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

Newsletter 81 – March 2015

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.

PLEASE WOULD NATIONAL LIAISONS
DISTRIBUTE THIS NEWSLETTER
IN THEIR COUNTRIES

This newsletter is available at the following website
http://iaucomm46.frm.utn.edu.ar/newsletters/

CONTENTS

EDITORIAL

Welcome to IAU Commission 46 Newsletter 81, the fifth to be published under the editorship of Larry Marschall (Professor Emeritus, Gettysburg College). This newsletter contains some information on educational events at the upcoming August General Assembly in Honolulu provided by Mary Kay Hemenway. It also contains the semi-annual report on educational activities by OAD Director Kevin Govender, which is a regular feature of the newsletter. Rick Fienberg and Douglas Arion report on Galileoscope activities in conjunction with the International Year of Light (IYL), Rosa Ros and Beatriz Garcia review the NASE program to bring astronomy to elementary and high-school teachers worldwide, and Charles Fulco reviews opportunities for astronomy education associated with the great US solar eclipse of 2017. We are happy, as usual, to have two 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 October 2015 issue the copy date is **Friday 2 October 2015**. 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 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

I 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 C46 websites

The "official" C46 website is at http://www.iaucomm46.org. The IAU Office of Astronomy for Development (OAD) is at http://www.astro4dev.org/ and the IAU Office of Astronomy Outreach (OAO) is at http://www.iau.org/public/ .

Back issues of the C46 Newsletter

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.

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)

THE IAU GENERAL ASSEMBLY

A NOTE ON EVENTS AT THE IAU GENERAL ASSEMBLY IN HONOLULU, AUGUST 2015

---Mary Kay Hemenway

As you plan for attendance at the August General Assumbly, the following information should be helpful:

There will be two session devoted to education at the meeting in addition to poster papers:

Friday August 7:

session 3. 4:00 - 6:00 PM Education (primary/secondary)
session 4. 6:00-7:30 PM Education (college/graduate)

Among the probable presenters are (in no particular order) are:

Rosa Ros, Pedro Russo, Paulo Bretones, Hakim Malasan, Linda Strubbe, Beatriz Garcia, and Andreja Gombac. We don't yet have final abstracts and titles.

In addition, there are others (outside of Division C) that are planning some education events:

There is a GHOU workshop in Honolulu (at UH) a few weeks ahead of the IAU, and a NASE workshop at Bishop Museum the weekend ahead of the IAU (7/31-8/3).

There will be some outreach events, such as public talks, some stargazing sessions for IAU attendees and the general public, and some school groups visiting the convention center on the Wednesdays of the meeting. Some astronomers will also be visiting local schools.

Since events are still in a state of preparation, be sure to check the IAU website for further information as the date approaches.

Mary Kay Hemenway
The University of Texas at Austin
marykay@astro.as.utexas.edu

==========

UPDATE ON THE IAU OFFICE OF ASTRONOMY FOR DEVELOPMENT (OAD) FROM KEVIN GOVENDER, DIRECTOR OF OAD

----Kevin Govender

1.**Background and Overview:**

The IAU Office of Astronomy for Development (OAD) was established in March 2011 in order to drive the implementation of the IAU Strategic Plan adopted at the 2009 General Assembly. The OAD is hosted at the South African Astronomical Observatory (SAAO) in Cape Town, South Africa. The OAD releases quarterly newsletters which are available on the OAD website or via the OAD mailing list (see www.astro4dev.org). This update to Commission 46 covers the period from 1 October 2014 to 15 March 2015, including a summary of projects funded for implementation in 2015. Any queries on the OAD and its activities can be directed to info@astro4dev.org – comments, suggestions, ideas and input are always most welcome.

2.**OAD Call for Proposals 2014 (for implementation in 2015):**

On 30th June 2014 the OAD released its third annual open Call for Proposals for projects related to its three Task Forces: TF1 (universities and research); TF2 (children and schools); or TF3 (public outreach). The response to the Call was again quite overwhelming with 131 proposals received (31 proposals for TF1; 67 for TF2; and 33 for TF3). Of these 27 projects were selected for funding and these are listed below. Funded projects are monitored by the OAD and individual project summaries/reports/updates are available on the OAD website www.astro4dev.org)

TF1 (Universities and Research):

Title	**Country**
Summer Visiting Program for Astronomers at the Harvard-Smithsonian Center for Astrophysics (CfA)	US (international participants)
Time Variability in Modern Astrophysics	Thailand
Latin American School of Observational Astronomy	Mexico
Summer School on Statistical Data Analysis and Data Mining in Astronomy	Kenya
Optical camera for a 14-inch telescope in Namibia	Namibia
Astronomy for Africa: Student Support for Astronomy Modules via Distance Learning	South Africa
National School on Astrophysical Simulation	Nepal
Introducing Data Analysis in the University System	Zambia
TARA, Fergusson College Node, Pune, India	India
Guatemalan School of Astrophysics 2015	Guatemala
Andean Cosmology School	Colombia

TF2 (Children and Schools):

Title	**Country**
The Travelling Telescope	Kenya
GalileoMobile Constellation	South America - several countries
Astro-Science Ambassadors Outreach for Science Education in Tanzania	Tanzania

Discover the Universe/e la decouverte de l'Univers - Online workshop for worldwide French teachers	Francophone countries
AstroMcGillos Adopt an Astronomer program	Canada
Astronomy Outreach for Inner City Youth	US (inner cities)
How Big Is Earth?	Chile, China, Nepal, Russia, South Africa, and the US

TF3 (Public Outreach):

Title	**Country**
SENSOROTECA ASTRONÓMICA	Colombia
Public Library Astronomy Corners	South Africa
Sign Language Universal Encyclopedic Dictionary	Global
COSMIC LIGHT: BRING GALILEO'S STARRY MESSENGER TO VIETNAM	Vietnam
Astronomy on Camel Cart	India
Poetry and Sky Competition	China
US National Park Service Night Skies Internship	US
"O Universo é velho, belo e cheio de vida"	Portugal
"Obsesión por el Cielo": A Weekly Astronomy Radio Show, and "Un Paseo por el Cielo": A Descriptive Guide to the Night Sky	Mexico

The OAD also welcomes innovative ideas from Commission 46 members for special projects that can be tested or coordinated from the OAD itself. These are independent of the annual Call for Proposals.

3.**Regional Nodes and Language Expertise Centres:**

Since the last C46 newsletter in October 2014, two more regional node proposals have been approved: one in Nigeria for the West African Region and one in Colombia for the Andean region of Latin America. These bring the total number of regions to 6 (the existing nodes are in China for East Asia and the Chinese language; Thailand for South East Asia; Ethiopia for East Africa and Zambia for Southern Africa). In January 2015 the OAD hosted the first face-to-face workshop of regional coordinators. This was an invaluable opportunity to enhance the synergies between the OAD and the regional offices. The meeting was attended by the Assistant General Secretary Piero Benvenuti, Deputy CEO of the NRF in charge of Astronomy, Nithaya Chetty, and Chair of the OAD Steering Committee, Khotso Mokhele. Links to the respective websites for the regions can be found on the www.astro4dev.org. As always, if members of Commission 46 have any ideas, contacts or experience related to these proposed regions, or new regions, please do get in touch.

4.**Some Highlights**:

Since the last C46 newsletter, the OAD has been quite occupied with the issuing of grant agreements and payments for 2015 projects, the annual OAD steering committee meeting, the first regional coordinators workshop and the first major OAD review. Some highlights since the last newsletter:

i. The OAD is developing a university level "package" that consolidates material that would be useful to universities wanting to start up astronomy programmes. Such a package would contain information relevant to e.g. introductory astronomy courses/modules; guidelines on using robotic telescopes; research/tutorial activities for

small telescopes; etc. The OAD is currently hosting a Visiting Fellow, Ramasamy Venugopal, who is working on this activity. Two more fellows are expected during 2015 to work on other special projects.

ii. A candidate from Kenya was selected at the end during this quarter for the OAD-IUCAA visiting fellowships for African individuals.

iii. A three-way Memorandum of Understanding was signed with Associated Universities Inc. (AUI) and Leiden University regarding the dissemination of educational resources globally and exchange programmes;

iv. The OAD participated in a collaboration which submitted (successful) proposals both in the UK and SA for funding through the Newton Fund/NRF opportunity. This project is focused on human capital development towards the African VLBI network;

v. The OAD hosted its annual meeting of the Steering Committee in January 2015. This was also attended by Assistant General Secretary Piero Benvenuti. At this meeting the annual plans for the OAD are reviewed and approved. This meeting was special in that it overlapped with the first face to face workshop of regional coordinators.

vi. The first formal review of the OAD took place during February 2015. The review was conducted by a high level independent panel chosen by the partners (IAU and South African National Research Foundation). The review covered the first 3 years of the OAD's life and we expect the report to be released during April 2015. The report, together with the "management response" will be made public. Watch the OAD website and mailing lists for more.

vii. New OAD staff member Eli Grant joined the team as Project Officer. Eli brings a wealth of experience from the field of evaluation and we look forward to using her skills to the benefit of the astronomy-for-development community.

5. **Future:** We are currently developing the OAD Impact Cycle. This cycle is meant as a positive feedback loop for projects such that new projects build on the experience and resources of previous similar ones. The cycle will enhance the OAD's project design, selection and delivery systems. By determining what works and, importantly, what doesn't work, the OAD can develop a library of evidence on best practice and empower projects to enhance their impact. At the next IAU General Assembly the OAD will organise Focus Meeting 20: Astronomy for Development, which plans to include a panel discussion with representatives of all IAU Divisions. We also plan to have an exhibition area jointly with the IAU Office for Astronomy Outreach from where we will help coordinate Young Astronomer Events. We look forward to the OAD review report which will help shape the way forward for the OAD.

6. **More information/Contact:** For more information or to provide suggestions and input, please visit the OAD website (www.astro4dev.org) or contact us at info@astro4dev.org.

Kevin Govender
Director: IAU Office of Astronomy for Development
kg@astro4dev.org

EDUCATIONAL REPORTS

THE NASE: FROM RIO, 2009 TO HONOLULU, 2015

----R.M. Ros & B. García

Abstract

The Network for Astronomy School Education (NASE) is an international program that organizes courses for secondary and primary school teachers in different continents. It attracts students, who love to know more about astronomy and teachers who have the opportunity to observe the sky that every school has above it.

In this article we present details about the kind of courses conducted by NASE, their contents, the complementary material distributed by NASE for continuity, and the structure of its local working groups.

The NASE program

The main goal of NASE is to provide teachers with enrichment courses in astronomy, which are conducted in the teachers' native language. A small group of two or three members of NASE visit the country and teach the courses in cooperation with IAU members in the country (if there are any) and any teachers interested in astronomy.

After each course, the teachers and astronomers that cooperate with NASE members, in turn, form a new local NASE working group made up of 6 or 7 people, teachers, professors, astronomers, and planetarium staff. Members of the working group are required to repeat the course at least once per year in their local area. In addition they are invited to cooperate with NASE in other courses and in the creation of materials in order to increase their knowledge. The local NASE working group cooperates with local institutions such as the Ministry of Education, and local Universities and Observatories interested in working together with NASE.

Educational resources and course materials are being produced in several languages. Resources are already available in English, Spanish, and Portuguese. The course without supplementary materials is also available in Mandarin Chinese and Romanian and we are planning to translate into other languages in the years to come.

Between 2009 and the present NASE has organized 65 courses and created 30 local NASE working groups in 18 different countries. The more than 250 volunteers who have been trained in primary NASE course now educate more than 2500 teachers who work with about 1,600, 000 students (on average we estimate that a teacher has 200 students per year) and we continue to expand. Our courses had been organised mainly in Central and South America and with a few in Africa and Europe (figure 6). We are planning to continue in to expand into underrepresented areas and to begin to work in Asia next year in cooperation with local institutions.

Fig. 1: NASE courses distribution until 2014.

The basic course is the same in all countries, with variations in material that are related to the latitude and longitude in the presentation. Other specialized single-topic courses related to more particular topics have also been created. Further information about the courses can be easily accessed by visiting the website of NASE (http://www.naseprogram.org).

Currently NASE offers courses in the following topics: The *History of Astronomy; The Earth-Moon-Sun System; The Solar System; Planets and Exoplanets;Measuring Stars; The Solar Spectrum; The Life of Stars; Non-Optical Astronomy; The Expansion of the Universe; and Observational Cosmology*. All NASE courses include an astronomical visit to a local site related to astronomy and a discussion about the status of astronomy in the country and the methodology on teaching astronomy and workshops for practical activities.

Classroom activity in the NASE courses is divided between informational lectures and participatory discussion groups. The course is also complemented with daytime and nighttime, observations, with and without telescopes, and with poster sessions that highlight the expertise of some participants.

All the activities, except workshops, are taught to the full group. The workshops are taught to small groups in which teachers are encouraged to develop their own activities. We also divide the groups into primary and secondary school teachers, because different methodologies and materials are appropriate to different levels of students.

The materials have been prepared by members of NASE group and tested by teachers in astronomy. These materials are posted on the website in the language of the country. Every participant receives a CD with the power point presentations and the digital material that they need in the most widely-used language.

For Spanish-language courses, which have been organized by the author, there are currently more than 300 papers (English and Spanish), for secondary and primary schools, including: activities, simulations, interactive projects, games, tales, videos, observations, pictures and articles, in fact everything that teachers and students could possibly need. The materials are distributed through two websites: one for secondary schools (11-18 years old students) and the other for primary schools (4-10 years old).

This year 2015, NASE is organizing two special-topic courses related to the International Year of Light. One of them focuses on astrophysics and the other one focuses on astrometry.

In all the NASE courses, we publish a book that includes the full papers (workshops and lectures) of the course. To date these published materials include:

- 14 steps to the Universe 2012, Ed. Rosa M. Ros & M. Kay Hemenway
- Geometry of Light and Shadow 2015, Ed. Rosa M. Ros & M. Kay Hemenway
- Cosmic Light 2015, Ed. Rosa M. Ros & M. Kay Hemenway
- 14 pasos hacia el Universo 2012, Ed. Rosa M. Ros & Beatriz García
- Geometría de Luces y Sombras 2015, Ed. Rosa M. Ros & Beatriz García
- Luces del Cosmos 2015, Ed. Rosa M. Ros & Beatriz García

Which can be obtained from NASE website free of charge

Some examples of the course and complementary material

Activity 1: Simulation of gravitational lens with a glass of wine

We can simulate a gravitational lens using a glass of wine. This experiment allows you to "show" how matter can introduce distortions in the images observed.Now let's simulate the Einstein ring or multiple images. Take a flashlight, place it on the other side of a glass full of red wine or juice and observe the ray of light passing through it.
It is easy to see that this simulation leads to the "distortion of space" that is observed. Simply place the glass on graph paper and look through the white wine (or apple juice). We see the distortion of the graph lines (figures 2a and 2b).

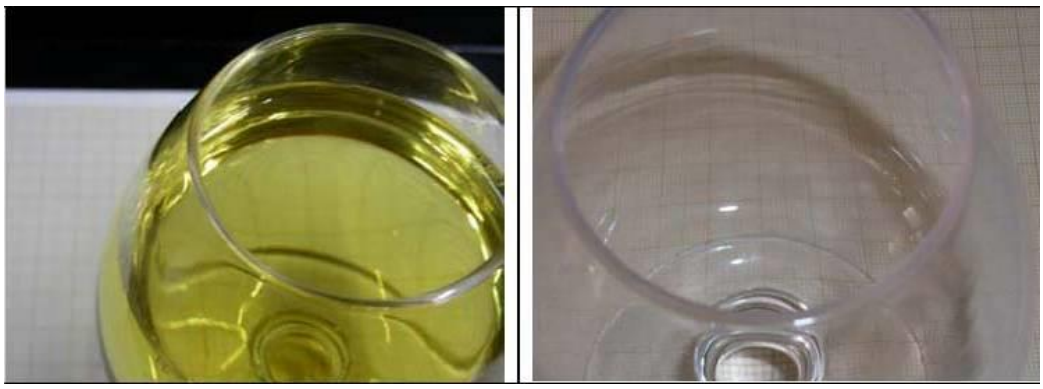

Fig. 2a and 2b: We only can see the distortion of the graph paper if the glass is full.

Looking at the ray of light, we move it from right to left and from top to bottom. We note that the light is not a point: the wine produces images repeatedly and in some cases some arches. This is a consequence of the glass acting as a lens that distorts the light trajectory. In particular, we can sometimes see an amorphous figure, or a bright red dot, four red dots or a red bow between points (figures 3a, 3b and 3c).

Fig. 3a: The flashlight beam is distorted as an arc between two bright red spots, Fig. 3b: like an amorphous rectangle, and Fig. 3c: the Einstein cross.

We can also simulate the gravitational lens looking through the glass foot of the wine glass. If we put the foot of the glass on a graph paper and look through it, we can see the deformation of the grid (figure 4).

Moving the foot of the glass slowly from right to left above an object, (e.g., a red circle about 3 cm), we can reproduce the shapes observed through gravitational lenses (figures 5a, 5b and 5c).

Fig. 4: Grid deformation.

Fig. 5a, Fig. 5b and Fig. 5c: The glass foot can simulate various shapes made by gravitational lenses: arc segments, images of points, and Einstein rings.

Activity 2: Building a Spectrometer

The white light from a bulb with a filament is composed of all colors while the light from bulbs that are gas (fluorescent tubes, energy-saving lamps, or street lamps) is composed of only certain colors. If we separate the colors of light, we obtain its spectrum, which in the case of gases consists of a set of colored lines. Each type of gas has its own spectrum, which is the "barcode" of the compounds in the gas. If we look with a spectroscope at the light of a distant galaxy, the lines characteristic of hydrogen and other gases are displaced toward the red (known as a “redshift”), with a greater displacement the farther away the galaxy is.

With strong scissors, cut pieces from a CD or DVD (figure 3a) that does not have a label. If you use a DVD, separate the upper layer from the bottom in the cut piece of plastic (you may need the scissors or a screwdriver to help) and you will have prepared the diffraction grating. If you use a CD, there is only one layer of plastic, and you must detach the metal layer with care. A craft knife or razor blade will be helpful.

Make a photocopy of the template in figure 7. If you do it at A3 size, it will be more accurate. Cut out the template, including the white part, the curved section, and make a thin slit in the flap with the scale. You do not need to cut out the scale. Assemble the box, putting the black on the inside, and paste the flaps. In the hole left by the curved section, paste the piece of CD or DVD.

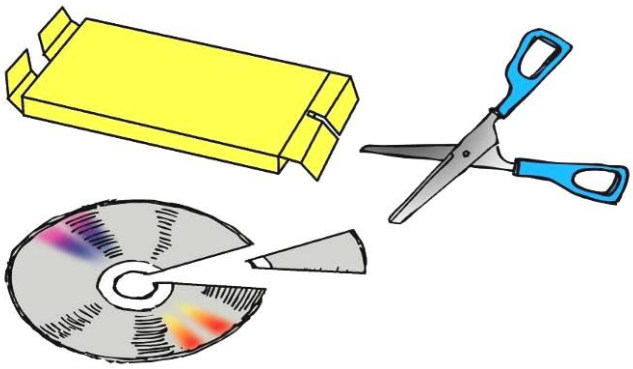

Fig. 6a: Material that you will need: DVD, scissors and paper box.

Fig. 6b: Removing the metal layer of the CD, with tape.

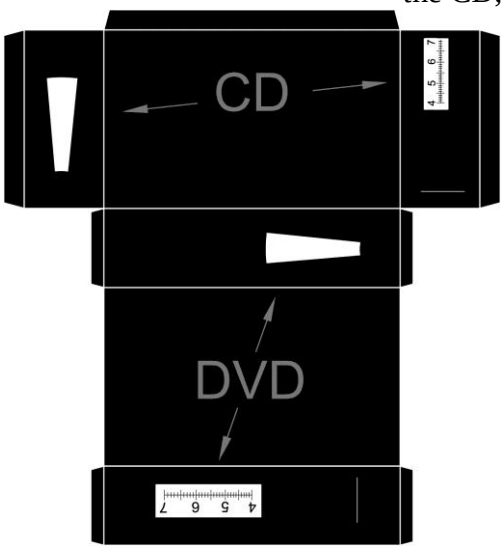

Fig. 7. Template for the spectrometer.

Look through the piece of DVD and aim the slit of the box (not the scale) at a low energy lamp or a fluorescent tube (figure 8). You should see the emission lines from the gases in the bulbs on the scale. If you do not see at first, move the slit back and forth until the lines appear. The scale is labeled in hundreds of nanometers, ie, the mark 5 shows 500 nm (500×10^{-9} m). The narrower the slit is, the more accurately you can measure the wavelength of the lines.

Fig. 8: Looking at a fluorescent lamp.

You can also make the box with cardboard, but if you do, you will need cut out the space for the scale and paste a paper copy over it so you will be able to see through the scale.

You can observe street lamps; both the orange (sodium) and white (mercury vapor) will work. Traditional incandescent bulbs produce a continuous spectrum.
Younger students can descompose the light and make a rainbow. Use a water hose with diffuser, and put the Sun behind (figure 9).

Fig. 9: Younger students can decompose the light into a rainbow

Conclusions

The NASE program has successfully organized many astronomy course which are presented in local languages, thus creating groups of teachers in each country who can repeat astronomy courses for other teachers. Ideally they get help from local institutions and the local Ministry of Education. NASE courses are currently recognized as official courses for training teachers in astronomy in Honduras and Bolivia and we are working to extend this support to other countries. The strategy of training teachers to train other teaches enables us to leverage the work of a 2 or three NASE visitors to create local groups that promote astronomy for years and years to come.

Astronomy is uniquely attractive to students, and as an additional benefit, the NASE methodology promotes the study of other related subjects, including mathematics, physics, and other natural sciences. As a result, teachers begin to teach all the sciences in a new way, introducing more activities, observations and experiments along the same lines that they have learned in the astronomy classes.

References:

- 14 steps to the Universe 2012, Ed. R. M. Ros & M. K. Hemenway, Ed. Antares, 978-84-940453-1-8
- Geometry of Light and shadow 2015, Ed. R. M. Ros & M. K. Hemenway, Ed Albedo Dome, 978-84-15771-47-0
- Cosmic Light 2015, Ed. R. M. Ros & M. K. Hemenway, Ed. Albedo Dome, 978-84-15771-50-0
- 14 pasos hacia el Universo 2012, Ed. R. M. Ros & B. García, Ed. Antares, 978-84-940453-0-1
- Geometría de luces y sombras 2015, Ed. R. M. Ros & B. García, Ed. Albedo Dome, 978-84-15771-40-1
- Luces del Cosmos 2015, Ed. R. M. Ros & B. García, Ed. Albedo Dome, 978-84-15771-42-5
- http://www.iau.org/education/commission46/
- http://www.naseprogram.org

Rosa M. Ros
Technical University of Catalonia, Barcelona, Spain
ros@ma4.upc.edu

Beatriz Garcia
National Technological University, Mendoza, Argentina
Instituto en Tecnologías y Detección de Astropartículas (CNEA, CONICET, UNSAM)
beatrizgarciautn@gmail.com

-----on behalf of 264 NASE members in 28 Local NASE Groups.

PRE-ORDER YOUR SPECIAL-EDITION IYL 2015 GALILEOSCOPES!

----Rick Fienberg & Douglas Arion

We are excited to announce that we are now accepting pre-orders for special-edition Galileoscopes for the International Year of Light 2015 at http://galileoscope.org. Deliveries will commence in May.

The Galileoscope, originally developed as a cornerstone project of the International Year of Astronomy 2009 (IYA 2009), solved a long-standing problem: the lack of an optically excellent but inexpensive telescope kit suitable for both optics education and celestial observation. In the process of assembling the kit, students explore fundamental optical concepts such as how lenses form images. Then, with their completed 50-mm (2-inch) diameter, 25- to 50-power achromatic refractor — which attaches to any standard photo tripod — they enjoy sharp views of lunar craters and mountains, Jupiter's moons, Saturn's rings, the phases of Venus, and other bright celestial objects. The kit is augmented with free, standards-based optics-education and observing activities, available in multiple languages. These well-tested activities can be used by classroom and after-school teachers as well as informal educators to provide a rigorous approach to teaching science and the process of science.

Since 2009 the Galileoscope has been featured in professional-development workshops for educators throughout the world. Among organizations routinely incorporating Galileoscopes into their teacher training are the US National Optical Astronomy Observatory (NOAO), the Astronomical Society of the Pacific, and the Galileo Teacher Training Program (another IYA 2009 cornerstone project). With NOAO we've established a program of workshops for educators (http://galileoscope.org/workshops) that can be carried out virtually anywhere, at nominal cost to the host institution.

Remarkably for an effort managed 100% by volunteers, some 225,000 Galileoscopes have been distributed to teachers, students, and astronomy enthusiasts in more than 100 countries over the last six years. Nearly 25,000 Galileoscopes have been distributed through our Telescopes4Teachers program, through which individual and institutional donors contributed kits at little or no cost to classroom teachers or school administrators. We're thrilled that the Galileoscope has been designated part of the International Year of Light's "Cosmic Light" cornerstone project. Cosmic Light is being coordinated by the International Astronomical Union (IAU), the lead organizer of IYA 2009, which celebrated the 400th anniversary of Galileo's introduction of the telescope to astronomy. Emphasizing both optics and astronomy, the Galileoscope supports three of IYL 2015's main themes: Science of Light, Light Technology, and Light in Nature.

For IYL 2015 we've expanded the Telescopes4Teachers donation program to attract corporate as well as individual and institutional sponsors to help us reach our goal of distributing another 100,000 Galileoscopes to teachers and schools worldwide. A Galileoscope sponsorship is a great way to support science education while also promoting an organization's products and services. We offer custom packaging; promotional inserts, stickers, and labels; and worldwide visibility to individuals and organizations that support the distribution of thousands of kits. Please inform any potential sponsors with whom you may come in contact — scientific organizations, educational institutions, individuals, and corporations — about this opportunity. For more information on Galileoscope sponsorships for IYL 2015, please contact (or refer potential supporters to) Doug Arion, president of

Galileoscope, LLC, at darion@carthage.edu and/or Rick Fienberg, vice-president, at rick.fienberg@aas.org.

We are delighted to report that Ric and Jean Edelman, the founders of Edelman Financial Services, have signed on as our first IYL 2015 sponsor. They are underwriting the production of 10,000 kits in special packaging. When these Edelman Galileoscopes arrive from our factory this spring, US teachers will have the opportunity to request them for their classrooms. Ric Edelman will promote their availability via his biweekly radio program, *The Truth About Money* (http://www.edelmanfinancial.com/radio).

In addition to the 10,000 Edelman Galileoscopes, 20,000 special-edition IYL 2015 Galileoscope kits are currently in production for worldwide distribution and will be ready for delivery starting in May. *We are now accepting pre-orders via our website (http://galileoscope.org)*. A case of six (6) Galileoscopes costs US $150 (US $25/kit) plus shipping; please note that this is our lowest (wholesale) price.

Shouldn't every student and teacher have access to a telescope and the celestial wonders it reveals, as well as the opportunity to explore the fascinating interplay of light and optics? We think so, and we know you do too. Please help us celebrate the International Year of Light by pre-ordering Galileoscopes today for use in your education and outreach programs and helping to find sponsors to underwrite the distribution of Galileoscopes to classrooms. Let there be Cosmic Light!

Rick Fienberg
American Astronomical Society
Rick.Fienberg@aas.org

Douglas Arion
Carthage College
darion@carthage.edu

The Galileoscope telescope kit with its new IYL 2015 packaging. Photo by Rick Fienberg.

BOOK REVIEWS

STARLIGHT DETECTIVES: HOW ASTRONOMERS, INVENTORS, AND ECCENTRICS DISCOVERED THE MODERN UNIVERSE

Alan Hirshfeld, *Starlight Detectives: How Astronomers, Inventors, and Eccentrics Discovered the Modern Universe* (New York: Bellevue Literary Press, 2014). 400 pages. PB $19.95. ISBN 978-1-934137-79-6.

This new title by Alan Hirshfeld, a professor of physics at the University of Massachusetts-Dartmouth and author of several other books, including biographies of Faraday and Archimedes, is an enjoyable and informative contribution to the history of astrophysics. His spin on the story is interesting, allowing him to introduce his readers to many nonprofessionals who played an unrecognized and therefore unacknowledged role in the birthing of the profession. The narrative more or less follows these lines: In the nineteenth century, a "cadre of amateur innovators," many of whom made up for in money and time what they lacked in advanced degrees, made major advances in photography, spectroscopy, and telescope design that transformed the work that could be done in institutional observatories and thus ushered in the era of astrophysics. Their immense contribution, however, culminated in an almost tragic outcome with the professionalization of the field. "Where once [professional and amateur observers] had shared a common platform, distinctions were being drawn between them in terms of academic credentials, mathematical acumen, and…the scientific value of their work," so that the amateur scientists often "found themselves rudely left behind," occasionally even attacked publicly for their failure to live up to the new, more stringent professional standards.

The book is divided into three main sections. Part I, "Picturing the Heavens," describes the development of celestial photography "from an amateur's hobby into a professional gateway to astrophysical discoveries"; Part II, "Seeing the Light," describes the importance of the spectrograph to the launching of the so-called New Astronomy, as well as the "auspicious merger of photographic and spectroscopic practice in astronomy" that followed the development of the gelatin dry-plate process in the 1870s; and Part III, "Money, Mirrors, and Madness," explains the role played by the refinement of reflector telescope-design in making it possible to apply celestial photography and spectroscopy "to a host of heavenly objects, primary among them the spiral nebulae." The book highlights the contributions of a sampling from among the "worldwide cadre of volunteer scientists and inventors" who, without an engineer's training, nonetheless were expert at "coolly analyzing problems; developing solutions on the fly; spending inordinate amounts of time (and money) on the minutest details; and, at least for the most passionate, never giving up." The book's final chapter introduces "theoretical developments in physics and mathematics" during the twentieth century—the "newfound conceptual tools"— that enabled astrophysicists to "probe beyond the limits of their instruments—indeed, beyond the limits of any conceivable instrument—and ponder the universe in its entirety."

Among the many amateurs into whose lives and achievements Hirshfeld opens a window, I found myself, for reasons of institutional loyalty and pride, drawn to the story of Lewis Morris Rutherfurd. I had long known that Williams College has the oldest extant American observatory, but I had never heard of its distinguished alumnus Rutherfurd, who was only 18 when he graduated with the class of 1833 (Wikipedia says 1834). At Williams, Rutherfurd studied physics, and even put together his own telescope from miscellaneous parts

he located in a college storage room. After a 12-year career as a lawyer, he spent some time in Italy studying with Italian astronomer, microscopist, and botanist Giovanni Battista Amici (1786-1863), best known for his improvement to telescope mirrors that fostered his own observations of double stars and other astronomical objects. Upon Rutherfurd's return to the US in 1856, he set up a small astronomical observatory behind his mansion (in what is today called Manhattan's East Village neighborhood) in collaboration with telescope-makers Henry and Harry Fitz. In 1871 Rutherfurd became the first to take a photograph of the Sun that showed granulation, although he did not publish this discovery until Jules Janssen independently discovered granulation seven years later. Rutherfurd also developed a succession of telescope-mounted spectroscopes and distributed over fifty of his machine-ruled gratings to spectroscopists around the world. In 1889, three years before Rutherfurd's death, Scientific American singled him out as "by far the most distinguished private scientist in the United States." When ill health kept him from working, Rutherfurd turned over all his plates (including 435 of the Moon, 349 of the Sun and its spectrum, and 664 of star groups and clusters) and measuring machines to Columbia University. The analysis by university faculty and graduate students of Rutherfurd's unfinished work culminated in a series of volumes published over a period of more than a decade as Contributions from the Rutherfurd Observatory of Columbia University New York.

Although most of the amateurs to whom Hirshfeld skillfully draws our attention are men, I give him high marks for including the contributions of women, including not only the relatively well known Maria Mitchell, Annie Jump Cannon, Williamina Fleming, Margaret Huggins, and Cecilia Payne-Gaposchkin, but also Anna Draper, Antonia Maury, Agnes Clerke, and an unidentified group of nuns. Anna Draper's determination to have her deceased husband's work outlive his early demise (in 1882 at age 45 of pericarditis) led her to make major gifts to the Harvard Astronomical Observatory under the leadership of Edward Pickering. Among the results of her subventions was the Draper Catalogue of Stellar Spectra, ultimately published in nine volumes between 1918 and 1924, with over 225,000 stars, providing astronomers with "an essential stellar database they might use to explore the physical nature of stars." Stars are still often commonly called by their "HD" numbers. Another female related to Henry Draper, Antonia Maury—his niece—was not only one of Harvard's first woman astronomers but also, in 1889, became the discoverer of the second spectroscopic binary, Beta Aurigae. Among the nineteenth-century sources from which Hirshfeld quotes amply is *A Popular History of Astronomy During the Nineteenth Century* by Agnes Clerke (1842-1907), who also wrote several other books to disseminate astronomical discoveries to the general public. (In 1903, Clerke and Lady Huggins became the third and fourth women to be elected to honorary membership by the Royal Astronomical Society.) As for the nuns, Hirshfeld's text does not mention them specifically, but the caption to a photograph on p. 140 indicates that Edward Pickering was not the only male astronomer who saw in women assistants an untapped pool of potentially productive labor; the photo (one of 101 interesting black-and-white illustrations in the book) shows "Nuns measuring star positions on Carte du Ciel plates at the Vatican Observatory around 1920."

Hirshfeld's discussion of the Carte du Ciel project is itself extremely interesting. Two leading figures behind this sky-mapping project were David Gill (1843-1914), director of the Royal Cape Observatory in South Africa, and Ernest Mouchez (1821-1892), director of the Paris Observatory, who shared a vision of "a comprehensive, pole-to-pole photographic chart of the heavens" but were aware that the task was beyond the ability of a single observatory—"Earth's spherical form dictated that participants had to be recruited from around the world." Their vision led to the assembling in Paris in 1887 of the Astrographic Congress, "the first-

ever international conference of astronomers," to work out the details of preparing the maps. In the end, eighteen observatories from Europe, North America, South America, Central America, and South Africa joined the effort, although none from the United States. When it became clear how expensive and tedious the task was, four observatories withdrew. By the time the project was finally completed in 1964, it became evident that the Carte du Ciel had done little to advance scientific progress: "Its hard-won photographic charts yielded no major discoveries and no insight into the physics of the stars themselves." Observatories in the United States, which had refrained from participation, instead of burdening themselves with a "mundane task that effectively barred [participating observatories] from new avenues of research," had "pursued privately funded programs of astrophysical research and telescope building that arguably brought them to world dominance in these areas." (Hirshfeld does, however, go beyond the generally accepted assessment of the Carte du Ciel as a failed project, to point out that, with the dawning of the computer age, all the project's data were keyboarded as the new Astrographic Catalogue. When that undertaking was completed by 1996, new analyses were made and errors corrected, so that the "restructured database has allowed astronomers to measure with great precision the movements of stars since the turn of the previous century.")

What the Carte du Ciel did achieve from the outset, however, was the fostering of international cooperation. Meetings of the project's committees culminated in 1919 in the formation of the International Astronomical Union. I like the way Hirshfeld weaves into his narrative the birth of other astronomical organizations, including the Astronomical Society of the Pacific, the American Association of Variable Star Observers, and the American Astronomical Society, as well as the beginnings of a number of journals, including the Astrophysical Journal.

A few factoids among many others integrated into Hirshfeld's overarching tale particularly caught my interest. As a biographer of Marie Curie, I am sensitive to issues related to her story, so I was struck by the disparity between treatment of her for her independent work while sharing her husband's lab and the treatment of William Bond's son George as his father's assistant at the Harvard Observatory. In 1846, as part of the package Harvard offered William Bond to induce him to turn down an offer from the Naval Observatory in favor of a position at Harvard, the university not only offered William an annual salary of $1,500 but also a $640 stipend for George, who had only recently graduated from Harvard. By contrast, although Marie Curie already had two advanced degrees and was doing independent work, no institution in France found the means to pay her for many years. I also discovered, however, that the Curies were not the only French scientists who had difficulty finding decent lab facilities. Curie devotees are familiar with the term "rude shed" as a description of the space made available to the husband and wife team in their search for the new elements they suspected lurked in their highly radioactive pitchblende ores. I was, therefore, both amused and horrified to learn that Paul and Prosper Henry, French opticians and astronomers who made instruments for observatories and were involved in launching the Carte du Ciel project, were—in the decade before the Curies' work at the School of Industrial Physics and Chemistry—given as an optical laboratory "a rude shed on the [Paris] observatory grounds."

Before reading this book, I had also not known that Christian Doppler, a household name because of the principle named for him, linking a wave's observed frequency with the relative speed of the source and the observer, was also the champion of a totally incorrect interpretation of the relationship between stellar motions and colors. When challenged, he

argued vehemently on behalf of his spurious claim, even while offering no evidence to support it. I was interested to read a comment made by Nobel laureate Henrik A. Lorentz in 1907, on the occasion of the publication of Doppler's collected works, summarizing the oeuvre of the Austrian physicist, who had been dead for over a half century: "[I]n considering the importance of his principle and the productive use to which it has been put, we must include Doppler as one of the great men of science, although it seems to me, that neither his other work nor the manner in which he defended his theory against various objections and applied it to the colours of the stars, confer on him any claim to such an honorific title."

To wind up my favorable review of Hirshfeld's book, let me say that he is a fine writer not only in the macro sense—his overall tale is a compelling one—but also in the micro sense—he writes terrific sentences, sometimes slyly witty, sometimes filled with interesting metaphors. As an example of the first, consider his comment on how astronomer David Gill paid for a project he undertook before inaugurating the Carte du Ciel: "When the Royal Society withdrew its funding in 1887, Gill paid for completion of the project out of his own pocket (after consulting his wife)." And as an example of the second, consider his description of one of the most important observational cosmologists of the last century: "Edwin Hubble became astronomy's John Wayne, a living Rushmore of American mettle, who seemed to overstride obstacles through sheer resolve."

I look forward to reading more works by Alan Hirshfeld and encourage readers of this newsletter to read this one.

Naomi Pasachoff
Williams College
Williamstown, MA 01267
naomi.pasachoff@williams.edu

SELECTED CORRESPONDENCE OF WILLIAM HUGGINS

Selected Correspondence of William Huggins, 2 volumes, ed. Barbara J. Becker (London: Pickering & Chatto, 2014). Volume 1: *Selected Correspondence, 1859-1889*. 641+L. Volume 2: *Selected Correspondence, 1889-1915*. 691+X. ISBN-13:9781848934153. $495 HB.

Barbara Becker, author of *Unravelling Starlight: William and Margaret Huggins and the Rise of the New Astronomy* (Cambridge: Cambridge University Press, 2011), which was awarded the 2015 Osterbrock Prize by the Historical Astronomy Division of the American Astronomical Association, has compiled an impressive collection of the correspondence of William Huggins (1824-1910), one of the amateur astronomers whose pioneering work led to the birth of astrophysics, as also discussed at length in Hirshfeld's *Starlight Detectives*. In his early thirties, Huggins (1824-1910) retired after a successful career as a London silk merchant. He established a private observatory at Tulse Hill in London. There, first alone and then, after marrying Margaret Lindsay (1848-1915) of Dublin in 1875, as part of a couple, he did pioneering work in the new fields of astronomical spectroscopy and celestial photography. Huggins was the first to detect emission lines in nebular spectra, to observe the spectrum of a nova, and to make use of the Doppler shift to determine stellar motion along the line of sight. Using a handheld spectroscope, he analyzed the chemical composition of meteors; he worked long and hard to develop methods to observe solar prominences in daylight and to photograph the solar corona without an eclipse. While the 1400-page two-

volume collection of Huggins's correspondence—comprising over a thousand documents retrieved from more than twenty archives around the world—is too expensive for most individuals to purchase for their personal libraries, readers of this newsletter would do well to encourage the libraries of their home institutions to purchase the set.

In the useful General Introduction to the first volume, Becker explains her motivation to travel widely in search of Huggins's thitherto unpublished correspondence: While "Huggins's notebook, like his published papers, offer essential but limited insight into…his role in the rise of the new astronomy," his voluminous correspondence highlights his "considerable skill at selecting and researching projects, designing and manipulating instruments to perform specific mensurational tasks, and rallying influential colleagues' support for his investigative ventures." Through the letters we see how he reacted to scientific controversies in the early years of the "new astronomy" and how he worried about the accuracy of his measurements. The letters also reveal his canniness in growing his career; while he was not risk-averse, "his risks were always calculated to maximize success." While the correspondence deeply informs Becker's 2011 award-winning book, she realized that presenting them in the annotated form of these volumes would make them a useful tool for other scholars "interested in the social and political dynamics of emerging scientific disciplines…who appreciate the value of listening in on the noisy chatter of key players' everyday conversations for clues to how the boundaries of those disciplines are established, policed and altered."

To some extent, one can be guided through this large collection by following up on matters Becker brings up in the introduction. She points out, for example, how Huggins was able to install state-of-the-art instruments at Tulse Hill even though they cost more than his budget would allow. Document 76, a report of the Royal Society's Council, dated 21 January 1869, includes a letter sent three months earlier to G. G. Stokes, Lucasian professor of mathematics at Cambridge and Physical Sciences Secretary to the Royal Society from 1854 to 1885, from Thomas Romney Robinson, director of the Armagh Observatory, who happened also to be Stokes's father-in-law. The letter urges Stokes to use his "weighty authority" to get funding from the Royal Society to help further 'the spectroscopic study of Stars and Nebulae" by encouraging the Society to provide a substantial grant for instruments to be placed in Huggins's observatory. The grant enabled Huggins to arrange with Grubb & Son of Dublin to furnish him with an 18-inch Cassegrain reflector and a 15-inch achromatic refractor for his personal use from 1871 until 1908. Then, two years before his death, when he was no longer able to use them himself to maximum benefit, Huggins turned them over to the new department of astrophysics at the University of Cambridge.

Given the limited space afforded me in this review, rather than attempt to find organizing ideas by wading through the chronologically arranged correspondence in the two volumes, I have chosen to be guided by what I have learned from two related books I have also reviewed for the Commission 46 newsletter, as well as by my general interest in the role of women in astronomy. Diligent readers may recall that in the March 2014 issue of the newsletter, I reviewed Biman Nath's book *The Story of Helium and the Birth of Astrophysics*. Nath presents English astronomer Norman Lockyer—another early spectroscopist and advocate of the belief that a powerful spectroscope might make it possible to study the bright-line spectrum of prominences even without an eclipse—as a highly confrontational figure. Huggins, we learn in that book, numbered among Lockyer's targets. Using Becker's excellent index, I was able to track down an item of correspondence to which Nath refers: document 821, a letter that Huggins wrote in late April 1895 to George Ellery Hale, then an

associate professor at the University of Chicago, complaining about Lockyer's treatment of him. "I can hardly believe myself that the main accusation he is now bringing against me is that I have stolen his ideas!!...he is constantly at work against me by underground methods, such as dinners at a club to which he invites editors & literary people, and in this way, as well as in his lectures is doing all he can to 'drown' us....It would be of no little assistance to us, if you would tell me quite frankly how the matter appears to you; you are out of it and see a wider horizon."

The other review that provided me some immediate access to Becker's two volumes appears alongside this one: Hirshfeld's *Starlight Detectives*. As Hirshfeld points out, Huggins's willingness to share his methods with other enthusiasts occasionally led to misgivings. This assertion is confirmed in a letter from Margaret Huggins to American astronomer E. S. Holden—at that time director of the Washburn Observatory at the University of Wisconsin-Madison. She sent this letter, document 364, dated 31 January 1883, shortly after the death of Henry Draper, who, she acknowledges, "was...your friend." Nonetheless, noting that she and William are the Holdens' friends also, Margaret encloses in her letter a portion of an earlier letter from William to Charles A. Young, a distinguished American solar spectroscopist at Princeton, in which William reports how during a visit of Henry and Anna Draper to the Hugginses' private observatory on Tulse Hill over four years earlier, Draper assured William that he had given up work on stellar spectra and that Huggins "need not hesitate to show me your apparatus." Believing Draper "to be a man of honour," Huggins was very forthcoming with him. When Draper proceeded to scoop his mentor—presenting "On Photographing the Spectra of the Stars and Planets" to the National Academy of Sciences in late October 1879, almost two months before Huggins got to deliver his "On the Photographic Spectra of Stars" to the Royal Society in mid-December—the older man concluded that Draper had taken unfair advantage of him. Margaret confides in Holden—"You cannot imagine the pain this Draper matter has caused us. I was bitterly angry that my gentle noble-breasted husband should have been so used"—and explains to Holden that her purpose in writing him is to set the record straight: "For you too as one of America[']s leading scientists and as a writer, should know the truth. The facts speak for themselves. Who ever heard to any purpose of Dr. Draper[']s star results before his visit to Tulse Hill?"

Having spent some time in my Hirshfeld review on the contributions to the new astronomy by Williams College alumnus Lewis Morris Rutherfurd, I checked Becker's useful Biographical Glossary and Index (pp. 603-684, immediately preceding the Subject Index that concludes volume 2) to see if his name was included. While no correspondence between Rutherfurd and Huggins appears in the collection, we learn from William's letters to others that the American and the English astronomers had a collegial relationship. In an October 1874 letter to T. R. Robinson (who six years earlier had helped Huggins get a grant from the Royal Society to furnish the Tulse Hill Observatory with commissioned instruments), Huggins notes that "Mr. Rutherfurd kindly gave me one of his grating on glass some two or three years ago," which Huggins then loaned to none other than Swedish physicist Anders Jonas Angström—one of the founders of spectroscopy. Although Angström "was able to make some measures with the grating," it subsequently "slowly broke up, the glass between the lines separating & falling off." Rutherfurd died on 30 May 1892, and from a note Becker includes with document 765, we learn that Huggins had been asked for information that might be used in the obituary to be published in the Monthly Notices of the Royal Astronomical Society. Huggins's response to Herbert Hall Turner (who had recently been appointed Savilian Professor of Astronomy and Director of the Radcliffe Observatory at Oxford University), dated 15 February 1893, indicates that despite the fact that "on two occasions

when visiting England, Rutherfurd paid me a visit here, I regret that I am not able to help you to give, as you say, a local colour, to your memoir." Huggins, however, does generously acknowledge that in the early work "on the spectra of star & planets &c.," following "Kirchhoff's discovery of the true meaning of the Fraunhofer lines," he and others, working "independently and unknown to each other,. . .were anticipated by Rutherfurd by a few weeks" in terms of publication of results. Touchingly, the final reference to Rutherfurd in the collection is in an undated letter from Margaret Huggins to Sarah Frances Whiting, professor of astronomy at Wellesley College in Massachusetts, where she was also director of the college's Whitin Observatory. The letter enumerates several gifts from Tulse Hill to the Whitin, including "a Diffraction Grating....I feel it is most fitting that this Grating should have its permanent home in the land it came from. Mr. L. Rutherfurd gave it to Sir William himself. It is his own work—ruled by himself with his own machine....The Grating performs well & we used it a good deal."

When I met Barbara Becker at Guilford Technical College in North Carolina in March 2014, she told me that as a biographer of Marie Curie I would be interested to learn of Lady Huggins's communication with and about this better known half of a husband-and-wife team of physical scientists. In document 1098, a May 1906 letter from the Hugginses to Joseph Larmor (Stokes's successor as Lucasian Professor of Mathematics at Cambridge and also as a secretary to the Royal Society), Margaret indicates that she plans to send a private condolence note to the newly-widowed Madame Curie, whose husband, Pierre, had died suddenly in an accident in mid-April. She adds beneath her signature, "It is terribly sad for poor Madame Curie. It makes me quite ill to think of her, poor soul. And it is always saddening to realize at such times,—as surely all of us do,—that we poor humans can do very little for each other in deep sorrow. We are really awfully alone....We are forced back on God at such times,—and if we will, we find Him strangely near,—and—consoling, beyond any human power of expression."

Clearly a thorough study of the correspondence included in these two volumes would reward a diligent reader with a deeper understanding of how scientists of the nineteenth and early twentieth centuries sometimes competed with, often helped, and more than occasionally gossiped about, one another. I am not the first to say so, but one wonders whether historians of science of the future—when correspondence has been replaced by tweets or the even shorter forms of communication that may come next—will be able to shed as much light on the life and times of the scientists whose work they are attempting to study as Barbara Becker has done through her comprehensive study of the correspondence of William and Margaret Huggins.

Naomi Pasachoff
Williams College
Williamstown, MA 01267
naomi.pasachoff@williams.edu

==========

PROMOTING THE GREAT AMERICAN 2017 TOTAL SOLAR ECLIPSE THROUGH EDUCATIONAL AND SCIENTIFIC OUTREACH

----Charles Fulco

Anticipating the 2017 Total Solar Eclipse over the United States requires significant public and educational outreach on the part of astronomers, scientists, and educators. This requires a concerted effort with one overarching goal: ensuring that as many people as possible get to the path of totality and view the eclipse properly.

At the moment, "eclipse awareness" is quite low in the U.S., even among the educational community. At the recent National Science Teachers Association's annual national conference in Chicago, most science teachers interviewed were not aware of the 2017 event, and of those who were, not all were familiar with the specifics of it (e.g., the exact date, the path of totality, how to properly observe the different stages).

With about 2½ years until Eclipse Day, generating awareness on a national scale is presenting itself as a daunting task. It is now incumbent upon the scientific and educational community to assume the responsibility of alerting the public to the eclipse. We also need to anticipate some roadblocks--and opportunities--along the way. To wit:

- The eclipse falls on a Monday in August. This means that for many U.S. school districts and universities, it's the first day of instruction (or a professional development day for teachers). If classes are in session, many primary and secondary schools will automatically shift into "self-protection mode" in anticipation of Eclipse Day, with the intention of covering themselves from personal injury liability, fearing that any student and teacher observing the eclipse will be permanently blinded (yes, many educators still do not realize that there are safe ways to view an eclipse). This usually means instructing students to remain at home, or remanding teachers and their students to their classrooms with the blinds down throughout the eclipse, forbidding them to be outdoors, or even glancing out the window, fearing that even reflected sunlight from an eclipse is harmful. The logical response to this is educating school districts and teachers, and this TSE provides an excellent "first day of school" activity for many around the country

- Conversely, many school districts and colleges are *not* in session on this date, meaning that there will be many families vacationing, providing an even greater potential viewing audience along the continent-long path of totality

- Since the entire U.S. sees at least a partial eclipse, media outlets in all markets should be prepared in advance, in order to report valid observing information, thus avoiding the dissemination of "bad science," and the myriad myths and fears about solar eclipses that have unfortunately perpetuated into the 21st Century.

- As many sizeable towns and cities (Salem, Oregon; Lincoln, Nebraska; Kansas City and St. Louis, Missouri; Carbondale, Illinois; Nashville, Tennessee; and Charleston, South Carolina, among them) fall within the path of the Moon's umbra, visitors

bureaus and chambers of commerce need to prepare for the influx of tourists and umbraphiles looking to book hotel rooms and take advantage of each city's offerings, possibly for up to a week's time. Stores should also have a supply of eclipse- and imaging-related items and services on hand to satisfy consumer demand

A number of valid educational and informational links are found online, each with specific information about TSE 2017:

- http://eclipses.info
- http://eclipse.gsfc.nasa.gov/eclipse.html
- http://www.mreclipse.com/MrEclipse.html
- http://www.greatamericaneclipse.com/
- http://www.eclipse2017.org/
- http://xjubier.free.fr/en/site_pages/SolarEclipsesGoogleEarth.html
- https://www.facebook.com/totality2017

No matter which information you share with others, it is important to get the word out on as large a scale as possible. Good information doesn't do much good if it doesn't get into people's hands. Think of this as a chain of information beginning with astronomers and educators being handed down to those responsible for students, employees and others seeing the eclipse. If those superintendents, school principals, college presidents, and business administrators come to realize that it IS safe (and inspirational, educational and even profitable) to have people under their responsibility view the eclipse, then this information will have met its goal.

Charles Fulco
Director of Space and Environmental Sciences
Port Chester Public Schools
Port Chester, NY 10573
saros61@gmail.com

==========

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/
IAU Office of Astronomy Outreach (OAO)	http://www.iau.org/public/

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://www.iaucomm46.org/ 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

ORGANIZING COMMITTEE OF COMMISSION 46

President **Jean-Pierre de Greve** jpdgreve@vub.ac.be
Department of Physics, Vrije Universiteit Brussel, Pleinlaan 2
B-1050 Brussels, Belgium

Vice President **Beatriz García (Argentina)** beatriz.garcia@iteda.cnea.gov.ar
National Technological University, Mendoza, and Institute in Technologies of Detection and Astroparticles, Mendoza, Azopardo 313, 5501 Godoy Cruz, Mendoza, Argentina

Retiring President **Rosa M Ros** ros@ma4.upc.edu
Department of Applied Mathematics 4, Universitat Politecnica de Catalunya Jorgi Girona 1-3, modul 3, ES-08034 Barcelona, Spain

ORGANIZING COMMITTEE MEMBERS (2012-2015)

Roger Ferlet	(France)	ferlet@iap.fr
Michele Gerbaldi	(France)	gerbaldi@iap.fr
Edward Guinan	(USA)	edward.guinan@villanova.edu
John Hearnshaw	(New Zealand)	john.hearnshaw@canterbury.ac.nz
Laurence Marschall	(USA)	marschal@gettysburg.edu
George K. Miley	(Netherlands)	miley@strw-leidenuniv.nl
Jay M. Pasachoff	(USA)	jay.m.pasachoff@williams.edu
Rosa M Ros	(Spain)	ros@ma4.upc.edu
Magda G. Stavinschi	(Romania)	magda_stavinschi@yahoo.fr
Silvia Torres	(México)	silvia@astroscu.unam.mx

Newsletter Editor: **Larry Marschall, Department of Physics, Gettysburg College, 300 North Washington St., Gettysburg, PA, 17325 USA, phone +1 717 337-6020, fax +1 717 337-6027**