COMMISSION 46
ASTRONOMY EDUCATION AND DEVELOPMENT
Education et Développement de l'Astronomie

Newsletter 79 – March 2014

Commission 46 seeks to further the development and improvement of astronomical education at all levels throughout the world.

Contributions to this newsletter are gratefully received at any time.

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http:/www.gettysburg.edu/~marschal/clea/IAU/

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EDITORIAL

Welcome to IAU Commission 46 Newsletter 79, the third to be published under the new editor, Larry Marschall (Gettysburg College). This newsletter contains a lead article from Commission 46 President Prof. Jean-Pierre De Greve regarding opportunities for educational action in the International Year of Light, 2015. It also contains a number of reports on OAD and other activities, a number of book reviews, and notices of upcoming events of possible interest to Commission 46 members.

As we ease into this new editorship, 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 October 2014 issue the copy date is **Friday, 3 October 2014**. If you can include photos or illustrations with any material, please do so. 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. You can either send a Microsoft Word attachment (preferred) or include the text in the body of the email. **Illustrations must be sent as separate, individual files**, preferably as JPEGs or TIFFs no larger than about 3 Mbytes each. **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.

I try to edit as lightly as possible, and I 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. I 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, as well as studies regarding the impact and effectiveness of such techniques for astronomical learning.

Book reviews

I welcome book reviews. Reviews should be of books centered on astronomy education or development or of interest for pedagogical material they provide, including historical insights on astronomy. If there's such a book that you think is worth reviewing, please send your review to me.

The C46 websites

The "official" C46 website is at http://iaucomm46.frm.utn.edu.ar The IAU Office of Astronomy for Development (OAD) is at http://www.astro4dev.org/

Back issues of the C46 Newsletter

During my predecessor, Barrie Jones' tenure as editor of this newsletter, October 1998 to August 2012, the Newsletters have appeared in March and October in every year. We continue the same publication schedule. So this issue, number 79, published in March 2014, will be followed by issue 79, to be published in October, 2014.

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 he case for earlier ones, edited by John Percy. These extend back to February 1992, but there are gaps.

A Further Note

To insert a personal note: As of September 14, I will be officially emeritus after 42 years at Gettysburg College. I intend to remain active in astronomy, including the editing of this publication. But with reduced teaching commitments I will probably have more time to devote to other activities, including writing, editing, and consulting. Let me know if you have any projects that might appeal to my experience and interests.

Larry Marschall
For further information on the editor, see my personal web page:
http://public.gettysburg.edu/~marschal/clea/lam.html
(for contact details see Program Group Chairs and Vice Chairs)

MESSAGE FROM THE PRESIDENT

THE INTERNATIONAL YEAR OF LIGHT: AN OPPORTUNITY FOR RESEARCH IN ASTRONOMY EDUCATION

2015 is the international year of light. For astronomers, this is an occasion to set up outreach events that demonstrate how their work relates to the physics of light. For astronomy educators, and researchers in education, it is an excellent occasion to set up new dedicated astronomy demonstrations and investigate their impact on the learning process.

Many such demonstrations have been developed in the past. From phases of the Moon to features in the spectrum of the Sun, pictures of galaxies, extinction experiments and observations of stellar variability, all sorts of physics and mathematics have been explored in an astronomical setting.

These demonstrations and experiments remain valuable, but it's worth rethinking their set up so that they become more attractive, more involving, and have a more effective impact on the required acquisition of competences in physics and mathematics.

Why, and why now? On one hand, there is a growing need for engineers and scientists to stimulate further developments in a socio-economic world that gets more and more complex. On the other hand, there is a worldwide problem with the interest of young people for the sciences, as a result of a combined effect. There has been, and still is, a decrease in interest in science studies because of its increasing complexity and of better career opportunities in other areas. And there is the economic situation that creates uncertainty or an unfavourable situation for studies in general. To counteract this tendency, STEM actions are needed on a worldwide basis. STEM stands for Science, Technology, Engineering, and Mathematics, and aims at introducing stimulating research experiences at all levels of education. This requires renewed curriculum and instructional design, and will determine the research and development agenda for learning designers in the coming years.

Educators around the world are investigating how to bring innovations in the education of STEM subjects. The Year of Light offers a nice framework for this, especially for astronomers. Below we present one example, Starlight in the university lab, abbreviated to Astrolab. It is the heart of a project sponsored by the Office for Astronomy Development (OAD), run by Michèle Gerbaldi (IAP, Paris), Jean-Pierre De Greve, Nicki Mennekens, and Garry W. Angus (VUB, Brussels) in collaboration with Close-The-Gap (Brussels), Anambra State University, Nigeria, and The Copperbelt University, Zambia.

The project aims at fully developing and implementing a research tutorial, Astrolab, in universities in need of astronomy infrastructure and curriculum, allowing undergraduate students in sciences to perform real-time observations on a remote telescope, and transforming those observations into a scientific result. The remote telescopes are elsewhere in the world, so that students can work during the local daytime.

The goal of this project is twofold :

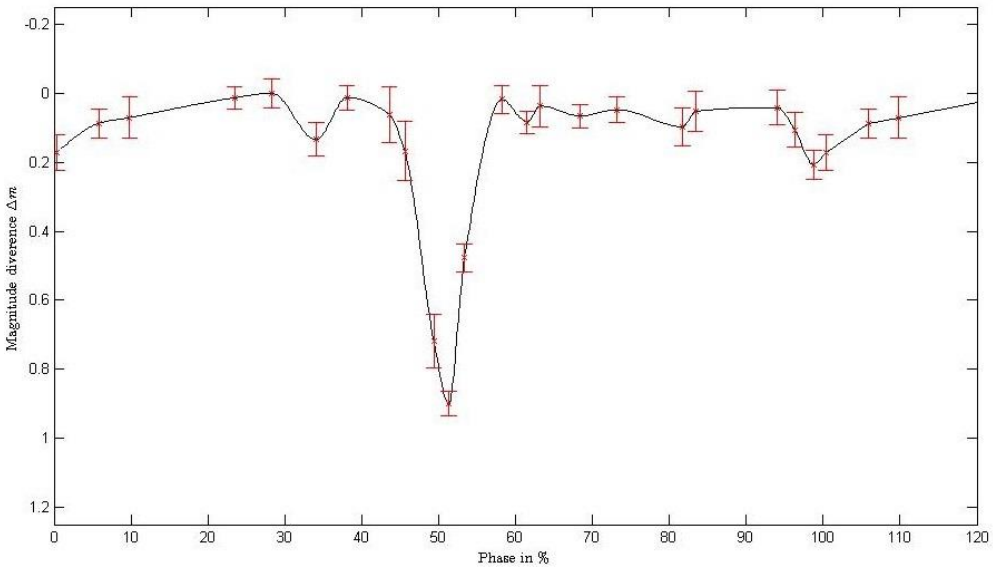
a) to introduce students to the scientific research method in general by working scientifically through project development and preparation, data acquisition and treatment, analysis and conclusions.

b) to enhance interest in science studies by making them more attractive and getting the students involved in the "learning".

The design of the tutorial uses several concepts that make up the success of pc gaming: *ownership* (students choose their objects, plan the project, command the telescope in real time, and acquire their own data), a thrilling *pressure* (telescope is in another place/continent and the student works in a limited timeslot), *chance for failure* but also for success (weather conditions, wrong/good strategy for data acquisition), and *community feeling* (results can be shared worldwide). So it is not a 'recipe' but a learning-by-doing tutorial to acquire research competences.

Astrolab is implemented at the Vrije Universiteit Brussel and is the driving experiment for a pilot implementation at Anambra University, Nigeria and The Copperbelt University, Zambia.

An example of an eclipsing binary light curve obtained by a student team is shown below (for UV Psc).



For such tutorials it is important to also implement a quality assurance frame. Part of such frame is the evaluation by the student him/herself, as part of his/her report. Below, we present one such evaluation (from Students Pablo Correa and Timothy De Deyn, Brussels) :

"This project was a good way to introduce us to the practical aspects of astronomy: the planning of observations, the use of telescopes and astronomy related software,

the analysis of the measured data, etcetera. These are all factors that have an influence on what to expect if we later choose to work in the branch of astrophysics.

On the other hand, the project itself was not flawless. First of all, the software used, including the websites, was not always too user friendly, but because we had Dr. Angus to assist us, this did not form much of a problem. It would have been nice, though, if the different software would give clearer instructions on how to synthesize the input, e.g., on how to set the location. A good example of such an unclear website, is http://catserver.ing.iac.es/staralt/.

Another thing that was annoying, was the fact that the weather in New Mexico in November and December wasn't too favourable: it occasionally snowed at the end of November, begin of December — this is not that unusual, partly due to the fact that Mayhill, New Mexico, lies next to a ski resort. Also, too strong winds would cancel the observations, because the dome would not open with the risk of getting blown away. It would have been more useful, perhaps, to have the possibility to use telescopes from Chile, since the dry weather in the Atacama Desert is always favourable for observations, during all seasons of the year. Thirdly, we had a few observations on which the image was pure noise, or worse. We presume something went wrong on their side, since we can not imagine what went wrong. We sent a report to https://go.itelescope.net, hoping that they would reimburse our credits for these failed measurements, but we did not get any response. A further issue we had, was that the telescope T4 was not operational the last few weeks, it went online all of a sudden. Since other students of the VUB's second Bachelor of Physics, also used T4 and T5 (and T14), this caused a cancellation of a lot of observations, and an accumulation of reservations on the remaining telescopes. Note that on this date, T4 does not appear on the website anymore.

Finally, we would like to discuss very briefly what we would have done differently during this project, if we would have had the chance. It might have been more interesting had we used multiple filters in the observations, this would have allowed us to calculate the change in observed surface temperature, using Planck's law for black body radiation."

Such critical evaluations help to continuously improve the overall setup and therefore enhance the student's experience.

Introduction of such modules into the science curriculum involves young people with research at an early stage and in an active, engaging way, thus stimulating them to explore more and at a deeper level. That's where and how the road to science starts.

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EDUCATIONAL REPORTS

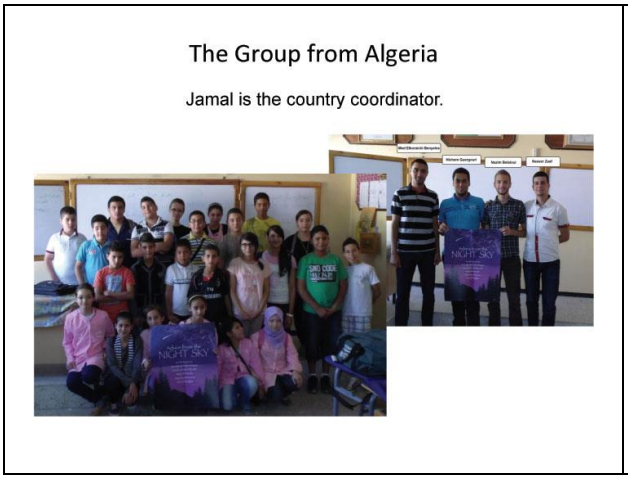
NOAO AND IAU OAD'S PROGRAM ON "DARK SKIES OUTREACH TO SUB-SAHARAN AFRICA"

The IAU's Office of Astronomy for Development (OAD) awarded the National Optical Astronomy Observatory (NOAO) a grant to deliver a "Dark Skies Outreach to Sub-Saharan Africa" program to institutions in 12 African countries during 2013. The program's first goal was to help students identify wasteful and inefficient lighting and provide ways to reduce consumption and to keep energy costs in check. The second goal was to inspire students to be responsible stewards in helping their community safeguard one of Africa's natural resources - a dark night sky.

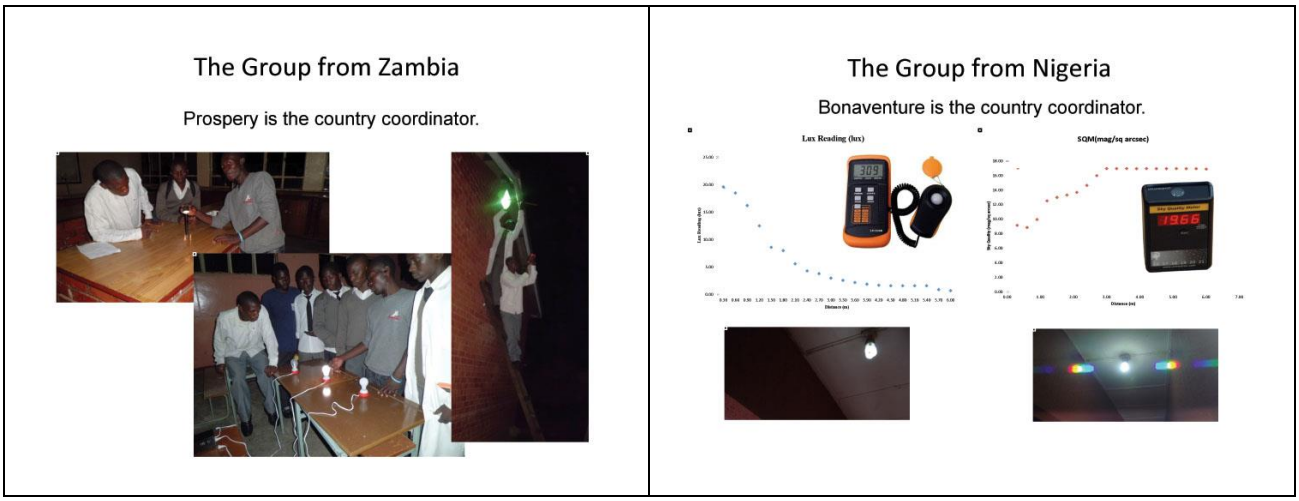
The Kit

From early 2013 until May 2013, thirteen kits were designed and produced by the NOAO Education and Public Outreach group and sent to the 12 coordinators and to the IAU OAD. The coordinators were located in 11 sub-Saharan countries and Algeria (Ethiopia, Gabon, Ghana, Kenya, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania and Zambia). The program's kit included complete instructional guides and supplies for six activities and a project on energy conservation and responsible lighting.

From June through November, the six activities and project were explained to the coordinators and some of the teachers in a series of six Google+ Hangout sessions offered a couple times each. (All Google+ Hangout sessions were recorded for future viewing at any time.) During the same period, the 12 coordinators trained local teachers in junior and senior high schools. One Google+ Hangout session included instruction on carrying out evaluations.



From November until the following February, students from the different African countries undertook final class projects (such as posters, videos or powerpoints), shared on the program's PBWorks website. Also shared on the program's website is every document connected to the program from the Google+ Hangout sessions to background resources to materials on the kit and activities to information on evaluation, to the progress reports, the final projects and photographs.



Everyone in the program will continue to have access to the web site, contributing to and getting information from its pages. The student projects focused on light pollution and energy conservation information such as light pollution hazards and solutions to light pollution and outdoor lighting audits with graphs and calculations on energy, cost and carbon footprint saved. In many cases, the students' comfort levels in presenting showed how well they mastered the dark skies and energy conservation materials.

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OUTREACH AND EDUCATION FOR ALL DURING THE EUROPEAN PLANETARY SCIENCE CONGRESS 2013 IN LONDON

The 2013 edition of the European Planetary Science Congress was hosted at University College London on the 08 to 13 September. The Outreach, Education and Policy sessions shared some of the most innovative and inspiring resources and best practices developed within the planetary outreach community around the world.

Throughout *'Sharing Space' - Outreach techniques and best practice* sessions, convened by Dr. Rosa Doran and Dr. Doris Daou, projects such as the citizen science Moon Zoo and Mars' Seasonal Fans were presented to a crowded room. Outreach were highlighted with such as the planetarium show by Google Lunar XPRIZE: 'Back to the Moon: For Good' or the European Space Agency's Rosetta comet chaser mission, exploring how to maximize its outreach potentials. Highlighting the importance of formal education was presented “Building the future of mankind in the classroom” and “Back to the future - observing the transit of Venus now and then” supported by Europlanet Outreach Funding to the Hungarian students leading this project. Also highlighted throughout the session were pro-am collaborations and their benefit to education, science and outreach awareness here highlighted with the Faulkes Telescopes.
Recently, Commission 46 created a new Working Group devoted to using research and development in education to coordinate, disseminate and improve teaching practices in the

use of astronomy as a vehicle for the inclusion of people with special needs. Highlighting the use of planetary science for inclusion in EPSC2013 were present was “A Multisensory Space to Teach and Learn Astronomy”, by Beatriz Garcia, vice-president of Commission 46, that featured within the framework of this project a “Mars Tactile” module where the user, traveling through the surface of the model, is able to recognize names and characteristics of the surface of the planet on a screen or using headphones meeting the audience’s different needs. Also in the field of Astronomy for inclusion the session featured the project “A Touch of the Universe”, by Amelia Ortiz-Gil, Spain. “A Touch of the Universe" team created a kit of tactile astronomy resources to reach children with sight related impairments, and distributed them to educators and teachers in developing countries. A project supported by Europlanet “Meet our Neighbours! – a tactile experience” presented by Lina Canas, Portugal, promotes and provides inclusive hands-on activities for visually impaired children and their non-visually impaired peers through the use of astronomy low cost materials. The additional poster sessions also featured several efforts on the use of planetary science for inclusion such as “The Sky in your Hands - From the planetarium to the classroom” a joint collaboration from Portugal and Spain. Using Astrobiology as an Interdisciplinary Starting Point to Natural Sciences for High-potential Children from Austria, and Space inclusiveness and empowerment, or how The (Planetary) Frontier becomes a mirror, from France.

As Planetary Science being one of the most exciting fields in astronomy, engaging many enthusiasts around the world, the need for activities and resources dedicated to all and sensitive to the special needs among the different audiences is paramount. From social inclusion, to better cognitive and orthopedically accessible experiences, a great deal has been accomplished so far regarding activities and resources in astronomy for people with special needs.

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BOOK REVIEWS

THE DAY WITHOUT YESTERDAY: THE SKY’S DARK LABYRINTH TRILOGY, BOOK III

Stuart Clark, (Edinburgh: Polygon Books, 2013). 252. HB £12.99. ISBN 978-1-84697-247-8.

This is the third time over a three-year period that I have had the pleasure of reading and then sharing with readers of the IAU Commission 46 newsletter my views of a volume in British science journalist Stuart Clark’s trilogy of novels about the history of astronomy. The first

novel, *The Sky's Dark Labyrinth,* focused on Galileo and Kepler; the second, *The Sensorium of God,* on Newton and Halley; and the third, *The Day Without Yesterday*—the subject of this review—on Einstein and Lemaître. Over this time I have taken an almost parental pleasure in watching Clark's skills as a novelist develop, from his awkward first steps with exposition, dialogue, and character portrayal in the first book to his confident stride in all those areas in the final book, where the main characters have a real emotional authenticity.

Each novel is divided into three parts, thematically appropriate to its heroes and their time period. For a book "starring" Einstein, you could probably guess on your own what those three divisions are, but I'll tell you anyway: Space, Time, and Curvature. The 10-chapter *Space* begins just as World War I is about to break out, with five chapters set in Berlin, where we are brought into the complex social life of Einstein and his scientific colleagues (and fellow assimilated Jews) the chemists Fritz Haber and Walther Nernst; two chapters set in the Russian Empire, where we learn what has become of astronomer Erwin Freundlich's hopes to provide observational proof for Einstein's theory-in-progress of general relativity at the eclipse of August 21, 1914; and three chapters in Belgium, where Georges Lemaître, an engineering student planning to switch to physics (since math for engineers "had proved too simple to hold his attention"), is serving in the military but studies his textbooks and his Bible in the down time.

The 11-chapter *Time* opens in 1916 with Einstein's having just finished presenting his general theory of relativity research to the Prussian Academy of Sciences in Berlin, and ends in New York City in 1921, where he has gone as part of a Zionist fundraising delegation, with Einstein less interested in a Jewish state than in a Jewish university. Geographical locales for this section of the novel include Zurich, where Einstein has left his estranged wife, Mileva, and their two sons; Ypres, Belgium, where Lemaître continues to serve in the military, and where he resolves to become both a physicist and a priest after the war; and Cambridge, England, where astronomer Arthur Eddington has taken over from Freundlich the mantle of making eclipse observations that he hopes will provide observational proof for Einstein's theory, and where Lemaître becomes a student of Eddington's.

The 11-chapter *Curvature* brings us to Einstein's decision in late 1932 (although the chronology in this part of the book is confused, about which more later) to leave Germany forever for the United States. This final section has a wider geographical sweep than the other two; in addition to three chapters set in Berlin, one in Zurich, and two in Belgium (one for the Solvay Conference of 1927, devoted to quantum physics), one is set in Florence, Italy, where Einstein has taken his older son, Hans Albert, now a university student; the remaining four chapters are set in American astronomical capitals: two at Harvard, where Lemaître has gone to study with Harlow Shapley and where the International Astronomical Union holds its fourth triennial meeting, one on Mount Wilson, where Lemaître has gone to meet Hubble, and the final chapter at Caltech in Pasadena, California, where Lemaître and Einstein are both lecturing. The final chapter also explains the title of the book. In clarifying for Einstein his assertion that the universe is expanding, Lemaître describes what we now know as the Big Bang: "Everything must once have been compacted together into some kind of primeval atom that split apart and led to the beginning of space and time, a moment at which the evolution of the cosmos began." Since this must be so, "There was once a day without yesterday." Einstein, who when he first met Lemaître at the Solvay Conference in 1927 was so hostile to the idea of the expanding universe, has now arranged for the press to attend Lemaître's Caltech lecture, because "They want to hear about the day without yesterday."

While I am bubbling over with thoughts about this book, I will limit myself to only a few comments, mainly positive, in the hopes that readers of this review will pick up the novel themselves and draw their own conclusions. I am interested in the way Clark's Einstein identifies himself with Kepler, one of the heroes of Book One of the Trilogy. In Chapter 15 we learn that Nernst has given Einstein to read during his convalescence from a serious illness (developed during his intense work on the general theory) a book by Max Brod, a German-speaking Czech Jew, who is best known for his close friendship with Kafka, whose works he later edited and whose biography he wrote. In his own right, Brod was a novelist and essayist whose works include *Tycho Brahe's Path to God,* which is the book in question here. Einstein tells his cousin Elsa, who will become Einstein's second wife, that "Nernst thinks that Brod has written Kepler using my characteristics." In Chapter 24, which finds Einstein and his son at the tomb of Galileo at the basilica of Santa Croce in Florence, Hans Albert asks his father if Galileo was the greatest astronomer. Einstein says he thinks Kepler was the greatest and doesn't understand "why he's not as well remembered as Galileo," since Kepler's laws of planetary motion "proved that Nature could be captured into numbers." In Chapter 27, set at the Solvay Conference of 1927 on quantum theory, Einstein compares himself to Kepler and Heisenberg to Tycho: Einstein's unwillingness to accept Heisenberg's insistence that uncertainty in nature is a fact that building more precise measuring instruments cannot overturn is like Kepler's unwillingness to accept Tycho's insistence that the Earth was at the center of the universe. "When Johannes Kepler asked Tycho Brahe whether he had observed the parallax and proved the movement of the Earth around the sun, Tycho told him he had not, and said that this proved that the Earth was stationary at the centre of the universe. Kepler believed that all it proved was that Tycho's instruments were incapable of detecting parallax, and in 1838 science finally developed telescopes capable of seeing the parallax. Without Kepler's belief, he would never have devised his three laws of planetary motion, now thoroughly tested."

As someone who has written fairly extensively on Jewish history and on early Zionism, I find Clark's treatment of the rise of anti-Semitism in Germany very insightful. What we now know to have been the naïveté of assimilated German Jews in the face of this development, and their conviction that service to the Fatherland would ensure their full acceptance in German society, is well depicted in the behavior of the novel's two Walthers—chemist Nernst and industrialist and later Foreign Minister Rathenau, with the latter's assassination by right-wing thugs ultimately convincing Einstein that he can no longer remain in Germany. Similarly, the two Walthers' attitudes to Einstein's halfhearted support of Zionist goals provides a window into the hostility toward Zionism among assimilated German Jews, who feared that the search for a Jewish homeland elsewhere would simply confirm anti-Semitic claims that Jews were not loyal Germans.

As well as successfully conveying social trends through his characters' actions, Clark is also good at focusing on specific traits of his characters that capture aspects of their complex personalities. We learn, for example, of Eddington's smirk, which confounds both Astronomer Royal Frank Dyson and Lemaître, and of Eddington's dry "British sense of humour," which eludes Lemaître for an entire day. Similarly, though warned by Harlow Shapley about Missouri-born Edwin Hubble's affected British accent and pretentious garb, when Lemaître meets Hubble on Mount Wilson, "It dawned on Lemaître that the accent was not being put on for comic effect," and he is taken aback by the astronomer's unusual outfit for telescopic work: "Hubble swaggered in, wearing dark brown jodhpurs and thick woolen socks pulled up to his knees. Everyone else ignored the bizarre attire so Lemaître did too, discovering later that it was Hubble's usual observing gear."

Among the several pieces of factual information I learned from details in Clark's story is that Harlow Shapley had more than one scientific passion: "Next to astronomy, Shapley's greatest interest was myrmecology, the study of ants. He spent much time studying them in the daylight hours at Mount Wilson, and even published a few papers on ant behavior." Nor had I known that the Harvard College Observatory performed a version of Gilbert and Sullivan's *H. M. S. Pinafore* in the 1920s (more about the date below), with Cecilia Payne taking the role of Josephine.

By contrast, while I had known that Chaim Weizmann, the Zionist leader who later became the first president of the State of Israel, and who plays a role in this novel, "was a chemist by training," as Clark tells his readers, he might have also explained how Weizmann's professional achievements helped propel the Zionist cause into political fact. Weizmann, born in Belarus, became a British subject in 1910, in his mid-thirties. As a lecturer at the University of Manchester, he developed techniques of bacterial fermentation to produce acetone, which was used to manufacture explosive propellants for British munitions in World War I. The importance of Weizmann's contribution to the war effort led to Foreign Secretary Arthur Balfour's issuance of the Balfour Declaration of 1917. This declaration, one of the foundational documents of Zionism, stated that "His Majesty's government view with favour the establishment in Palestine of a national home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine, or the rights and political status enjoyed by Jews in any other country."

For the most part, Clark does a fine job of providing the necessary exposition to move his story along without boring those who know the history well while at the same time not leaving the less well-initiated reader floundering. I wonder, however, what a reader coming fresh to the *dramatis personae* and to Einstein's biography will make of Mileva's several references to "Marcel" in the opening chapter, in the course of trying to convince her estranged husband to get out of militarized Germany and move back to neutral Switzerland, at least for the duration of the war. While Clark goes so far as to have her counter Einstein's comment that Marcel in Zurich "isn't in the same league" as his scientific colleagues in Berlin by saying "Marcel helped you recently because you couldn't do some piece of mathematics," he might have further enlightened the reader as to Marcel's identity. I am sure readers of this newsletter will know that the man in question is Swiss mathematician Marcel Grossmann, who, as Einstein's friend and classmate at the Polytechnic Institute in Zurich, not only helped Einstein develop his revolutionary theory of gravity but also was instrumental in finding Einstein employment at the Swiss patent office, whose director was a friend of Marcel's father.

My major criticism of *The Day Without Yesterday*, however, has to do with confusions in chronology and a smattering of errors in the final third of the book. Despite the fact that Clark in his Acknowledgements makes the disclaimer of having "distilled certain events in the hope of serving the story better," I am nonetheless disturbed by certain inaccuracies that seem to serve little purpose. The chronology of Chapter 22 is out of whack, since it jumbles together Lemaître's year at the Harvard College Observatory, which took place in 1924-25, with Hubble's discovery of Cepheids in M31, which took place in 1923, as well as the production of *The Observatory Pinafore*, which took place in 1929. Both the chronology and the factual accuracy of Chapter 30 are skewed. Fritz Haber, who, despite his Jewish ancestry was

lionized by Germany for having developed the poison gas that the Kaiser put to lethal use in World War I, was not "hounded out" of Germany by the Nazis before the November 1930 wedding of Elsa Einstein's daughter Margot. Haber left Germany on his own accord in 1933, even though the Nazis wanted him to develop weapons for them. Likewise, the chronology and the factual accuracy of Chapter 31 are compromised. The Fourth General Assembly of the International Astronomical Union took place at Harvard in September 1932, not 1931, as Clark's chapter heading would have it. The last chapter also suffers from chronological confusion. In the novel, Lemaître meets with Einstein after the IAU meeting, but in fact the two men lectured together at Caltech in January 1932, months before the IAU. Einstein did not learn about his younger son's schizophrenia on the morning of his first conversation in Pasadena with Lemaître, as the chapter would have it; Eduard Einstein had been diagnosed with schizophrenia at the age of 20, in 1930. A minor annoyance to anyone who knows Einstein's delicious comparison of Princetonians to "pygmies on stilts" is Clark's having Einstein comment to Lemaître in the final chapter that he prefers Princeton to Pasadena because the former is "not quite so…full of itself."

These reservations notwithstanding, I will miss having a Stuart Clark novel about astronomers to look forward to reading and reviewing next year. We can hope that he will follow up on his own words urging that the effort "to tell stories about science to entertain and inspire" will be carried on.

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THE STORY OF HELIUM AND THE BIRTH OF ASTROPHYSICS

Biman B. Nath,(Heidelberg: Springer, 2012).285 pages.PB $39.95. ISBN 978-1-4614-5362-8.

Biman Nath (who, we can learn from Google, is a member of the IAU, connected with the Raman Research Institute in Bangalore, and a member of the National Committee for Astronomy in India) is a man with a mission. His goal in this book is to straighten out the history of the discovery of helium, the second most abundant element in the universe after hydrogen. Even usually highly reputable reference books like the *Encyclopedia Britannica* are likely to attribute the discovery not to British chemist William Ramsay, who isolated the gas on Earth, but to French astronomer Jules Janssen. Janssen is widely, if somewhat misleadingly, credited with having discovered helium at the total solar eclipse of 1868, with the discovery confirmed by English astronomer Norman Lockyer.

Interested to test Nath's assertion by seeing what Wikipedia had to say about Janssen and Lockyer, I found their entries there indeed assuring us that each man, along with the other, "is credited with discovering the gas helium," but the story, as Nath (and also Danish historian of science Helge Kragh in his 2009 *Annals of Science* article, "The Solar Element: A Reconsideration of Helium's Early History") show, is not that simple. (I also felt called upon to check what Françoise Launay has to say about the matter in her recent biography of Janssen, which I had the pleasure of reviewing in an earlier issue of this newsletter. To her

credit, Launay has a section in an early chapter called “Janssen and the helium that he did not discover.”)

Part of Nath’s mission is to correct the record of who did what at the eclipse of 1868. While Janssen may have indeed been the first to see a spectral line of helium there, he mainly demonstrated that a total solar eclipse is not needed for spectroscopic studies of solar prominences, and he did not immediately comment on the helium line. Lockyer, recuperating in Switzerland from a serious illness, did not even go to the eclipse in India, but had already suggested that a powerful spectroscope might make it possible to study the bright line spectrum of prominences even without an eclipse. It took some months for the spectrograph he had ordered to arrive, at which point he began to observe prominence spectra from England. These observations showed the spectral line that was later identified with helium.

Another part of Nath’s mission is to resurrect the overlooked contribution of English astronomer Norman Pogson, who did observe the eclipse of 1868 from India, where his instruments would be those “through which the first signatures of an unknown gas in the Sun would strike the eyes of a scientist on Earth.” Turning to Wikipedia once again to test Nath’s claim that Pogson’s contribution has been forgotten, I found that his involvement in the Indian solar eclipse expedition is noted but not his detection of a yellow line in the solar spectrum that would ultimately turn out to be the helium that Ramsay would isolate and recognize in his lab in 1895. (Launay, however, does list Pogson among several astronomers who observed the gaseous spectrum at the eclipse.)

Even though Ramsay was awarded the Nobel Prize for Chemistry in 1904, less than a decade after his discovery of helium, no less an authority than the president of the Royal Swedish Academy, in no less august a venue than the awards ceremony itself, stated merely that Janssen had first observed helium from India. So the story of the discovery of helium has been corrupted from the beginning.

While I’m not sure that Nath’s book will achieve its goal of undoing nearly 150 years of muddled coverage of the subject, I can assure would-be readers that it fulfills its promise to provide a lively story of the true history, one that includes “intense rivalries and lifelong loyalties, missed opportunities for some and undue advantages for others, voyages to exotic lands for discoveries, and competing with discoveries made in one’s backyard, soldiers giving up arms to study the stars, and crackpots queuing up with their cranky ideas about helium.” In addition to clarifying the story of the discovery of helium, the book, as the second part of its title suggests, also sheds light on how the age-old study of the skies was transformed into astrophysics.

Nath attributes the profession’s transformation from astronomy to astrophysics to “the twin pillars of spectroscopy and photography. While one enabled astronomers to think of the physics and chemistry of stars, the other freed them from the constraints of hand sketches and limitations of human eyes.” Nath underscores the importance of the work of Gustav Kirchhoff and Robert Bunsen, who in 1859 figured out how scientists could “identify a gas with the help of the light it emitted when it burned,” with the spectrum of each gas analogous to a fingerprint, since no two substances had identical spectra. I was interested to read that, as late as 1840, Astronomer Royal George Airy preached that the proper work of astronomy is to “lay down rules by which the movement of the celestial bodies…can be computed,” and that nothing else about these bodies “possesses…proper astronomical interest.” As Nath notes, “The work of Kirchhoff and Bunsen shattered this view,” ushering in a “new era in

astronomy," so that by 1874, French astronomer Hervé Faye could describe in a report to the Académie Française his profession's purview as "no longer a matter of Celestial Mechanics, but of celestial Physics and Chemistry: stellar matter is analyzed as if it were in a crucible."

As a bonus to his readers, Nath also spends several pages at the beginning of the book explaining the importance of helium to 21st-century life and at the end, musing on how the history of science is written. We learn at the outset that "Magnetic resonance imaging (MRI) machines use helium. The magnets could not help make the images unless cooled to the low temperatures induced by liquid helium. NASA programs routinely use helium to clean out their rocket engines and to pressurize the interior of liquid fuel rockets. Deep-sea divers have their oxygen supply mixed with helium in order to avoid the toxic nature of oxygen under extreme pressures. Pure helium is also essential as a shielding gas in laser welding, as its inert nature suppresses the formation of an obstructing plasma cloud and brings down the power consumption." Although in the body of his text Nath doesn't mention the helium shortage, which has been widely reported in news media, in footnote 4 in the first chapter he mentions the Helium Privatization Act of 1996 (though not the bipartisan legislation that awaits approval in our woebegone Congress, which would prevent the need to obtain helium from other countries to assure the health of the U.S. semiconductor industry and others that make products used regularly by Americans). In the same footnote, Nath explains that "Finding new sources of helium has been cited as a motivation to send missions in the future to the Moon, in order to mine helium….It is believed that the solar wind, which consists of energetic particles emanating from the Sun, deposits helium-3 on the lunar soil."

As his coda, Nath shares with us his ideas about the problems his research has uncovered in the practices of historians of science. He believes that the complicated and intertwined steps leading up to a discovery are sometimes reduced to "a story of heroes and their rivals." He also notes that the history of science is told "from the point of view of the present," so that the focus is on those aspects of a complicated tale that "are aligned with modern ideas." In the penultimate paragraph of the book Nath notes that in the current age of big science, "there is much less scope for one individual to shine."

This is not an elegantly written book, but occasionally Nath turns out a fine phrase. I was charmed, for instance, while reading his explanation for why helium is rare on Earth despite its ubiquity in the universe, to find the element described as "less promiscuous than other elements." Helium is, after all, he reminds us, a so-called noble element, which doesn't "socialize" with other substances or even with itself; no helium molecule has yet been found. Nath calls helium "a hermit among the elements," of all the noble elements the one that most resists mixing "with other, more common elements."

Whatever the reader may conclude about Nath's writing style, certainly this book would have benefited from closer editing. Nath, for example, who knows so much about so many interesting things, should not have misspelled the name of the man for whom the brilliant points of sunlight that appear briefly around the moon just before and after a total solar eclipse are named; the first to call attention to what we now call "Baily's beads" was Francis Baily, not Bailey, as it appears twice on page 111. Nonetheless, I took great delight in learning many small facts that work their way into Nath's tale, only a few of which I will share here. Did you know that a grandson of William Herschel became "famous for his pioneering work on using fingerprints for identification"? Or that Alfred, Lord Tennyson, poet laureate of England through much of Queen Victoria's reign, was a member of Lockyer's "smoker's club," which met at the astronomer's home on weekends? As interesting

as it may be to learn how Lockyer's enthusiasm for advances in astronomy permeated some of Tennyson's poetry, I was more surprised to see how Lockyer's confrontational personality drove one of the greatest physicists of all time, James Clerk Maxwell, to vent his annoyance in this verse:

And Lockyer, and Lockyer,
Gets cockier, and cockier
For he thinks he's the owner
Of the solar corona.

Lockyer's *ad hominem* attacks on fellow astronomer William Huggins, another pioneer in spectroscopy, also led to Huggins's poetic *cri de coeur* in a letter to his American friend George Ellery Hale, "These attacks of Lockyer, only just begun I fear, are giving us much pain. It is difficult to keep them from eating out of our life all joy of life." The "us" to whom Huggins refers includes his wife, the former Margaret Lindsay Murray, who as a teenager in Dublin had constructed not only telescopes but also a spectrograph of her own. She and Huggins were married in 1875, when he was 51 and she 27. I was delighted to learn that before their marriage, Huggins's closest companion was his dog, Kepler. The fact that Nath includes Lady Huggins in his story is also a feather in his cap, in my opinion. Although all the main characters in the story are men, Nath notes the important contributions both of wives (including Anna Draper, observatory assistant to John William Draper; and Winifred Lockyer, who helped keep the family financially afloat by translating books from French into English) and daughters (including Elizabeth Isis Pogson, who served as her father's unpaid assistant, and whose nomination for Fellowship in the RAS in 1886 was ignored, but who finally became FRAS in 1920).

As I finished reading the book, it occurred to me that spending time with Nath had been an unexpected pleasure, akin to finding oneself seated at a dinner party next to someone who turns out to be a much more interesting interlocutor than might have been anticipated. From googling Nath, I learned that he is the author of four previously published popular science books, two in English (*Dawn of the Universe,* published by Universities Press India in 2005, and *Eyes on the Sky: The Story of Telescopes,* published in India in 2009), as well as two books published in Kolkata in Bengali, one in 2002 and one in 2007. I find myself hoping to have the pleasure of reading another book by Nath in the future, and maybe even of being seated next to him at a dinner. I can feel confident that the man who goes out of his way to talk about the contributions of the women behind the men who star in his narrative would also make a point of asking me about what I do.

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ELEMENT 94: A THRILLER FOR YOUNG ADULTS

Barrie W. Jones, (available from Amazon UK, 2011). 152 pages. PB £5.60. ISBN 978-1-291-32550-8.

Readers of IAU Commission 46's Newsletter will recognize not only the name of the author of this book but also the identity of element 94—plutonium. While a "thriller for young

adults" is not the usual sort of book to be reviewed in this space, I wanted members of the commission to know that Barrie Jones, the long-time editor of this newsletter, who is currently on the organizing committee of the commission, has written a most engaging book in his very active retirement.

Without giving away anything that would spoil the reader's enjoyment, I will mention just a few matters that caught my attention. First, I wonder at Barrie's choice of the Welsh name Geraint for the uncle of two of the three teenage heroes of the tale. According to tradition, Geraint, if he ever lived, was a valiant warrior. In this book, however, it is Geraint's nephew, Thomas, and especially his niece, Emma, who are the valiant ones, while Geraint learns about their hair-raising skirmish with a criminal gang only after the kids have succeeded in their seemingly impossible task of protecting Shropshire and Herefordshire from the fallout from a dirty nuclear device.

The only other unusual name in the book is that by which the leader of the criminal gang upon whose plans the three teenagers accidentally stumble is known: Sirocco. Since we are told about the Mediterranean origin of the gang leader, however, this name seems perfectly apt; the sirocco is the Mediterranean wind that comes from the Sahara and reaches hurricane speeds in North Africa and Southern Europe.

Aside from the matter of names, I also found myself wondering why Barrie takes the trouble to tell his readers at least twice about the non-traditional lifestyle chosen by the parents of the third teenage hero, Ben, or about how Ben and Emma met. Neither fact seems necessary to the development of the story, unlike the minimal information Barrie gives about the whereabouts of Emma's and Thomas's parents, which explains why the children are in the custody of Uncle Geraint for the duration of the novel. The only other bit of backstory to which we are made privy is the parental abuse suffered by Sirocco, which is meant to explain our villain's predilection for a life of crime.

I also note that the plot device that clues the teenagers in to the precise nature of the criminal enterprise upon which they have unwittingly stumbled is a bit on the clumsy side. That said, however, it is certainly no clumsier than many such devices in television shows like the popular *24*.

Among the several aspects of the tale for which I applaud Barrie is its feminist message; for good and for evil, women play leadership roles. I also think he skilfully inserts just enough science so that the novice reader can understand radioactive decay, fallout, and radiation sickness. Having myself been carried along by the suspense throughout, I can recommend *Element 94* as a good read not only to your teenage students and relatives but also to any of you who like to read thrillers. For the delicate of sensibility, however, I will point out that I noticed two uses of an expletive in the course of the tense unfolding of the plot; if any such readers there be, you are duly forewarned!

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EDUCATIONAL NOTICES AND RESOURCES

THE NEXT INTERNATIONAL OLYMPIAD IN ASTRONOMY AND ASTROPHYSICS WILL BE HELD IN ROMANIA FROM 1-10 AUGUST, 2014

Romania can be considered a remarkable phenomenon when it comes to astronomy teaching and learning. Despite the fact that astronomy and astrophysics are not included in the official curriculum, the interest of the students and teachers in astronomy subjects is increasing every year. The proofs of this are the excellent results obtained by Romanian students in the two international astronomy Olympiads, i.e. International Astronomy Olympiad – IOA and the International Olympiad in Astronomy and Astrophysics – IOAA.

Romanian teams have excelled in astronomy achievements: Consider only the last three years: in IOAA, 2011 - winner of the Team competition; in 2012 – the golden medal won (Racoreanu Mihai and Catalina-Ana Miritescu); in 2013 – the golden medal for the best competitor in 2013 (Denis Turcu), 2 golden medals (Craciun Iustina), one for the best theoretical solution and, last but not least, the Romania best result of all times in IOA 2013 with 7 diplomas. Not to mention numerous silver, bronze and honorable mentions.

The most important thing is that these excellent results are the result of the enthusiasm and the commitment of a yearly increasing number of Romanian physics and mathematics teachers, actively promoting and teaching astronomy.

As recognition of these results, in 2014 Romania will host the 8th edition of the International Olympiad in Astronomy and Astrophysics. The 8th IOAA will be held from 1 to 12 August 2014, in Suceava County, Northern Romania.

This venue was chosen not only because of Romania's tradition of good science education, particularly in astronomy, but also because the locality is positioned in an exceptional historical area, where the most beautiful monasteries from Romania can be found, some of them under the protection of UNESCO.

The main organizers are the Romanian Ministry of Education, University, Ştefan cel Mare" Suceava, School Inspectorate of Suceava County, Suceava County Council, Cygnus Scientific Society – UNESCO center.

The national contest has 4 ongoing tests for the students:

1. Theoretical test (duration of 5 hours, which includes 15 short problems and 2 or three longer ones).
2. Data analysis test (duration 4 hours, which includes 2 or 3 problems).
3. Observational test (if the sky is clear, then this test will be taken outside, on the field, using astronomical telescope – duration 0,5 h; if it is cloudy, the test will be taken in the "Ştefan cel Mare" University Planetarium Suceava)
4. Team test (it contains a set of problems that need to be solved by each team as a group) The Cygnus Science Society – UNESCO center.

We wish to extend a cordial invitation to all interested students and teachers to join the 8th International Olympiad in Astronomy and Astrophysics.

For more details see the website: www.ioaa2014.ro

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Fig. 1 Olympic Team 2013, Romania

Fig. 2 Suceava University

Fig. 3 Dragomirna Monastery

GLOBAL ASTRONOMY MONTH'S "DARK SKIES AWARENESS" PROGRAMS FOR APRIL 2014: THREE ACTIVITIES OF INTEREST

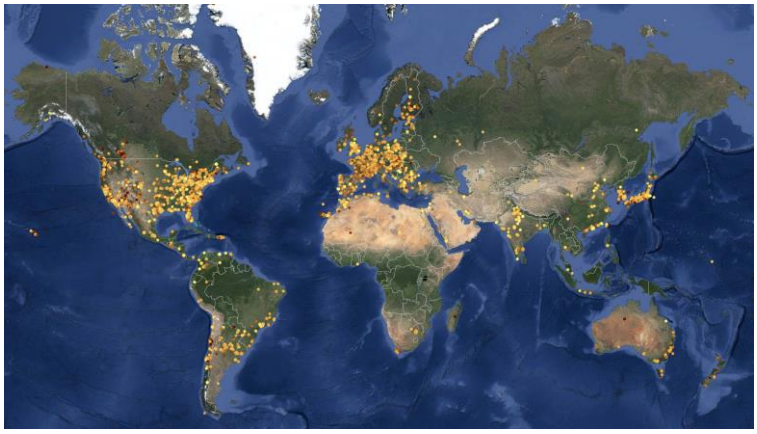
Continuing the legacy of 100 Hours of Astronomy during the International Year of Astronomy in 2009, Global Astronomy Month (GAM) has been celebrated every April. GAM 2014 brings together astronomy enthusiasts to celebrate "One People, One Sky" through many astronomy events, activities and programs. One set of programs is the Dark Skies Awareness programs, which is intended to raise awareness of the importance of preserving our night skies. The Dark Skies Awareness program does this through three main opportunities for involvement: Globe at Night citizen-science light pollution campaign, the Earth and Sky photo contest and the International Dark-Sky Week.

The **Globe at Night program** is an international citizen-science campaign to raise public awareness of the impact of light pollution by inviting citizen scientists to measure their night-sky brightness and submit their observations from a computer or smart phone. Students and scientists use the data to monitor levels of brightness or light pollution around the world. They also use the Globe at Night data to understand light pollution's effects on energy consumption, plants, wildlife and human health, as well as our ability to enjoy a starry night sky. Since its inception in 2006, about 105,000 measurements from 115 countries have been

reported. For 2014 the Globe at Night campaign is offered each month of the year. Since the Moon is a natural light bulb in the night sky we would like to avoid, the 10 day observation window each month has been chosen so the Moon will not be up at least an hour after sunset to about 10pm. The remaining campaign dates are: March 21-30, April 20-29, May 19-28, June 17-26, July 16-25, August 15-24, September 15-24, October 14-23, November 12-21 and December 11-20.

Globe at Night offers 4 ways to measure night-sky brightness: the traditional method of matching what you see toward a constellation with star charts; the use of a handheld digital device called a Sky Quality Meter (SQM); the use of the Loss of the Night app on Android phones, which asks you to find certain stars as a measure of star visibility; or the use of the Dark Sky Meter app on iPhone 4s/iPhone 5, which uses the phone's camera to measure night sky brightness.

The easy steps to participating in the campaign are listed at http://www.globeatnight.org. The Globe at Night holds an abundance of background information, such as helpful resources and tools from finding the constellations used in the campaign, to understanding concepts like light pollution, to games that test your expertise in choosing the faintest star visible or "limiting magnitude". "Dark Skies Rangers" activities used in grades 4-14 provide a foundational basis for and extensions to the Globe at Night campaign. You can also explore the last 8 years of data in our interactive map. Or use our map app to see how your city or any area in the world did. The database is usable for comparisons with a variety of other databases, such as how light pollution affects the foraging habits of bats. Since Globe at Night is entering its 9th year, there is sufficient data from at least a dozen cities to study how light pollution has changed over time. …We look forward to your joining the campaign and/or playing with the data. Enjoy!



The on-line **"Earth and Sky" photo contest** is open for submission by any photography enthusiasts of any age from around the world. International projects, The World at Night (TWAN) and Global Astronomy Month, along with the National Optical Astronomy Observatory, are the organizers of the contest. The contest was founded by TWAN and IAU Dark Skies Awareness cornerstone project in 2008 as a regional program. It was expanded to an international effort in 2009 during the International Year of Astronomy. In 2013 participants from about 45 countries submitted a wonderful collection of nightscape images. The contest news was broadcasted by major science news media world-wide and the winning images were widely promoted. With the growing impact of TWAN on both photography and astronomy communities along with the efforts of Astronomers Without Borders (AWB), the organization behind the Global Astronomy Month, the Earth and Sky Photo Contest will

have an even larger feedback this year. Submitted photographs must show both the Earth and the sky -- by combining elements of the night sky (e.g., stars, planets, the Moon or celestial events) in the backdrop of a beautiful, historic, or notable location or landmark. This style of photography is called “landscape astrophotography". The contest theme, “Dark Skies Importance,” has two categories: “Beauty of the Night Sky” and “Against the Lights.” Photos submitted to the contest should aim to address either category: either to impress people on how important and amazing the starry sky is or to impress people on how bad the problem of light pollution has become. Both categories illustrate how light pollution affects our lives. Photo submissions will be taken through April 22. Winners of the 5th contest will be announced by mid-May 2014. To submit photos, see "Guidelines" midway down the webpage, http://www.twanight.org/newTWAN/news.asp?newsID=6096

The **International Dark-Sky Week** (IDSW), April 20-26, is another way to celebrate the stars. Created in 2003 by high-school student Jennifer Barlow, IDSW has grown to become a worldwide event and a key component of Global Astronomy Month' Dark Skies Awareness programs. The goals of IDSW are to appreciate the beauty of the night sky and to raise awareness of how poor-quality lighting creates light pollution. Light pollution is a growing problem. Not only does it have detrimental effects on our views of the night sky, but it also disrupts the natural environment, wastes energy, and has the potential to cause health problems. IDSW provides solutions to those challenges. IDSW is a great time to host a neighborhood star party to introduce the idea of preserving a dark night sky to your community or to evaluate your own lighting at home to make sure that it is dark sky friendly. There lots of great ways to participate. The more people there are that turn out their lights when they are not needed, the less light pollution there will be. How can you help the cause? Find some great ways to fight light pollution and some cool IDSW events at the International Dark-Sky Association’s IDSW page at www.darksky.org/resources/109-international-dark-sky-week .

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ASTRONOMY IN THE INTERNATIONAL YEAR OF LIGHT 2015

In December 2013 the United Nations General Assembly proclaimed 2015 as the International Year of Light and Light-based Technologies (IYL 2015), recognizing “the importance of raising global awareness of how light-based technologies promote sustainable development and provide solutions to global challenges in energy, education, agriculture, and health.”

John Dudley, president of the European Physical Society and chair of the IYL 2015 Steering Committee, explains: “An International Year of Light is a tremendous opportunity to ensure that policymakers are made aware of the problem-solving potential of light technology. Photonics provides cost-effective solutions to challenges in so many different areas: energy, sustainable development, climate change, health, communications, and agriculture. For

example, innovative lighting solutions reduce energy consumption and environmental impact, while minimizing light pollution so that we can all appreciate the beauty of the universe in a dark sky."

IYL 2015 is bringing together many different stakeholders, including scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations, and private-sector partners to promote and celebrate the significance of light and its applications during 2015.

The American Astronomical Society (AAS) and the International Astronomical Union (IAU), which were heavily involved in the International Year of Astronomy in 2009, will play a role in IYL 2015 — especially since the AAS will host the 29th General Assembly of the IAU in August 2015. Other US-based organizations, such as NOAO and SPIE, are organizing their efforts as well. Discussion for this presentation will center on the IYL cornerstone project in astronomy, dark-skies awareness, and optics and the related projects and events being formed, as well as the regional, national, and international committees and contact points being established to ensure that all nations of the world can participate.

Note: This abstract is adapted, in part, from press releases by the European Physical Society and the AAS.

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USEFUL WEBSITES FOR INFORMATION ON ASTRONOMY EDUCATION AND OUTREACH MEETINGS

The following websites contain information on future (and recent) meetings and conferences on, or very relevant to, astronomy education and development. In compiling this short list I am well aware of a strong European bias. **Please send me URLs by email for relevant websites in other areas of the world.**

WORLDWIDE	
IAU Office of Astronomy for Development (OAD)	http://www.astro4dev.org/
UK	
The Association for Astronomy Education	http://www.aae.org.uk
The British Association of Planetaria	http://www.planetaria.org.uk/
The National Schools Observatory	http://www.schoolsobservatory.org.uk
Europe	
The European Association for Astronomy Education	http://www.eaae-astro.org
The European Astronomical Society	http://eas.unige.ch/
The European Southern Observatory	http://www.eso.org/outreach/eduoff
USA	
(among several other good sites)	
The Astronomical Society of the Pacific	http://www.astrosociety.org

OTHER EDUCATIONAL RESOURCE WEBSITES

Project CLEA—Research Simulations in Astrophysics
http://public.gettysburg.edu/~marschal/clea/CLEAhome.html
The Nebraska Astronomy Applet Project -----Online Labs for Introductory Level Astronomy
http://astro.unl.edu/naap/

INFORMATION THAT WILL BE FOUND ON THE IAU C46 WEBSITE

Among the information that will be contained on the IAU C46 website http://iaucomm46.frm.utn.edu.ar is the following

- Overviews (of C46, in English, French, and Spanish)
- Guidelines (including Programme Groups)
- Resolutions
- Newsletters (including OAO newsletters and triennial reports from National Liaisons)
- Organizing committee
- National contacts (liaisons)
- Links
- News

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