

Launching *Light: Beyond the Bulb* for the United Nations' International Year of Light 2015

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Keywords

Light, astronomy, exhibits, public science

In astronomy, light is the language used to understand the Universe. From radio waves to gamma rays, light in all its forms delivers information that helps astronomers learn about the Universe. When the United Nations declared 2015 to be the International Year of Light and Light-based Technologies (IYL2015), it presented an opportunity to share the role that light plays in astronomy and beyond. The IYL2015 also offered a chance to build on experiences and sustain networks from the International Year of Astronomy in 2009. *Light: Beyond the Bulb* is an IYL2015 project that melds both of these goals. The project takes the form of an exhibit that showcases what light can do, from here on Earth and across the vastness of space, hosted by volunteer networks in public spaces for informal science learning.

Introduction

Whether it comes from a distant galaxy or a neon sign around the corner, light is all around us. We use it to communicate, navigate, learn and explore. But light is far more than just the visible light that we can detect with our eyes. It takes the form of

radio waves, infrared, ultraviolet, X-rays and more. Astronomy communicators often find that engagement has to begin with an explanation of the existence and nature of types of light other than those observed with the human eye, a concept that is not common knowledge for most public audiences.

Due in part to the opportunity provided by the International Year of Light and Light-based Technologies (IYL2015)¹ a new exhibit called *Light: Beyond the Bulb (LBTB)* has been developed to help address this knowledge gap and engage non-expert audiences with the capabilities of light. This global initiative was adopted



Figure 1. A selection of images from the *Light: Beyond the Bulb* project, from a mouse retina, to light pollution, to star formation. Credit: *Light: Beyond the Bulb*

by the United Nations and, supported by The United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Astronomical Union, and a host of other scientific societies, organisations, corporations and individuals around the world.

*LBTB*² is a free, open-access international exhibition containing 75 images that were crowd-sourced from photographers, scientists and artists. The exhibits are curated by experts for science content, high-quality printability, aesthetics, and the potential to be relevant and interesting for non-experts.

In collaboration with experts in the field, the project creators developed short, descriptive captions designed to focus on various aspects of light and its properties; from refraction and reflection, to transits and shadows. The scales that the photographs represent vary from cell-sized to Universe-sized and encompass a range of topics from microbiology to astronomy, creating connections with physics, optics, photonics, atmospheric and earth sciences, astrophysics and more.

Building on the 2009 International Year of Astronomy

During the International Year of Astronomy in 2009 (IYA2009), the authors and their colleagues created the *From Earth to the*

Universe (FETTU) project³, which developed an online repository of curated material that allowed large-scale astronomical imagery to be placed in approximately 1000 public spaces around the world (Arcand & Watzke, 2010). This public science model (Arcand & Watzke, 2011) is a useful way to communicate with non-experts in everyday venues such as shopping malls, outdoor parks, hospitals and cafes. These experiences can lead to small learning gains, inspiration and increased interest in science for participants, as well as the creation of networks of science event hosts (Arcand & Watzke, 2013).

Exhibits and materials

There are approximately 200 exhibit locations⁴ in progress or being planned for 2015–2016, in over 30 countries, with the majority of locations signing up throughout 2015. Examples of locations include exhibits at the O'Hare Airport in Chicago, USA; Baykal, a village in Dolna Mitropolia, Bulgaria; the Saint Ignatius College Siggiewi Primary School in Siggiewi, Malta; the K11 Art Mall in Shanghai, China; and the Galway Astronomy Festival in Ireland. Figures 2–7 show images from *LBTB* events that have occurred so far and highlight the variety in the events.

In addition, there are another five hundred locations, including schools, science

centres, libraries, parks and other informal learning spaces that are hosting small exhibits of *LBTB* posters as provided by the Chandra X-ray Center and the international society for optics and photonic (SPIE) — these posters can be downloaded for free from the *LBTB* website.

Materials developed for the exhibits over the past year include videos, infographics, slide shows, handouts, posters and guideline documentation. Translations of the *LBTB* texts into languages including Spanish, French, Portuguese, Brazilian Portuguese, Mandarin, Afrikaans and others, are in progress, or have already been completed, by networks of volunteers.

Networks of science hosts were created through previous projects spearheaded by the Chandra X-ray Observatory Center — including *From Earth to the Universe*, *From Earth to the Solar System*, and *Here, There & Everywhere*⁵ — and for this project these were combined with networks from the international society for optics and photonics (SPIE), as well as the International Astronomical Union and others. These networks were used to announce the project, garner programme interest and help promote the events. Tapping into networks of volunteers, has been shown through evaluation of previous projects to be critical to a successful project (Arcand & Watzke, 2013) and was an important



Figure 2. For the month of April in 2015 a Chandra-funded exhibit of Light: Beyond the Bulb was displayed at the main library of the University of Puerto Rico (UPR) and was seen by thousands of people, according to event coordinators. Exhibit tours with hands-on activities on the topics of lensing, shadows, electric discharge, atomic collisions and others were conducted by volunteer physics students. Additional talks, conferences, and other events connected to the exhibit attracted many hundreds of participants. Groups of local school children and their teachers visited from neighbouring towns and university students attended with professors from courses in physics, architecture, art and education. Credit: University of Puerto Rico



Figure 3. In conjunction with the Light: Beyond the Bulb exhibit events mentioned in Figure 2, on 17 April 2015 an inclusive event on light was held at the University of Puerto Rico for the visually impaired and blind and their families titled Estrellas Para Todos. This activity had 26 participants, including 11 who were blind. Organisers displayed tactile posters on light, plus a tactile Moon, Sun, spiral galaxy and several tactile books including Touch the Sun and Touch the Star. Credit: University of Puerto Rico



Figure 4. At Duke University in North Carolina, USA, the Fitzpatrick Institute for Photonics Annual Symposium hosted the World Photonics Forum with international speakers as well as an Open House for the greater public. One goal of the event was to help bring together experts and non-experts to discover new ideas about light and light technologies in celebration of IYL2015. Held during the week of 8 March 2015, about 700 people attended, with approximately 500 members representing the public and 200 representing symposium attendees and speakers. Credit: Duke University



Figure 5. In February 2015, an amateur astronomy organisation created a special event for the Palora Higher Secondary School in India. The exhibition was conducted alongside an inauguration event for a new telescope. Approximately 2500 attendees participated in the exhibition programme to celebrate the International Year of Light 2015. The head of the physics department, MR Sreekumar of Devagiri College Kozhikode, delivered a lecture on light pollution, one of the key topics of IYL2015, and its effects on nocturnal life. Credit: Chindankutty Nambiar, Astronomical Organisation Kerala (AASTROKERALA)



Figure 7. International Astronomy Day 2015 at the Royal British Columbia Museum (Victoria, BC, Canada) was celebrated on 25 April 2015. Organisers collaborated with the Royal Astronomical Society of Canada (RASC) for a daylong event. The hosts provided *Light: Beyond the Bulb* posters, a monitor displaying images, and a large wall screen displaying more science images. Approximately 750 people attended the event. Credit: Dennis Crabtree

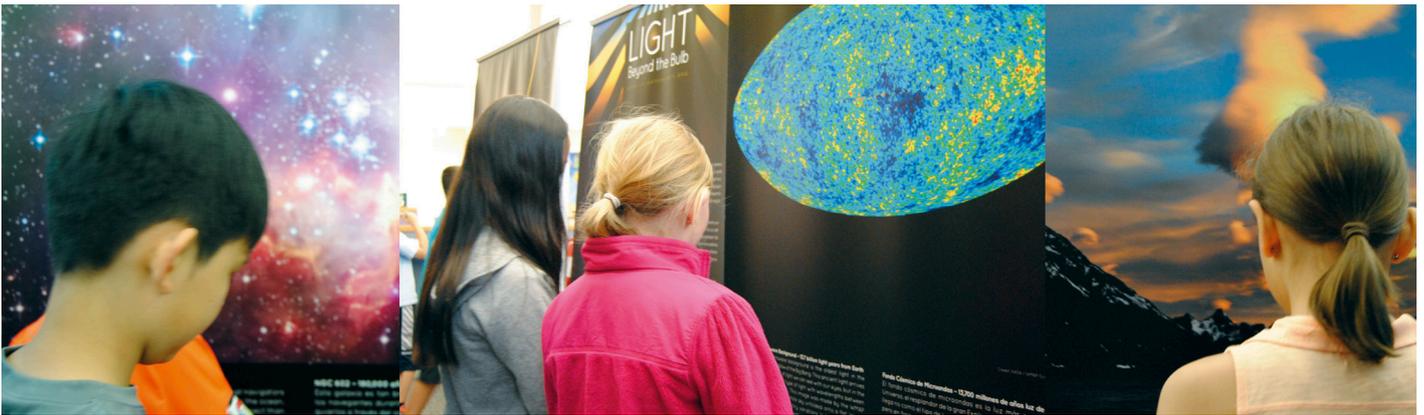


Figure 6. A traveling Light: Beyond the Bulb exhibit visited the Carmel High School (CHS) for the month of May 2015. Local school children toured the exhibit at the CHS Media Center as part of their annual field trip to the school's planetarium. The exhibit tied in with the children's science curriculum, with students also learning about the Hubble Space Telescope, the International Space Station, and other observatories. Credit: CHS

component when launching a new project in the relatively short time period of one year. There was existing buy-in for such community-based, grassroots projects from a number of hosts as well as proof of concept for new hosts.

Conclusion

Initiatives such as IYL2015 provide those who communicate astronomy with a chance to connect scientific results in astrophysics with those in other fields of academic and industrial research. Placing astronomy in a wider context can provide a thought-provoking experience for both those who create events and ultimately for those who attend them (Arcand & Watzke, 2014).

By bringing together organisations and scientific disciplines that don't regularly work closely together, this project generated new thematic content. For example, the need to connect the concepts of reflection and absorption across the electromagnetic spectrum allowed those working on the project to break down more traditional ways of discussion within their own scientific disciplines. By "stretching" efforts beyond astronomy and into the fields of optics and microscopy, for example, the content creators learned new ways of describing concepts that may benefit astronomy communication efforts in the future.

LBTB has also re-energised existing networks that have been developed over years of astronomy communication, including

IYA2009, and has provided the opportunity to reach out to new partners and delve into topics that are often beyond the scope of astronomy outreach. Using light to thread these seemingly disparate scientific topics together has allowed for a more coherent scientific story to be told for the scientific disciplines involved.

Acknowledgements

Together with the international society for optics and photonics (SPIE), the Chandra X-ray Center/Smithsonian Astrophysical Observatory is leading *LBTB* for the International Year of Light 2015 (IYL2015). *LBTB* is also a cornerstone project for the International Astronomical Union. IYL2015 was declared by the United Nations and is supported by UNESCO.

Notes

- ¹ A full version of the IYL2015 Resolution is available in several languages: <http://www.light2015.org/Home/About/Resources.html>
- ² More information on the *Light: Beyond the Bulb* project: <http://lightexhibit.org>
- ³ *From Earth to the Universe* project for the International Year of Astronomy in 2009: <http://www.fromearthtotheuniverse.org/>
- ⁴ Full exhibit list: <http://lightexhibit.org/iylexhibits.html>
- ⁵ *From Earth to the Universe*: <http://www.fromearthtotheuniverse.org>
From Earth to the Solar System: <http://fettss.arc.nasa.gov>
Here, There, & Everywhere: <http://hte.si.edu>

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Biographies

Kimberly K. Arcand is the Visualisation Lead for NASA's Chandra X-ray Observatory, which has its headquarters at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. She studies the perception and comprehension of data visualisation across the novice-expert spectrum and is active in the creation, distribution and evaluation of large-scale science and technology communications projects.

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