00pm	**David**	How do we know what we know?
	1:00		**Lunch**
	2:00 – 2:30pm	**David**	Simple hands-on activities.
	2:30 – 3:00pm	**Sarah / Katrien**	Free Astronomy software and Citizen Science projects, working with online data.
	3:00		**Break**
	3:30 – 4:30pm		**Discussion** - **Growing the Next Generation of Scientists and Astronomers**
	5:00 – 6:00pm	**Katrien**	Music of The Stars, Stellar Sounds & Cultural Astronomy.
	6:30pm		Telescope viewing (weather permitting).
Fri 16th Aug	9:00 – 10:00am	**Katrien**	IAU, OAD and the strategic plan, the call for proposals and other activities.
	10:00 – 10:30am	**Bonaven -ture**	Amateur astronomy.
	10:30 –		**Break**

	11:00	**Jacob**	The AfAS and the Astronomical Society of Ghana.
	11:30		Planetarium show.
	12:00		**Discussion – what have we learned from the Workshop?**
	12:30		**Lunch**
	1:30 – 2:30pm 3.30pm		**Discussion – The Way Forward** Action Plans Evaluation forms
	4:00 – 5:00pm		**Closing Ceremony**

LIST OF PHOTOS ON THE SLIDESHOW

1. Bonaventure and Sarah in the Conference Room at the Ministry of Information; 2. Sarah and Katrien in the summer hut at Ghana Planetarium; 3. Katrien holding an Earthball talking to participants; 4. Bonaventure talking to participants in the summer hut; 5. Student discussions on Monday; 6. Charles (Gyamfi) showing Esther one of his science demonstrations; 7. Jacob and Rustom (Nii Armah) displaying the star chart; 8. Professor Borte-Doku talking about stars; 9. David interacting with participants; 10. Participants' discussions on Tuesday; 11. Ghana Planetarium staff holding a Galileoscope kit; 12. Night sky viewing with the large telescope; 13. Nkuntunse Earth Station; 14. Katrien at Nkuntunse; 15. David, Emmanuel, Rustom and Godfred in front of the luxury coach that took us to Nkuntunse; 16. Sarah and Bonaventure at Nkuntunse; 17. Discussion while waiting for the tour to start; 18. The Satellite dish; 19. and 20. Tour of the Earth Station; 21. Katrien giving an explanation; 22. Discussion with participants; 23. Back at base on Thursday; 24. Jacob talking to officials from the Ministry; 25. Friday in the summer hut; 26. Papa Nii (Godfred) receiving his certificate of workshop attendance from David; 27. Nii Armaah (Rustom) receiving his certificate; 28. Participants listening to a presentation on Friday; 29. Sarah, David, Professor Borte-Doku, Bonaventure and Katrien.