

## The Global ALMA EPO programme: Communicating astronomy with the public at millimetre and submillimetre wavelengths

Mark Adams<sup>1</sup>, Henri Boffin<sup>2</sup>, William Garnier<sup>3</sup> & Daisuke Iono<sup>4</sup>

<sup>1</sup> National Radio Astronomy Observatory (mtadams@nrao.edu)

<sup>2</sup> European Organisation for Astronomical Research in the Southern Hemisphere (hboffin@eso.org)

<sup>3</sup> Joint ALMA Observatory (wgarnier@alma.cl)

<sup>4</sup> National Astronomical Observatory of Japan (d.iono@nao.ac.jp)

### Abstract

The Atacama Large Millimeter/submillimeter Array (ALMA) is a major 21<sup>st</sup> century international science research facility that will open new windows on celestial origins. ALMA construction is underway in the high-elevation Atacama Desert of northern Chile. Science operations will begin in 2010, and full science operations will start in 2013. The ALMA Education and Public Outreach (EPO) programme is a global collaboration that seeks to communicate the excitement and value of the ALMA mission, science, and technology to international audiences effectively. The ALMA EPO programme is the responsibility of the Joint ALMA Observatory (JAO), the National Radio Astronomy Observatory (NRAO), the European Organisation for Astronomical Research in the Southern Hemisphere (ESO), and the National Astronomical Observatory of Japan (NAOJ). This contribution provides an overview of the ALMA Project and the global ALMA EPO programme.

### Introduction

The Atacama Large Millimeter/submillimeter Array (ALMA) is a partnership of Europe, Japan, and North America in cooperation with the Republic of Chile that will open new windows on celestial origins. ALMA is funded in Europe by the European Organisation for Astronomical Research in the Southern Hemisphere (ESO) and in Japan by the National Institutes of Natural Sciences in cooperation with the Academia Sinica in Taiwan, and in North America by the U.S. National Science Foundation in cooperation with the National Research Council of Canada. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of Japan by the National Astronomical Observatory of Japan (NAOJ), and on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI).

Because millimetre (mm) and submillimetre (sub-mm) radiation is strongly absorbed by atmospheric water vapour, ALMA is being built at a very dry, high altitude site. Since ALMA antennas are separated by baselines of up to 18 km, the array's physical extent requires a relatively flat high altitude site. After an extensive survey, the 5000 m+ elevation Chajnantor plain in northern Chile's Atacama Desert was chosen as the ALMA site.

When complete, ALMA will be a radio telescope array of at least 66 high-precision millimetre and submillimetre antennas: at least fifty 12 m diameter antennas, and an Atacama Compact Array of twelve 7 m and four 12 m diameter antennas. Construction began in November 2003, and the first

antennas arrived on-site in April 2007. Early Science will be achieved in 2010 and Full Science operations will begin in 2013.

## **ALMA EPOroles**

The ALMA Education and Public Outreach (EPO) Working Group was organised in summer 2006 to provide oversight for the global ALMA EPO programme and to provide a forum for communication between the partners. Through this Working Group, the existing EPO organisations at the NRAO, ESO, and the NAOJ collaborate on international and Chilean ALMA EPO that the JAO coordinates. The NRAO, ESO, and NAOJ also lead regional EPO programmes in their respective communities: the NRAO leads North American ALMA EPO; the ESO leads European ALMA EPO; and the NAOJ leads East Asian ALMA EPO. The global ALMA EPO programme is the sum of these international, Chilean, North American, European, and East Asian ALMA EPO programmes.

## **ALMA EPO programme elements**

The global ALMA EPO Programme seeks to communicate the excitement, discovery, and value of the ALMA mission, science, and technology to the broadest possible international audience effectively. Vision, leadership, and excellence in astronomy education and public outreach are mandates for the programme. Seven primary ALMA EPO programmes have been implemented initially: Science Community Outreach, Online Outreach, News & Public Information, Formal Education, Informal Education, Astronomical Data Visualization, and Public Affairs.

## **Science community outreach**

To communicate ALMA's progress and vision to the professional science community, the ALMA EPO Programme designs and deploys informative exhibits, support materials, and staff to key science meetings around the world. These include truly international venues, such as the International Astronomical Union (IAU) General Assembly, as well as regional science meetings. In North America, for example, the NRAO designs and staffs ALMA exhibits at meetings of the American Astronomical Society and the American Association for the Advancement of Science. In Europe, ESO designs and staffs ALMA exhibits at the Joint European and National Astronomy Meetings (JENAM) and the EuroScience Open Forum.

## **Online outreach**

The internet is arguably ALMA's most important communication tool, given the web's round-the-clock availability and ability to reach millions. Thus, the JAO, NRAO, ESO, and NAOJ are currently renovating and integrating their ALMA websites<sup>1</sup>. Innovative use of the internet, staying abreast of technology development, and aggressively employing emerging internet-related technologies are essential programme elements. Existing and planned web content includes news releases, media resources, educational materials and programmes, images and illustrations, animations, video, podcasts, presentations, and more.

---

<sup>1</sup> <http://www.almaobservatory.org>

Through the internet, the ALMA science vision and construction progress are reported to and discussed with the science community, the public, and the media. ALMA data will be broadly accessible to the public, teachers, students, and the media via online tools, procedures, and tutorials that will enable anyone with a computer, a web browser, and an interest in astronomy to access and study ALMA images, data products, and educational materials. To achieve this capability, the ALMA EPO programme will establish mutually beneficial partnerships with companies working at the cutting-edge of internet technology.

### **News and public information**

The generation and distribution of ALMA news and information to the international electronic and print news media is a critical programme element. This work requires coordination with the international media, as well as establishing and maintaining strong working relationships with regional news producers in North America, Europe, East Asia, and Chile. Prior to the initiation of Early Science in 2010, the news team tracks and publicises key ALMA construction milestones. When Early Science commences, the news team effort begins to shift towards publicising ALMA's scientific discoveries.

The EPO teams at NRAO, ESO, NAOJ, and the JAO collaborate and coordinate ALMA news and information distribution through the ALMA EPO Working Group. News release packages include informational copy, images, illustrations, animations, video interviews, and supplemental background information. In addition to being directly used by print, television, and online journalists, news products feed into numerous other products and activities such as brochures, DVDs, books, podcasts, and public exhibitions.

The News and Public Information team is also documenting ALMA via video and photography, creating short and mid-length features that relate the many compelling ALMA stories about science, technology, people, and the Atacama Desert.

### **Formal education**

The ALMA EPO Formal Education programme employs science, education, and multimedia experts to develop online and hard copy curriculum support products for K–12 educators and students. The ALMA Interdisciplinary Teaching Project encompasses physics, engineering, Earth sciences, life sciences, and culture, exploring the extraordinary astronomical observations planned with ALMA, as well as the Atacama Desert.

ALMA EPO education products are crafted in accord with the appropriate educational standards and are subjected to rigorous evaluation before and after their release. Addressing the curriculum requirements of the many countries participating in ALMA is a significant challenge. This programme also supports education communities by developing and hosting professional development training and workshops for teachers. In the future, software tools will be developed and distributed that enable the exploration of ALMA data in the classroom.



ALMA/ESO/NRHO/NAOJ

Figure 1 — An artist's concept of ALMA on the high-elevation Chajnantor plain of northern Chile.



ESO

Figure 2 — The latest ALMA news and information is communicated to the science community by the ALMA EPO programme's active participation in exhibitions and science meetings around the world.

## Informal education

The ALMA EPO Informal Education programme establishes links with science centres, planetariums, natural history museums, observatory visitor centres, libraries and similar forums that are visited by public audiences seeking to broaden their understanding of science. A planetarium show, *Exploring the Cold Universe* is under development for IYA2009, for example.

ALMA informal education materials will be distributed via existing infrastructure such as ViewSpace<sup>2</sup>, through new technologies such as video podcasts, and through new programme opportunities such as the Virtual Astronomy Multimedia Project<sup>3</sup> and the World

<sup>2</sup> <http://hubblesource.stsci.edu/exhibits/self-update/viewspace>

<sup>3</sup> <http://virtualastronomy.org>

Wide Telescope. ALMA will also be incorporated into exhibits at existing facilities such as the NRAO Green Bank Science Center in the US and the Museo Interactivo Mirador<sup>4</sup> in Chile.

An ALMA Visitor Centre will be integrated with the Operations Support Facility in Chile. This centre will be operational in 2013 and will include exhibits describing the project's science and technology.

## Astronomical data visualisation

ALMA will provide a quantum leap in our ability to generate high-resolution images of astronomical objects at mm/sub-mm wavelengths. The value of breathtaking astronomical images for capturing media and public attention need hardly be stated, and excellent images will be a major contributor to establishing and maintaining ALMA's public and media profile.



Figure 3 — The ALMA EPO Programme creates and delivers a wide range of products to the media and the public, including brochures, DVDs, and books.

Thus, the ALMA EPO programme is investing in mm/sub-mm data visualisation, supporting the marriage of ALMA science and art. This programme will also develop methods to create effective composites with images acquired by ALMA era observatories operating at other wavelength regimes such as the James Webb Space Telescope, the European Extremely Large Telescope, the Expanded Very Large Array, and the Large Synoptic Survey Telescope.

## Public affairs

Actively promoting ALMA science, technology, and value to the Chilean national and regional governments, and to the Chilean people, is an important EPO responsibility. The ALMA EPO programme has established and maintained excellent relations with Chilean communities, especially those located near the ALMA site: San Pedro de Atacama and Toconao. The project partners place a high priority on their obligation to be excellent stewards of the ALMA Science Preserve, conserving archaeological sites as well as the flora and fauna within the Preserve.

<sup>4</sup> <http://www.mim.cl>

## Summary

The ALMA is a major international astronomical observatory under construction in northern Chile that will soon open new windows on celestial origins and explore new science frontiers. A global ALMA EPO programme has been initiated by the NRAO, ESO, NAOJ, and the JAO that includes Science Community Outreach, Online Outreach, News & Public Information, Formal Education, Informal Education, Astronomical Data Visualisation, and Public Affairs. ALMA is as an extraordinary new astronomical observatory, and the global ALMA EPO programme described here seeks to take full advantage of ALMA as an extraordinary opportunity to communicate astronomy to the public.