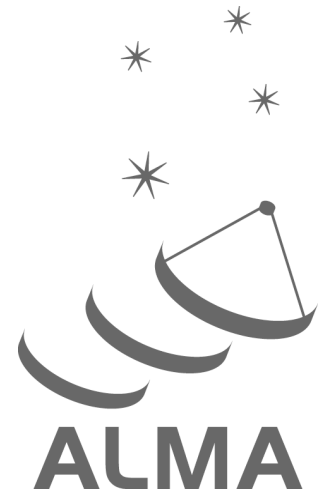


A Guide to the North American ALMA Regional Center and the NAASC

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www.almascience.org

ALMA, an international astronomy facility, is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ.

User Support:

For further information or to comment on this document, please contact your regional Helpdesk through the ALMA User Portal at www.almascience.org. Helpdesk tickets will be directed to the appropriate ALMA Regional Center at ESO, NAOJ or NRAO.

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1 Introduction

This document describes services provided to the observing community by the North American ALMA Science Center (NAASC). The NAASC is operated by the National Radio Astronomy Observatory (NRAO) in Charlottesville, Virginia, in collaboration with Canada's National Research Council Herzberg Astronomy and Astrophysics (NRC Herzberg), and the National Science Council (NSC) of Taiwan. The NAASC supports the science use of ALMA by astronomers in North America and Taiwan and supports research and development for future ALMA upgrades.



Figure 1: NRAO Headquarters and location of the NAASC

The following websites provide additional information on ALMA and the NAASC, and connect users to resources and tools they will need to use the telescope.

The ALMA Science Portal

<http://almascience.nrao.edu>

The NAASC website

<http://science.nrao.edu/facilities/alma>

The ALMA Helpdesk, which is also linked from the Science Portal and the NAASC website

<https://help.almascience.org>

The Taiwanese ALMA website

<http://alma.asiaa.sinica.edu.tw>

2 About ALMA

The Atacama Large Millimeter/submillimeter Array (ALMA) enables transformational research into the physics of the cold universe, where the sky is dark in the visible part of the spectrum but shines brightly at (sub)millimeter wavelengths. ALMA is a global collaboration involving partners in North America, Europe, and East Asia, in cooperation with the Republic of Chile. The telescope has 66 high-precision antennas located on the Chajnantor plain of the Chilean Andes, 5000 m above sea level. In Full Operations, ALMA will image the sky at resolutions as fine as 0.005" with unprecedented sensitivity, and will operate at frequencies between 31 GHz and 950 GHz. The capabilities of ALMA are outlined in the Proposer's Guide and details on the telescope are given in the Technical Handbook. New users can learn about ALMA and get an introduction to radio interferometry in the ALMA Primer. These documents are available at the ALMA Science Portal website.

3 Organization and Role of the ARCs and the NAASC

Being an international facility, ALMA serves a worldwide community of astronomers. To interface with the geographically distributed user community, the three partners have established ALMA Regional Centers, or ARCs. They are the North American ARC (NA ARC), based in Charlottesville, VA; the East Asian ARC (EA ARC), based in Mitaka, Japan; and the European ARC (EU ARC), based in Garching, Germany. The ARCs are staffed by scientists with expertise in radio astronomy, millimeter/submillimeter astronomy, and interferometry, and their purpose is to work with the community of astronomers to maximize the scientific productivity of the telescope. The NA ARC is part of the NAASC, concentrating on internationally agreed core ALMA functions.

Each astronomer who uses ALMA is assigned an ARC for user support at the time they register with the ALMA Science Portal. Astronomers in North America, East Asia, or Europe are assigned to that region's ARC. Astronomers from Taiwan can select to use either the NA ARC or the EA ARC. Astronomers elsewhere in the world can select any one of the three ARCs.

The NAASC is located at NRAO Headquarters, on the Grounds of the University of Virginia (UVa), and a short walk from the UVa Department of Astronomy. The NRAO and UVa Astronomy share colloquia, journal clubs, and lunch talks. Several NAASC staff have joint or adjunct appointments at UVa. A listing of NAASC staff, including research interests, is available here:

<http://science.nrao.edu/alma/ALMApeople/people.shtml>

The key services provided by the NAASC to the North American astronomical community include:

- Organizing ALMA workshops and tutorials
- Hosting and supporting NRAO "Community Days" events
- Hosting ALMA sessions at national and international conferences, such as AAS meetings
- Helping to prepare and distribute the Call for Proposals and other user documentation
- Assisting users with the preparation and submission of ALMA proposals
- Preparing Scheduling Blocks, the observing scripts used to control the telescope
- Calibration and preliminary imaging of ALMA science data

- Hosting visits by ALMA observers to assist with data reduction and analysis
- Maintaining a local copy of the ALMA data archive and operating a copy of the ALMA data processing pipeline
- Staffing the ALMA Helpdesk
- Developing user-oriented observing and analysis tools, such as the spectral line catalog (Splatalogue), and the CASA-based observing simulator (*sim_observe*, *sim_analyze*, and *simalma*)
- Providing opportunities for student funding, and page charge support for U.S. investigators
- Organizing and hosting ALMA-themed science meetings
- Supporting future development of the telescope
- Helping investigators with education and public outreach activities

4 Essential Resources

4.1 The ALMA Science Portal

The Science Portal is the primary access point to ALMA for all science users. The website is:

<http://almascience.nrao.edu>

At the Science Portal, users can:

- Access the Call for Proposals, the Proposer’s Guide, the Technical Handbook, the Primer, and other documentation
- Download the Observing Tool, the software used to prepare and submit ALMA proposals
- Search and access public data from the science data archive
- Access “Knowledgebase” articles from the Helpdesk
- Access software tools and documentation, including a sensitivity calculator, the ALMA Observation Support Tool, and Splatalogue
- Get an overview of ALMA’s scientific capabilities during Full Operations

Astronomers can also register with the Science Portal. Indeed, every astronomer who intends to submit an ALMA proposal, or appear on one as a co-investigator, must register. Once registered and logged in, users at the Science Portal will be able to:

- Submit tickets to the Helpdesk
- Use the Project Tracker to follow the status of their observations in the queue
- Access their proprietary data and public data from the archive

4.2 The NAASC Website

The NAASC website provides up-to-date news and information of particular use to North American ALMA users. The website is: <http://science.nrao.edu/facilities/alma>

At the NAASC website, users get information on:

- ALMA and NAASC news and events

- Tutorials on ALMA’s capabilities and proposal preparation
- Workshops on ALMA data processing and analysis
- Financial support for travel and publications
- Visiting the NAASC
- Student and postdoc programs
- Education and outreach activities
- NAASC staff

4.3 The Helpdesk

The ALMA Helpdesk is the main user resource for getting help. The Helpdesk is a website that can be accessed from the Science Portal, from the NAASC website, or directly at: <https://help.almascience.org>

The Helpdesk includes a library of “Knowledgebase” articles that address a number of common issues and questions. To submit a ticket, users must first log in. As the user types a question, knowledgebase articles are searched in real time and relevant articles are presented as the question is being typed. If the user does not find an answer in the articles suggested, the user can submit the ticket. While it is necessary to log in before submitting a ticket, users can browse and search the knowledgebase articles without logging in.

Helpdesk staff will make every effort to respond to tickets promptly. During normal operations, users can expect a response within 2 business days. During the week prior to a proposal deadline, extra staff will be assigned to the Helpdesk and every effort will be made to address time-critical questions in a rapid manner.

5 Getting Help from the NAASC at Each Step of Your Project

The NAASC provides user support through all stages of an ALMA project, from learning the telescope’s capabilities through the publication of results.

5.1 Learning about ALMA: Documentation, Workshops, and Community Days

Preparing for an ALMA project begins with learning the telescope’s capabilities and learning the tools needed to design observations, prepare proposals, and submit proposals. The NAASC provides user documentation, including the ALMA Primer, at the Science Portal.

The NAASC helps to organize and support NRAO “Community Days” and other regional workshops in the USA and Canada to promote ALMA to the astronomical community and describe the tools needed to write proposals. These workshops focus on preparation of proposals and observations, and feature talks on the telescope’s capabilities, mm/submm interferometry observing techniques, and the tools required to design effective ALMA observations. Attendees learn to use the Observing Tool, the software used to prepare and submit observing proposals. The workshops may include a hands-on session to introduce attendees to imaging ALMA data with CASA. At the request of the hosts, the workshops may also include talks and information on CASA tasks for simulating ALMA observations. Future workshops are arranged in response to the level of interest from the user community. NRAO Community Days and ALMA workshops can be organized and hosted by university groups or research institutes, or can be tied to other scientific meetings or workshops.

The NAASC also supports NRAO splinter sessions and training events at AAS meetings. These events promote all NRAO observing facilities, and include a focus on the tools needed to prepare effective proposals. NAASC staff describe ALMA capabilities, NAASC support services, and ALMA user tools.

Finally, the NAASC hosts periodic workshops that focus specifically on data calibration and imaging. These workshops are aimed at helping users process their own ALMA data, or process archival data.

Visit the NAASC website for an up-to-date list of workshops, Community Days, and training events, or visit the workshops page directly at: <https://science.nrao.edu/facilities/alma/community1>

Registration is required for workshops and Community Days, and is available on the website.

5.2 Proposal Preparation

A Call for Proposals is issued prior to each scheduling period. The Call and supporting documents are made available on the Science Portal. These documents describe the capabilities of the telescope for the upcoming cycle and the policies and procedures for submitting proposals.

ALMA proposals are prepared using the ALMA Observing Tool, an application that can be downloaded from the Science Portal. Proposals must include a scientific and technical justification, a list of targets and frequencies to be observed, and details such as sensitivity and angular resolution required to meet the science goals. The Observing Tool includes a sensitivity and exposure time calculator. Users must be registered with the Science Portal to submit proposals with the Observing Tool.

NAASC staff are available to help users learn the Observing Tool and prepare proposals. We emphasize here that the Observing Tool is used not only to assemble and submit the scientific and technical justifications, but also to design and fully specify the observations, so users are encouraged to become familiar with the Observing Tool well in advance of the proposal deadline. The Helpdesk is the primary resource for those seeking assistance. It may be possible to arrange face-to-face assistance at the NAASC for particularly challenging projects.

The CASA task *simalma*, and the lower-level tasks *sim_observe* and *sim_analyze*, allow users to simulate an ALMA observation of a target based on a model with a given source structure and brightness. These tasks also help one to understand how different antenna configurations and track durations affect an observation.

More information on simulating ALMA observations is available at:

http://casaguides.nrao.edu/index.php?title=Guide_To_Simulating_ALMA_Data

More information on CASA and Casaguides is available at these websites:

<http://casa.nrao.edu>

<http://casaguides.nrao.edu>

The ALMA Observation Support Tool (OST) provides another method of simulating ALMA observations. The OST provides a web interface through which the user can specify observing parameters and upload a FITS file with a model image, or select a model image from a pre-existing library. The OST is available on the Science Portal.

5.3 Preparing Your Observations

ALMA proposals are reviewed for scientific and technical merit, and the outcome of these reviews are emailed to the investigators. Projects eligible for scheduling are assigned a Contact Scientist, a member of the NAASC staff who provides a single point of contact for project support. NAASC staff and the Contact Scientist work with the project team to review observing strategies and prepare Scheduling Blocks. After the observations are made, the Contact Scientist can assist with questions related to data reduction. Most interaction happens through the Helpdesk. For particularly complex observations, users may arrange a visit to the NAASC to prepare the observations.

Observers do not travel to Chile or elsewhere to take part in the observations. ALMA observations are scheduled dynamically, taking into account the weather conditions, instrument status, availability of the targets, and proposal ranking.

5.4 Reducing Your Data

The challenge posed by storing and processing ALMA data is formidable. The NAASC will host a copy of the ALMA data archive and the NAASC site will serve as the primary data access point for North Americans, and will provide a backup of the archive in Santiago. Upon completion of the observations and initial data processing, investigators are notified and given instructions on how to download their data.

ALMA data is processed in two steps: first it is calibrated, and then imaged. Most ALMA data are calibrated using a pipeline, but in some cases the observatory staff may prepare CASA scripts for the calibration. Calibrated data are supplied to the project team as part of the delivered data package. After the proprietary period, calibrated data are also available in the ALMA archive. Generally, calibrated data provided to users are ready for science imaging. In some cases, though, users may get best results by refining the calibration themselves, with assistance from NAASC staff, if desired.

NAASC staff also prepare and provide imaging scripts and a set of reference images to the observing team as part of the delivered data package. Starting with these scripts, users generally will complete the imaging of the full data set themselves.

Users are encouraged to visit the NAASC to get help with their data processing. The NAASC has computers with ample resources to reduce ALMA data, including powerful desktops and a cluster machine. Presently, the NAASC does not support remote access to the data reduction computers. On the NAASC website there are recommendations for computing hardware required to process ALMA data outside of the NAASC. See: <https://almascience.nrao.edu/alma-data/data-processing>

The primary software package used to process ALMA data is CASA. The CASA website is: <http://casa.nrao.edu>

Note in particular the *Casaguides* link available from this site. The *Casaguides* site provides a collection of data reduction tutorials and step-by-step processing and analysis examples, including scripts for processing Science Verification data.

5.5 Visiting the NAASC

The NAASC welcomes short-term visits to Charlottesville from investigators of successful ALMA programs for expert assistance with processing and analyzing their ALMA data. Visits for data reduction are expected to last about a week. Student visitors must be accompanied by an experienced investigator, usually their academic advisor. Visitors will have access to an office and a computer to process their data. Investigators on accepted projects can apply to the NAASC for assistance with travel expenses. To request a visit, send a ticket to the Helpdesk using the “Face to Face Support” category. More details are available at:

<http://science.nrao.edu/alma/visitors-shortterm>

5.6 Publishing Your Results

Upon request, NRAO provides financial support for page charges to authors at U.S. scientific or educational institutions. The paper may report either original observations made with an NRAO telescope, or original research made with NRAO archival data. Details on the page charge support policy are here:

<http://library.nrao.edu/pubsup.shtml>

5.7 Promoting ALMA Science

The NAASC sponsors ALMA-themed science conferences on roughly an annual basis. A listing of previous ALMA conferences and information on upcoming conferences is available at the following site:

<http://science.nrao.edu/alma/workshops.shtml>

NAASC activities and ALMA results are publicized in the NRAO eNews: <http://science.nrao.edu/enews>

The NAASC is also involved in community outreach through special ALMA sessions at American Astronomical Society and Canadian Astronomical Society meetings. At these sessions we provide attendees with highlights of recent ALMA science, describe the current status of ALMA, and give updates on the proposal submission and data processing tools.

The Education and Public Outreach (EPO) team at NRAO select a number of successful ALMA projects for publicity and work with the investigators to develop the press release and other outreach products. In addition to providing expertise and advice on outreach activities, the EPO team can work with investigators to develop images and other visuals to promote science results.

6 Working with the Community to Improve ALMA

The NAASC encourages involvement from the user community to develop and improve ALMA. Through the NRAO visitor program, the NAASC offers financial support for approved long-term visits that can range from a few weeks to several months. NRAO particularly encourages long-term visits that could lead to new and innovative instrumentation on ALMA and visits to develop innovative new software or techniques. Full details on the visitor program are available on the NAASC website:

<https://science.nrao.edu/facilities/alma/visits>

Also, the NAASC periodically invites proposals from North American entities for studies or projects for potential inclusion in the ALMA Development Plan. The primary aims are:

- To give groups in North America the opportunity to propose ALMA upgrades that may later be implemented as part of the ALMA Development Plan
- To support the development of conceptual and detailed designs for ALMA upgrades, and
- To encourage relevant long-term research and development

Calls for development proposals will be announced on the NAASC web site.

7 Student Support

The NAASC supports student involvement in ALMA through the NRAO student programs. NRAO has a Summer Student Program aimed at introducing undergraduate and graduate students to forefront research. A Student Observing Support Program funds graduate students working on eligible ALMA proposals. Additionally, a graduate Pre-Doctoral Program is available to give students the opportunity to conduct thesis research at NRAO sites under the supervision of an NRAO scientist. Details on the student programs are available at: <http://science.nrao.edu/opportunities/studentprograms.shtml>

8 Addresses for the NAASC, NRC-HIA, and ASIAA

The North American ALMA Science Center
520 Edgemont Rd.
Charlottesville, VA 22903
USA

Phone: 434-296-0211

Directions: <http://science.nrao.edu/alma/edgemont.shtml>

National Research Council
Herzberg Institute of Astrophysics
5071 West Saanich Road
Victoria, BC V9E 2E7
Canada

Phone: 250-363-0001

Directions: <http://www.nrc-cnrc.gc.ca/eng/about/directions/victoria.html>

Institute of Astronomy and Astrophysics, Academia Sinica.
11F of Astronomy-Mathematics Building, National Taiwan University
No.1, Roosevelt Rd, Sec. 4 Taipei 10617, Taiwan, R.O.C.

Phone: +886-2-3365-2200

Directions: <http://www.asiaa.sinica.edu.tw/guide/transport.php>

9 Map of the Area Near NRAO Headquarters and the NAASC



Figure 2: NRAO headquarters and the NAASC are located by the red marker labeled "A"



The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of the European Organization for Astronomical Research in the Southern Hemisphere (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Republic of Chile. ALMA is funded by ESO on behalf of its Member States, by NSF in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and by NINS in cooperation with the Academia Sinica (AS) in Taiwan and the Korea Astronomy and Space Science Institute (KASI).

ALMA construction and operations are led by ESO on behalf of its Member States; by the National Radio Astronomy Observatory (NRAO), managed by Associated Universities, Inc. (AUI), on behalf of North America; and by the National Astronomical Observatory of Japan (NAOJ) on behalf of East Asia. The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.

