DIVISION C1
ASTRONOMY EDUCATION AND DEVELOPMENT
Education et Développement de l'Astronomie

Newsletter 84 – December 2016

Contributions to this newsletter are gratefully received at any time.

This newsletter is available at the following website
http://iaucc1.frm.utn.edu.ar/wp-content/uploads/2012/11/IAUNL84.pdf

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A WELCOME FROM THE EDITORS WITH A NOTE ON EDITORIAL POLICY

Welcome to IAU Commission C1 Newsletter #84, the second to be published new divisional structure of the IAU established at the General Assembly XXIX in Honolulu, August, 2015. (We are continuing the numbering of the newsletter consecutive with the old C46 education newsletter.) This newsletter contains reports on several meetings held in the last year. And we are pleased, as always, to continue the series of informative book reviews by Naomi Pasachoff.

As always, comments and contributions are both needed and welcome. Thanks to everyone who has made a contribution to this edition of the Newsletter. Please note the text in this Editorial highlighted in RED.

For the March issue the deadline for submitting material is **Friday 3 March 2017**. If you can include photos or illustrations with any material, please do so in the manuscript. Feel free to encourage others to submit material – anything with an astronomy education or development aspect will be considered.

IAU C46 NEWSLETTER – GUIDANCE FOR CONTRIBUTORS

The editor is happy to accept articles on any aspect of astronomy education or development, including obituaries and other articles on people. 500-2000 words are the approximate upper and lower limits. Shorter contributions, up to a few hundred words, such as meeting announcements, meeting reports, and other news items, are also welcome.

> Send contributions to me by email, at marschal@gettysburg.edu. or to the Kathy Eastwood, secretary of CC1 and co-editor of the newsletter: kathy.eastwood@nau.edu. Please send manuscripts as a Microsoft Word attachment (much preferred) or include the text in the body of the email. **Illustrations should be sent as separate, individual files**, preferably as JPEGs or TIFFs no larger than about 3 Mbytes each. **Please include contact information for the author, including email and postal address, DO NOT SEND ANYTHING AS A PDF.**
>
> Do not send a preliminary draft unless it is clearly marked as such, but feel free to contact me with preliminary ideas for contributions.

We try to edit as lightly as possible, and we certainly don't care whether US English or British spelling conventions are used, so you may notice an inconsistency in style insofar as such conventions can vary from author to author with no loss of comprehensibility. We also leave local turns of phrase untouched unless the meaning is obscure. Clarity, conciseness, and being interesting or informative are what is needed. Only in rare cases is heavier editing necessary.

Notes on Resources and Methods for Education

I welcome short notes pointing readers to resources useful for education. Such notes can just point to a website, or can include a paragraph describing the nature and application of the resources available. You will find several examples of these notes in this edition. I also welcome longer articles detailing methods and techniques and reports on educational activities and summer schools, and well as studies regarding the impact and effectiveness of such techniques for astronomical learning.

Book reviews

We welcome book reviews. Reviews should generally be of books centered on astronomy education or development or of historical interest for educators. If there's such a book that you think is worth reviewing, please send your review to me.

The C1 websites

The "official" IAU CC1 website is at http://iaucc1.frm.utn.edu.ar/ The IAU Office of Astronomy for Development (OAD) is at http://www.astro4dev.org/ and the IAU Office of Astronomy Outreach (OAO) is at https://www.iau.org/public/

Back issues of the C46 Newsletter, our previous incarnation

Back issues are available at http://iaucomm46.frm.utn.edu.ar/newsletters/. Newsletter 49, October 1998, has been scanned from hard copy, so the quality of reproduction is only modest. This is also the case for earlier ones, edited by John Percy. These extend back to February 1992, but there are gaps.

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EDUCATIONAL REPORTS

CELEBRATING 10 YEARS OF UNIVERSE AWARENESS

In 2016, Universe Awareness is celebrating 10 years of inspiring children with our wonderful cosmos. These last 10 years have been full of exciting activities and collaborations across the world. To celebrate this, we will be organizing contests, training, education events and many other activities across the globe throughout 2016:

Fig. 1 Olympic Team 2013, Romania

CONTESTS

- **Space Scoop Comic Contest**
  We're asking our readers to create their very own Space Scoop comic. Anyone between the ages of 8 and 18 years is invited to create an original short comic based on one of our Space Scoop stories. Deadline is 31 August.
- **Win Your Own Telescope Contest**
  Do you want to have a telescope for your astronomy outreach and education activities? In collaboration with Sterren Schitteren voor Iedereen, we are giving away 4 Bresser Refractor telescopes to our UNAWE network this year. Deadline is 31 July.
- **EAAE Space Art Contest**
  Discover the Universe and its beauty through art. The European Astronomy Space Art Contest aims to stimulate the creativity and independent work of students from European primary schools using astronomy.

TRAINING

- **Space Education International Workshop**
  Between 18 and 22 October, we will host a Universe Awareness Symposium at the Space Education International Workshop in Leiden, the Netherlands. The event, organized by Space Awareness in collaboration with the Galileo Teacher Training Workshop and the

European Space Agency, invites participants to explore best practices and innovative uses of astronomy and space sciences for education.

- **Space Education Online Course**
  In September, Space Awareness will launch a series of four MOOCs dedicated to the use of space in education. These free and open online courses will be hosted by the European Schoolnet Academy and have been developed by the Space Awareness partners in collaboration with international teachers.
- **Google Hangouts Teacher Training**
  Throughout the world, UNAWE network members organise teacher training events. At the end of 2016, Universe Awareness will be hosting an international teacher training online, led by UNAWE resource specialists from around the world.

EVENTS

- **Asteroid Day**
  In 2016, UNAWE is the educational partner of Asteroid Day 2016. Asteroid Day will take place on 30 June this year. Universe Awareness has developed Asteroid Day educational resources for children, in collaboration with LCOGT.
- **Global UNAWE Network Event**
  This year, during World Space Week, we will organise a global Universe Awareness Event where all countries of the UNAWE network will celebrate the inspirational aspects of astronomy at the same time with children around the world.

OTHER ACTIVITIES

- **Microfunding for UNAWE projects**
  Inspired by the success of our colleagues at Astronomers Without Borders and Galileo Teacher Training Programme, we will be launching microfunding campaigns for select UNAWE projects in collaboration with Fiat Physica.
- **Universe Awareness 10 Years Publication**
  Later this year, we will publish a book about the successes, challenges and milestones of the Universe Awareness programme over the past 10 years, which will function as a toolkit for future astronomy education projects.
- **Updated Universe Awareness Logo and Website**
  We have also been working on updating the current Universe Awareness logo and website, to better be able to support our network. Keep an eye out!

For more information, please contact us:
E-mail: info@unawe.org
Twitter: #unawe10 and @unawe).

A REPORT ON ACTIVITIES BY WG3 ON EQUITY AND INCLUSION

During the last months the WG3 on Equity and Inclusion has been involved in different kinds of activities and discussions, regarding mainly the use of edible materials to talk about astronomy, new 3D resources that are becoming available and a new document with recommendations on how to improve the accessibility of astronomical publications. This document has been developed by the Working Group on Accessibility and Disability of the American Astronomical Society (WGAD) with the support of our Commission.

A number of new collaborators have joined the WG enriching it with their diverse expertise and backgrounds. New and exciting discussions and projects will surely arise in the next future, as well as the start of new collaborations between the group members.

All this activity has been highlighted by the workshop "Astronomy beyond the Common Senses" that the WG organized in Cartagena de Indias, Colombia, last October. It was a big success and we expect it is only the first one of many to come. You can read a very nice report about it from Wanda Díaz-Merced somewhere else in this Newsletter.

Finally, all these topics and more are available at the WG website (http://sion.frm.utn.edu.ar/iau-inclusion/) which is regularly updated with news and new contents thank to the effort and dedication of Lina Canas from the OAO.

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A REPORT ON ACTIVITIES BY THE INTERCOMMISSION WORKING GROUP B7&C1: DARK SKIES CHALLENGE AND EDUCATION

by Margarita Metaxa, Richard Green, Constance Walker and Beatriz García

We find ourselves at a crossroads where many of our planet's most critical scientific and environmental challenges are occurring when we are not well prepared to address them. Global climate change, loss of nightscape, rising sea levels, changing weather patterns, collapsing fisheries, and habitat losses are real threats to the world-wide economy and way of life.

At the same time, youth continue to fall further behind their global peers in science and math, resulting in the threat of a future where fewer Earth-citizens are prepared for careers that will address these challenges.

IAU recognized this perilous track and organized this working group, which gives a broad mandate to educate the public about nightscape, astronomy science and stewardship through achieving sustainable development within quality lighting framework.

Our WG's proposal focus on education for achieving sustainable development a within quality lighting framework, since through educating future citizens will help reorient education towards sustainable development, in order to empower the world's 60 million teachers to become key agents of change, and through them reach local – global authorities and change the situation.

For this reason, our objective is

"Establish a National Contact in each country with active members of the Commissions C.C1 and C.B7, through the main observatory of the country or other institution willing to support

the activities of the National Contact, with the commitment to the transfer and sharing of knowledge."

Using as a tool the following successive programs, as good practices and as a source of organized integrated knowledge

1. Globe at Night (https://www.globeatnight.org)/
2. Cosmic Light EDUKit (http://nuclio.org/cosmiclightedukit)
3. IYL Quality Lighting Teaching Kit (http://www.noao.edu/education/qltkit.php)
4. NASE KIT (http://itedamza.frm.utn.edu.ar/wp-content/uploads/2014/07/PL-IAU-FM-NASE1.pdf)

we intend to establish a strong professional network with pre-service teacher courses as well as the in-service education of teachers, at all levels, education policy-makers, and authors of educational materials, with final target to integrate the concept of quality lighting and the Light Pollution topic to the national educational environmental curriculum.

Already a strong team from all over the world has been gathered as a first nucleus for this initiative. We all hope and count to more participations so to achieve our goals

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INFORMATION ACCESS IN ASTRONOMY: THE CARTAGENA MEETING

The age of total inclusion in Astronomy, has been declared by the Commission C1 on Education and Development of the International Astronomical Union, a goal that, when implemented, will take astronomy ahead of any scientific field.

As a result, 32 professionals (astronomers, outreach professionals, educators, computer scientists) from around the world met in Cartagena de Indias, Colombia to discuss the work done to improve accessibility and to exchange new ideas to maximize, standardize, and innovate information access in Astronomy. Information access embraces all levels, and having a wide vision of future, the commission paved the way to a vigorous and open discussion of human-centered design in Astronomy.

The presentations (soon available at the Working Group for Accessibility and Inclusion webpage http://sion.frm.utn.edu.ar/iau-inclusion/) embraced the subject of efficient, useful and effective access to astronomy information. The, presenters and attendees were welcomed by a spectrum of multisensorial exhibits, examples of what can be done to make astronomy accessible to all. Among the topics discussed were outreach, education, support for astronomers parenting children with disabilities, literature revision, access to data bases, and multi-sensorial representation of astronomical information. Everyone was in agreement that there was a need for more meetings of this kind. Those who attended were recognized by

the University of Cartagena with certificates (I will personally use mine as proof of professional development training!).

Photographs of the Cartagena Meeting by Allyson Bieryla, abierla@cfa.harvard.edu

I had never seen the like of it before! Everyone's spirits were high from beginning to end as they enjoyed a serious exchange of ideas that promise to enrich our field by opening it up further to those with diverse learning and coping styles. Thank you to all the presenters and organizers. Let's meet again and welcome everyone to the team!

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IMPROVING ACCESSIBILITY OF ASTRONOMICAL PUBLICATIONS

Recommendations from the Working Group on Accessibility and Disability

Each individual copes, searches, thinks, performs, perceives, and interacts differently. Interaction implies a response to physical, cognitive, emotional, and other stimuli that have been processed by an individual. In the interest of disseminating knowledge to the community in a fully inclusive way, we would ideally accommodate the coping and cognitive needs of every single human being. Well-designed user-centered interfaces take into consideration characteristics of the target audience to create a Human-Computer Experience that will not prevent access, frustrate, or serve to disengage the user. For the field of astronomy, where thousands of publications are generated each year, the number of articles published by a scientist is highly weighted in performance and productivity metrics. To publish and stay up-to-date on the latest research is mandatory to find the next job. However, the pervasive dependence on language and expressions that fit only one perceptual style suggests that our field has limited itself to the participation of only this perceptual style. This

dependence forces people with other learning styles to learn or memorize using this particular style. To unwittingly deny people with disabilities the same amount and quality of information that is available to a traditional visual learning astronomer has the exclusionary effect of severing our links with the field and society.

We recommend that journal staff consult User Centered, Universal Design specialists among other information access professionals rather than relying on a checklist for developers to follow to achieve "accessibility," as the latter will lead to more complications than solutions. User Centered design considers all of the perceptual strategies of humans to design systems that will not disengage the user. This strategy lends itself to widen the participation of a large diversity of people by enabling their participation in tasks that have traditionally excluded non-visual learners. Astronomy and physics are very visual fields that often force people that do not fit that learning style out of the field.

Information Access (IA) technology (Assistive Technology, hereafter AT) is very expensive, which in itself excludes most people from efficient, effective and useful IA. Common assistive technologies used by people with disabilities are alternative keyboards, pointing devices, eye-tracking equipment, voice-recognition software and screen scanning options. Software in general is overcrowded and updates frequently change the way things are done whenever new features are added. Changes in software may frustrate users who are accustomed to a certain interface. This is a major challenge for people with disabilities. On top of that, we note that accessibility is not a priority for our culture: for example, journal display typically prioritizes use of PDF generators that save space over ones that make it easy for people with cognitive, attention, and focus challenges. Technology used to improve accessibility should be compatible with freely available accessibility software; for example, the NVDA (NonVisual Desktop Access) screen reader is compatible with the Mathematical Markup Language (MathML). A culture where the use of words does not disempower people is mandatory if science is to become truly representative. Moreover, accessibility should be performed automatically and not as an exception.

Deaf and hard of hearing people are often assumed to not face difficulties when reading or navigating webpages. That assumption is far from reality, and excludes many individuals. Words commonly used in astrophysics often lack direct equivalents in sign language and so must be painstakingly spelled out letter by letter. Ideally every word used in a journal article should have a translation to sign language. The Office of Astronomy for Development (OAD) and the International Astronomical Union Working Group on Accessibility and inclusion are coordinating efforts to address the lack of sign language for astrophysical words at the professional level, and as needed to develop international signs. We advise the journal staff to seek their advice.

Below, the reader will find recommendations for improving the accessibility of astronomical journals. It is important to highlight that no user centered testing or focus group has been performed to gather the suggestions below. These suggestions should serve as a guide and motivation for the reader to perform a user centered study and deepen the research on how best to use technology to bring different learning styles on board. We mentioned previously that a list of steps for developers to follow is not the solution, even though our suggestions below may look like a list. Lists limit creativity, limit possible new solutions, and may be unintentionally taken as absolute, thereby leaving out the very important phase of continuous focus groups and usability testing. Good back-end and front-end design is guided by

continuous usability evaluations. We hope that readers will gather help from experts on user centered design, human computer interaction, and disability in astronomy to enrich the field at all levels.

On the same token, there are many learning styles and disabilities, and we are not specialists[1] in all these learning styles. It is not our intention to leave any disability out, but if we did then please reach out to us with your suggestions. These suggestions were gathered from astronomers whose experiences are informed by our own disabilities.

In order to meet the needs of all readers with disabilities, we recommend that journals conduct focus groups with different users from the target audience (students and astronomers with disabilities). This will require approval of an Institutional Review Board. Studies with astronomers with disabilities have already been done while respecting their anonymity: the journals may also begin with the target audience doing a high granularity usability evaluation of the journal interface as it is, together with remote login to monitor the navigation and text-to-speech interface. This approach lends itself to widening diversity, identifying deeper situations affecting the target audience, and prioritization. It is important to develop new methods that will lead us to create robust and enduring interventions. The work to be done also comprises the design of a template where the article will be inserted; that may require additional unique expertise.

Procedural Recommendations

- **Form a committee to evaluate and improve the accessibility of astronomical publications.** This could be done in partnership with the Working Group on Accessibility and Disability (WGAD), the Office of Astronomy for Development (OAD), and the Office of Astronomy Outreach (OAO). The knowledge gained should be shared openly with other journals and publishers.
- **Perform user-centered studies** to deepen the research on how to best use technology to make astronomical publications accessible to people with different learning styles and disabilities.
- **Perform usability evaluations** regularly to make sure that articles are compatible with accessibility software. However, assistive technology compatibility does not necessarily mean that information may be accessed by the reader.
- **Seek feedback from the astronomical community about the accessibility of journals**, especially from students and astronomers with disabilities.
- Provide space in astronomical publications for articles on accessibility, equity & inclusion, astronomy education research (possibly as a supplemental journal article or letter series).
- **Provide authors with guidelines on accessibility.**
- **Ask referees to comment on the accessibility of manuscripts.** Provide specific criteria for referees to comment upon such as the accessibility of graphics and captions, and the understandability of the manuscript. A side benefit is that referees will learn better strategies for accessibility that they may use in their next publication.
- **Provide accessibility trainings for journal staff.**

Navigation

[1] The reader may write to access-astronomy@googlegroups.com or to the chairs of the American Astronomical Society Working Group on Accessibility and Disability.

- **Organization of the articles, browser, and content should follow a consistent/standard format.**
- **Use tags and links within documents to improve ease of navigation.** For example, a table of contents with links to the different sections should improve screen reader compatibility. Use usability evaluations to refine how tags are used to fit the cognition and thinking styles of the target audience.
- **Ensure that people using screen readers and other assistive technologies are able to get the gist of an article, and can go back and forth between different sections at will.** For example, imagine someone who only wants to hear the methodology section and has no need to hear the introduction, but the screen reader goes through it anyway. Readers should be able to easily jump between the text, table of contents, footnotes, and references. Documents should have a defined safe spot in case a reader loses orientation.
- **Speech recognition software** may ultimately be a good option for navigating journal articles. However, speech recognition software presents its own problems (Hwang et al. 2003; Wobbrock & Gajos 2008) such as difficulty distinguishing between similarly sounding words.
- **Find and use resources such as MathML and/or Mathspeak that are compatible with free screen readers and other assistive technologies.** It is important not only to read the variables and operators one by one in an equation (which is the equivalent to reading a sentence by spelling it letter by letter), but to know what the equation means and how it is being used (e.g., what graphemic symbol in the equation changed and how) to tackle the whatever situation the author is considering. The user should be able to recognize the equation and not to be forced into a memory overload.
- The **spotlight technique** proposed by Lee and Oulasvirta (2015) brings important information to the foreground and may be used in PDF readers to accommodate people with attention challenges. A very useful resource is the Americans With Dissability Act Network, Great Lakes Training Center library training session on "How do I know my PDF is accessible" http://www.accessibilityonline.org/ada-tech/archives/110440
- Journals should provide users with accessible, time-effective, efficient, and useful ways to **choose the settings** to engage with the content. This should be possible without having to perform complicated movements with the mouse. Shortcut keys could be used, for example, to hear the spelling of a word or navigate within the document.
- To **aid users with motor impairments**, avoid small clickable elements, mouse-dependent actions (Cannon 1987), and keyboard traps.

Content

- **Provide articles with a logical and clear structure.**
- **Research articles should be as understandable as possible for students and early career astronomers.**
- The written content should **use richer (sensorial, verb, etc.) descriptors and expressions**. Non-visual learners require **more descriptive text**. Publications should **provide visual content to accompany text** when possible for deaf and hard of hearing individuals.
- Journal articles are notoriously dense and use many words that are beyond the everyday experience of some users with perceptual disabilities. **Sensorial**

information (visual, hearing, touch, taste) is involved in the dissemination of knowledge through construction of analogy and development of relatable explanations. The sensorial information linked to linguistics and the creation of knowledge has been extensively studied. Journal managers should consult with professionals in linguistics and phonology, For a specific example, the recent LIGO gravitational wave detection news heavily circulated the analogy of "hearing" them for the first time; this is a fraught and technically incorrect description that misleads the general public and can be alienating or insulting to persons with disabilities (e.g., "we were deaf but now can hear").

Layout and Style

- **Prioritize accessibility over other criteria in the design and layout of astronomical publications.** Redesign format with accessibility in mind.
- **The display should be simple** and accommodate the search and coping strategies of the diversity of possible readers.
- Websites should **allow users to easily change display settings related to accessibility**. Provide high contrast and high visibility options, mouse-over text, and descriptive image captions. Allow the fonts and font size to be changed.
- **Maximize accessibility for people with dyslexia.** Use dyslexic accessible fonts (including but not limited to Helvetica, Verdana, and OpenDyslexic) at a reasonably large font size (12 pt) with sufficient space between lines. Avoid crowding,[2] and follow best practices related to the length and arrangement of sentences that are displayed.[3] Many potential astronomy students have dyslexia (Schneps 2006), and some people with disabilities are excluded because they feel incompetent when the situation is mostly related to access to information.

Multimodal Access

- **Provide multiple modes of access to the information contained in journal articles.** Possibilities include podcasts, presentation slides, and videos to complement research articles. Options should be made available for embedding varied media formats (audio, video).
- **The format of articles should allow Braille embossing.**

Graphics and Charts

- **Use colorblind intuitive palettes** for graphics.
- **Provide sufficiently descriptive captions for graphics**.
- **Descriptions of charts should follow a standard form and use richer descriptors and expressions.** Research should be done to create guidelines on best practices. For example, if a person or screen reader describes graphemic symbols one by one to a blind person, this overwhelms their memory and makes it difficult to recognize meaning. This situation is similar for many others with perceptual and reading challenges.
- Data from plots and charts should be made available for **sonification and/or audio descriptions**. An example tool is xSonify.

[2] **Crowding** is a perceptual phenomenon where the recognition of objects (or graphemes) presented away from the fovea is impaired by the presence of other neighbouring objects (sometimes called "flankers").

[3] Schneps, M.H., Thomson, J.M., Sonnert, G., Pomplun, M., Chen, C., & Heffner-Wong, A. (2013). Shorter Lines Facilitate Reading in Those Who Struggle (link) (see research of laboratory of visual learning for people with reading challenges (ex. dyslexia) (article on crowding and vertical display on scientific American: Using Technology to break the Speed Barrier of Reading posted at researchGate)

In conclusion, we hope that astronomical publishers and journal staff find the information useful in the important task of making astrophysics accessible to all. WGAD is here to help in this process, and we appreciate your time and efforts. We are glad to be part of a community that values inclusion and access.

With our best regards, the coordinating committee members of the AAS WGAD:

Wanda Díaz-Merced (Co-chair)
Nicholas Murphy (Co-chair)
Alicia Aarnio
Jacqueline Monkiewicz
Jason Nordhaus
Sarah Tuttle

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1ST SEMINAR ON NASE PRACTICAL ASTRONOMY EDUCATION

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NASE was born in 2010 after a couple of pilot courses conducted in collaboration with UNESCO during the International Year of Astronomy 2009. After seven years of continuous work mainly in Central and South America, it is time to carry out an overall review of the project to begin a new phase with renewed and stronger forces. In Bogota, on October 11st, NASE organized the 1st Seminar on NASE Practical Astronomy Education in order to discuss all the coordinator from center and South America countries where NASE works for a lot of years and organized a lot of courses. In this meeting participated Argentina, Bolivia, Brazil, Colombia, Cuba, Ecuador, Guatemala, Honduras, Mexco, Nicaragua, Panama, Pataguay, Peru, Spain and Uruguay. Some of them face to face and in some case by virtual solutions. Proceedings of this seminar are in the NASE website.

If NASE was initially established in the Americans countries it was not merely by chance but was the result of a clear desire from the NASE presidency to organize courses for teachers in the language of the country. No doubt the American continent has a great advantage over others, and that is that with two or three languages we can easily operate. We started with materials translated into Spanish, English and Portuguese. This is what has enabled a progressive, active and dynamic launch in these years and achieve difficult objectives carried out in another geographical location. Having to translate materials to a language in almost every country would have consumed a lot of energy in the period of foundation and sedimentation.

We must also recognize that making contacts has been easier on this continent due to the cultural and geographical proximity of the two people who are in charge of the program: president and vice president.

Fig. 1: NASE Courses through August 2016

MAIN OBJECTIVES

From the beginning, NASE objectives have been bringing astronomy to schools to enhance their knowledge and by means of this method taking a different approach to science. NASE

offers a new methodology that presents astronomy experimentally and in close proximity. By taking advantage of the fact that astronomy provides an easy path to the observation of the heavens, because above each school there is sky and it is also a branch of science, perhaps the only one which arouses people's interest and particularly among young people. But to bring astronomy to schools it is necessary to start training teachers. Teachers do not teach something they do not know and few make observations if they are not encouraged previously by means of practical examples. The new methodology has sparked interest in many teachers who see the activities of the workshops as an option in their astronomy classes or subjects related to astronomy. In addition, active participation in promoting models and observations means that astronomy clubs located in many countries are interested in NASE.

It has been of great benefit for the courses to be supported by the IAU, which also requires all instructors with a high level of preparation in the content. In consequence, it is clear that instructors cannot give different contents that NASE establishes and regulates. Also NASE guarantees a common level professionalism in all courses in relation to their content and format.

WORK DEVELOPMENT

The work is developing continuously in most countries. The first local groups helped create others groups in their own country or in neighboring countries and also hotlines established collaboration from NASE's headquarters. NASE is a network of people who know each other.

In the texts that follow this introduction, details of the various situations of each local group will be given. In some countries they are working in coordination with the Ministry of Education, so NASE courses are approved as part of teachers' professional training, this is the case in Honduras and Bolivia. Even the Ministry of Education in Bolivia has published NASE's book and distributed it to all schools in the country.

Most local groups have organized courses throughout the country to reach more teachers in remote areas and sometimes with transportation problems. This is the case of Ecuador, Guatemala, Nicaragua, Paraguay and Peru. In larger countries the number of local groups has been multiplied through collaboration between them, so for example, Argentina currently has seven groups of NASE, in Colombia they have already formed four groups and in Mexico they are working towards creating a set of three groups for next year.

The courses continue to develop in Uruguay, where there is a long tradition of education in astronomy. NASE is waiting for their collaboration in the development of courses elsewhere. In Cuba they are starting the work of NASE with a very motivated group focused on planetarium of Havana and, in the future they will develop their activities independently. In Brazil, it has translated the whole course into Portuguese and we hope to publish the NASE book in this country or in Portugal. The latter country has joined to NASE now and they will begin their courses from next year.

Next year we will start courses in Chile, where so far no contact had been made, and try to recover the courses in Panama where for various local causes there have been interruptions. Concerning Central and South American we only need to get to Costa Rica, El Salvador and Venezuela, where they are beginning to make contacts to that end.

It is our mission that this development continues and we maximize the value of astronomy teaching as an enhancer of new scientific vocations.

LIST OF NASE COURSES

1st Lima (Perú)- July 17-20, 2009
2nd Salinas (Ecuador)- July 18-21, 2009
3rd Barranquilla (Colombia) - July 6-9, 2010
4th Managua (Nicaragua) - July 12-15, 2010
5th Lima (Perú) - July 17-20, 2010
6th Rosario (Argentina) - October 12-15, 2010
7th Cañada de Gómez (Arg) - October 13-15, 2010
8th Venado Tuerto (Argentina) - May 26-28, 2011
9th Rafaela (Argentina) - June 22-25, 2011
10th Tegucigalpa (Honduras) - July 11-14, 2011
11th Managua (Nicaragua) - July 11-14, 2011
12th Panamá (Panamá) - July 18-22, 2011
13th Barranquilla (Colombia) - July 21-24, 2011
14th Asunción (Paraguay) - July 27-30, 2011
15th Reconquista (Argentina) - November 2-5, 2011
16th Lima (Perú) - January 18-21, 2012
17th Managua (Nicaragua) - July 2-6, 2012
18th Tegucigalpa (Honduras) - July 9-12, 2012
19th Guatemala (Guatemala) - July 10-13, 2012
20th Quito (Ecuador) - October 23-26, 2012
21th La Paz (Bolivia) - October 29- November 1, 2012
22th Barranquilla (Colombia) - November 14-16, 2012
23th Santa Fe (Argentina)- November 19-21, 2012
24th Asunción (Paraguay) - November 21-24, 2012
25th Montevideo (Uruguay) - November 26-29, 2012
26th Accra (Ghana) - January 8-11, 2013
27th Cañada de Gómez (Argentina) - March 12-15, 2013
28th Mendoza (Argentina) - March 18-20, 2013
29th Cochabamba (Bolivia) - July 16-18, 2013
30th Uberlandia (Brasil) - July 29- August 1, 2013
31th Foz de Iguaçu (Brasil) - August 5-8, 2013
32th Bauru (Brasil) - August 12-15, 2013
33th Managua (Nicaragua) - August 5-7, 2013
34th Beijing (China) - August 19-21, 2013
35th Medellín (Colombia) - September 2-5, 2013
36th Bogota (Colombia) - September 2-5, 2013
37th Quito (Ecuador) - September 23-26, 2013
38th Barraquilla (Colombia) - October 8-10, 2013
39th Nairobi (Kenya) - October 24-26, 2013
40th Tegucigalpa (Honduras) - November 4-7, 2013
41th Guatemala (Guatemala) - November 11-13, 2013
42th San Luis Potosí (México) - November 19-22, 2013
43th Montevideo (Uruguay) - December 2-5, 2013
44th Huancayo (Perú) - March 17-20, 2014

45th Ica (Perú) - March 24-27, 2014
46th Mendoza (Argentina) - April 24-26, 2014
47th Cluj (Rumania) - April 24-26, 2014
48th La Habana (Cuba) - June 9-12, 2014
49th Bogotá (Colombia) - June 16-19, 2014
50th Quito (Ecuador) - June 16-19, 2014
51th Medellín (Colombia) - June 25-28, 2014
52th Accra (Ghana) - July 28-31, 2014
53th Asunción (Paraguay) - July 30 - August 1, 2014
54th Barranquilla (Colombia) - July 31 - August 1, 2014
55th Salta (Argentina) - August 12-14, 2014
56th Tegucigalpa (Honduras) - October 23-24, 2014
57th Cochabamba (Bolivia) - October 27-28, 2014
58th Guatemala (Guatemala) - November 3-5, 2014
59th Oruro (Bolivia) - November 4-7, 2014
60th Managua (Nicaragua) - December 10-12, 2014
61st Lima (Perú) – February 3-13, 2015
62th Barranquilla (Colombia) – March 19-21, 2015
63th Tucumán (Argentina) – March 25-27, 2015
64th Cuenca (Ecuador) – March 25-27, 2015
65th Jujuy (Argentina) – May 11-13, 2015
66th Medellín (Colombia) – June 24-27, 2015
67th Guatemala (Guatemala) – June 25-27, 2015
68th Managua (Nicaragua) – July 13-15, 2015
69th Honolulu (USA) – August 1-2, 2015
70th Tegucigalpa (Honduras)- August 24-27, 2015
71th Bogotá (Colombia) – October 5-7, 2015
72th Bucaramanga (Colombia) – October 11-14, 2015
73th Salta (Argentina) – November 2-5, 2015
74th Concordia (Argentina) – November 18-20, 2015
75th Rosario (Uruguay) – December 1-3, 2015
76th Tegucigalpa (Honduras) – February 24 – May, 2016
77th Macas (Ecuador) – April 4-8, 2016
78th San Luis Potosí (México) - May 31 - June 3, 2016
79th Matehuala (México) - June 6-9, 2016
80th Guatemala (Guatemala) - June 23-25, 2016
81th Managua (Nicaragua) - July 12-15, 2016
82th Malang (Indonesia) - July 25-28, 2016
83th Pamplona (Sain) - July 26-29, 2016
84th Mendoza (Argentina) – August 10 -12, 2016
85th Villarubia (Paraguay) – August 13-27, 2016
86th Tegucigalpa (Honduras) – August 20-25, 2016
87th Cluj (Romania) – September 5-8, 2016
88 th Jujuy (Argentina) – September 5-7. 2016
89 th Concordia (Argentina) – September 12- 14, 2016
90 th Habana (Cuba) - September 27-30, 2016
91th Bogota (Colombia) – October 12-13, 2016
92th Medellin (Colombia) – October 13-14, 2016
93th San Luis Potosi (Mexico) – October 28-30, 2016

NASE Quality System Certification

The Quality Systems are based on rules aimed to improving processes within organizations. The most used are the standards issues emitted by the International Organization for Standardization (ISO) regarding the implementation of quality systems through the family of ISO 9000. The ISO is an independent, non-governmental organization formed by the standards organizations of its 164 member countries. It is the world's largest developer of voluntary international standards and facilitates activities worldwide by providing common standards between countries. They have been established near twenty thousand standards covering various fields including education.

THE STANDARDS

The implementation of quality systems aims to improve products, services or processes in various fields of activity. In this respect, quality systems are related to rules that determine the conditions to perform a process or the characteristics of the product or service in question. Thus, if the product or service is performed according to the reference standard, one can say that it meets quality standards of this regulation and, once passed the corresponding audits, you can obtain the certificate. Quality systems have been developed for many areas of activity. The use of standards facilitates the creation of products and services that are safe and reliable. The Standards help to increase productivity while minimizing errors and expenses.

The Quality is a long-term strategy, aimed to provide goods and services to fully satisfy both external and internal customers to suit their explicit and implicit expectations, using the knowledge and skills of all employees of the organization to get benefits for the organization.

The quality is approached from two perspectives: external and internal. The first considers quality as something that creates value to the user, to the extent that the product or service meets your expectations and maintaining good relations between the management of the organization and participants and stakeholders; and the second is based on the identification of a strategy that mobilizes the entire organization to achieve optimization of all operations, a cultural change and the internal transformation, necessary to maintain or achieve a competitive position.

A new ISO standard aims to improve the quality of supply on the world market that has grown around education and non-formal training, such as vocational training, lifelong learning and training into the company.

ISO 29990: 2010, Learning services for education and non-formal training - Basic requirements for service providers, aims to improve the quality of supply in the growing global market around education and non-formal training, offering a unique alternative backed by international consensus to the huge variety of standard services and management that now exists in the field of non-formal learning.

The growing economic importance of learning in the global knowledge society has created new opportunities such as the activity related to the provision of learning services for profit. Therefore, quality assurance becomes a crucial issue.

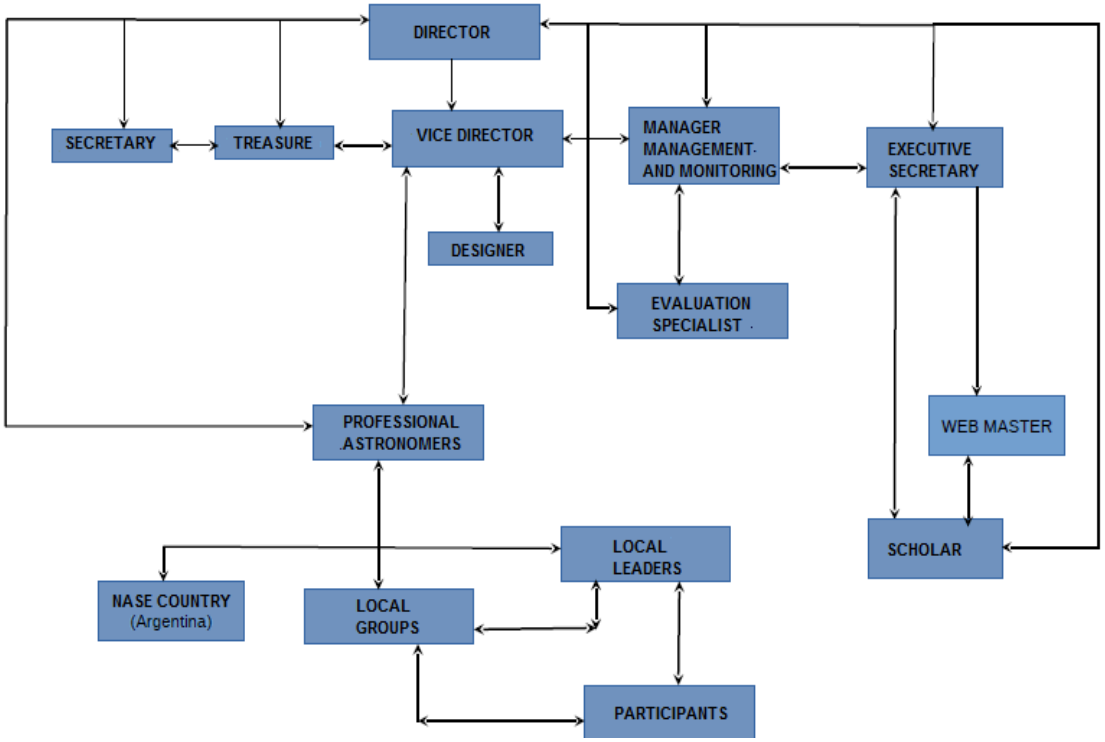

Fig. 2: NASE Organizational Structure

NASE QUALITY ASSURANCE POLICIES

NASE Management System of Learning Services has been developed according to the IRAM-ISO 29990: 2013 standards, which means about "Learning services for non-formal education and training and basic requirements for learning service providers (LSP), in order to achieve compliance with certain goals and achieve concrete results that comply with an applicable standard worldwide.

In that sense, it was refreshing to discover that NASE suited perfectly to the requirements of this international standard that ensures not only the quality of the teaching-learning processes, but also a method for evaluating the service, ensure continuous improvement and from specific indicators quantitatively analyze the impact of activity

As part of the Quality Politics, NASE should define goals and concrete results in regard to:

✔Teach to teach astronomy to professors from primary, secondary and in some cases the tertiary level (science professorships) and students at the basic cycle of university careers, within a practical framework, with emphasis on the development of workshops and laboratories.

✔ Provide the teachers the specific practical tools to use astronomical topics in different curriculum areas, using the concepts of discipline, but applying the techniques in areas such as Mathematics, Physics, Chemistry, Biology, Geography, History, Philosophy.

✔Promote the teaching of the Astronomy forming the primary, secondary and university / tertiary teachers.

✔ Encourage the Astronomy teaching / learning active process by observing patterns and phenomena.

✔ Set up in each province that requires the Service, a Local NASE Group of local teachers to give the basic course and prepare materials for the web program, continuously.

In its commitment to: Work according to the needs and requirements of society ensuring the proposed goals:

✔ Provide a service oriented to the customer satisfaction and to the quality requirements

✔Assure a better training of teachers - students, with a maximum efficiency in the process.

✔Orientate the processes to the continuous improvement from the clear definition of process indicators, evaluation and promotion of special activities by trainers and trained teachers.

The organizational structure (see Figures 1 and 4) ensures the continuity of the task and feedback from the steering authorities, ensuring continuous improvement processes.

On the other hand, a quality management system requires the definition of the Vision and the Mission. NASE has proposed the following Mission and Vision:

MISSION

• Promote the teaching of astronomy forming teachers (secondary and primary).
• Encourage the active teaching / learning process of astronomy by observing patterns and phenomena.
• Motivate teachers and students to observe the natural world and especially to associate these observations with astronomical topics.
• Establish in each province a Local NASE group of teachers which give the basic course and prepare materials for the web of the Working Group continuously, ensuring the survival of the course in the world and the constant updating of the supplementary teaching materials.

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BOOK REVIEWS

THE INTERSTELLAR AGE: INSIDE THE FORTY-YEAR VOYAGER MISSION

Jim Bell, (New York: Dutton, 2015). 324+x pages. HB $27.95. ISBN 978-0-525-95432-3.

This, the second book by Jim Bell that I have reviewed for this newsletter, is very different in format from the first. Bell's previous project, *The Space Book: From the Beginning to the End of Time, 250 Milestones in the History of Space & Astronomy* (New York: Sterling, 2013), is essentially a picture book with corresponding text for each of the milestones. *The Interstellar Age,* by contrast, which contains only a few line drawings and an eight-page insert of color photographs, is basically a professional memoir with a flowing narrative. It describes Bell's personal involvement with the *Voyager* mission as an undergraduate at Caltech (B.S. 1987, in planetary sciences and aeronautics) and graduate student at the University of Hawaii (Ph.D. 1992, in planetary geosciences), with forays back into his boyhood and forward into his present professional life. In the three-page Prelude that precedes the ten-chapter narrative, Bell tells us that "the space-exploration mission known as *Voyager*" set him on a path "toward new and undiscovered territory and experiences," and that the "trajectory of my life has been guided by the slow, gentle, persistent gravitational pull of two elegant robotic spacecraft and the teams of people…who made their missions of exploration so marvelously compelling." It turns out that *The Interstellar Age* is perfectly suited to readers of this newsletter, who have an interest in astronomy education and outreach. What I particularly like about the book are its many takeaway lessons that can inspire students of all backgrounds, whether or not they aspire to professional careers in science. The book is also full of fascinating details for general readers, even those who make it their business to keep informed about current astronomical research.

First a word about the title: Many readers are likely to think of the *Voyager* mission as history, but it was only the primary mission that was completed in 1989, when the planetary flybys were completed. As the book's final two chapters explain more fully, *Voyager* 1 seems to have already become the first manmade object to enter interstellar space, with its partner expected to do so in 2016. We have thus, without much fanfare and if only in "baby steps," embarked on the Interstellar Age. (In the final chapter, Bell explains more fully that while the *Voyagers* are "interstellar travelers," they are not "intergalactic travelers," which would have required accelerating them "about fifteen times faster than they're currently going, or about 1 million miles per hour, to escape the gravity of the Milky Way.")

Bell interweaves his own story very gracefully into the history of the mission, without any preening whatsoever. In fact, what makes his story inspirational for students is that despite his mediocre undergraduate academic performance and his unimpressive score on the physics GRE, he found excellent mentors through the diligence and commitment he showed by signing up to participate in mission-related research, never mind the lowly tasks at first assigned to him. By incorporating into the memoir stories of other young people's career paths, Bell expands his teaching moment. From the experience of Gary Flandro, for example, readers learn not to be discouraged if a contribution they make to a project isn't recognized right away, or even ever. Flandro was a Caltech grad student in the mid-1960s, assigned to study techniques for exploring the outer solar system planets. Realizing that "there would be a rare alignment of all four giant planets, plus Pluto, on the same side of the solar system in the 1980s," Flandro calculated that a single spacecraft launched in the mid-1970s could visit Jupiter, Saturn, Uranus, and Neptune, or Jupiter, Saturn, and Pluto, using the gravity-assist process. By July 1965, Flandro had calculated the details of what became known as the Grand Tour, including the best launch times. Although his work significantly impacted the design of the mission, his contribution was not officially recognized until 1998, when he was honored

with NASA's Exceptional Achievement Medal. Sometimes a student can have the personal satisfaction of making a meaningful contribution even if his or her success is acknowledged only by immediate mentors. Bell gives another example of this lesson by telling the story of Heidi Hammel, who in the mid-1980s was a grad student at the University of Hawaii, working on Neptune's winds. Her thesis advisor, Dale Cruikshank, knew that the *Voyager* team would need such information in order to plan imaging sequences. When her results differed significantly from those of previous studies, Cruikshank had her present her results directly to the imaging team leader, Brad Smith. She may have been shaking in her shoes, but having successfully demonstrated that her data didn't support the rotation period the team was currently intent on, Hammel was invited to join Smith's imaging team after she completed her doctorate.

On more than one occasion in the course of the narrative, Bell drives home the valuable lesson that if something goes wrong with your well-laid plans, don't panic; see if you can salvage a situation by working around the mishap. Among the inevitable glitches that occasionally derailed the plans of this very complex mission, was an unanticipated problem that occurred early in Voyager 1's mission when out-of-sync-computers resulted in images so smeared that they were useless. Rather than despairing about a lost opportunity, the team realized they had time to salvage the situation. They "quickly uploaded new, last-minute versions of the camera sequences…and were able to avoid such problems for the rest of the mission." A second example of team members working around a serious and unexpected problem occurred with *Voyager* 2. To this day, no one is certain what caused the spacecraft to experience a series of hardware and software errors while it was behind Saturn. Nonetheless, the team—staggering from but not incapacitated by their sense of loss—figured out a way to circumvent the problem.

I consider myself fairly literate with regard to astronomical news, but I did not realize what Bell makes very clear in the book's last two chapters: What we can learn from the *Voyagers* did not end with the conclusion of the flybys and the conclusion of the imaging program. Now called the *Voyager* Interstellar Mission, the current goal of the spacecraft is "to extend the NASA exploration of the solar system beyond the neighborhood of the outer planets to the outer limits of the sun's sphere of influence and possibly beyond." At the moment, instruments like the Cosmic Ray Subsystem are increasing our understanding of the high-energy particles from the sun and how they differ from cosmic rays beyond the solar system. I hadn't realized that for another decade, *Voyager* is likely to be able to operate at least a single instrument, and that into the 2030s we might still be able to have occasional radio contact with it. According to JPL's Ed Stone, Project Scientist of the *Voyager* mission for over four decades, "As long as we have a few watts left, we'll try to measure something." Bell explains that just by "pinging" the spacecraft and waiting for the ping to be "acknowledged and sent back," scientists will be able to learn something about the spacecraft's location and its environment. And even after we on Earth will no longer be able to detect *Voyager*'s "so-called engineering signal," the spacecraft will still have a "final mission": to carry forth into interstellar space and whatever intelligent life it might encounter there, the Golden Record, launched with it, which is encoded with sounds and images selected to portray the diversity of life and culture on our planet. I was fascinated to read that it might just be possible to send the *Voyager*s out on this final mission with pictures *uploaded* back onto its tape recorders that document the spacecraft's achievements in our own planetary system.

Let me conclude my praise of this interesting book with a few aspects of it that particularly caught my fancy. In April 2015 I heard a fascinating lecture about Islamic forerunners of Copernicus, by McGill University Professor F. Jamil Ragep, a specialist in the history of science in Islamic societies. I was interested to learn from Bell's discussion in Chapter 6 that Copernicus was influenced by writings from the 16th-century Kerala School of mathematics in India that proposed some early models for a heliocentric universe. I was disappointed, however, when I found no references in the Notes and Further Reading at the end of the book that might have enabled me to investigate the source of Bell's claim for confirmation and further elucidation.

With the IAU's new commitment to outreach, other readers may share my interest in Bell's comment that one reason Carl Sagan was never elected to the National Academy of Sciences was that his efforts to introduce scientific results to the general public were dismissed by many NAS members as soft science at best, and grandstanding at worst.
Having been at the IAU 2006 session where the discussion on reclassifying Pluto was held, I was interested to read that Bell disagrees with the outcome. Claiming that he is not a "splitter" but rather a "lumper," Bell makes a case for including everything in "our cosmic neighborhood" as a planet if it meets his own set of criteria, of having had "a complex geologic history" and of orbiting either the sun or another planet. Bell's solar system thus has about 35 planets and counting.

Finally, as one who has traveled far and wide to witness a respectable number of solar eclipses as well as two transits of Venus, I was interested in, if not convinced by, a prediction Bell makes in the very last pages of the book: that a new kind of "astronomical adventure" tourism is likely to result from the emerging space industry sector sometimes referred to as NewSpace. He foresees the launching of spaceships to exactly the right place in order to provide the public with "safer, more affordable, and more personally meaningful access to space," giving them the opportunity to see not only total solar eclipses and planetary transits, but also to fly through active comet tails, to land on asteroids, to visit outdated spacecraft (including *Voyager*). We shall see.

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