

NRAO



National Radio Astronomy Observatory



Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array



Observing with ALMA

Introduction: ALMA and the NAASC



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The Atacama Large MM/Submm Array :ALMA

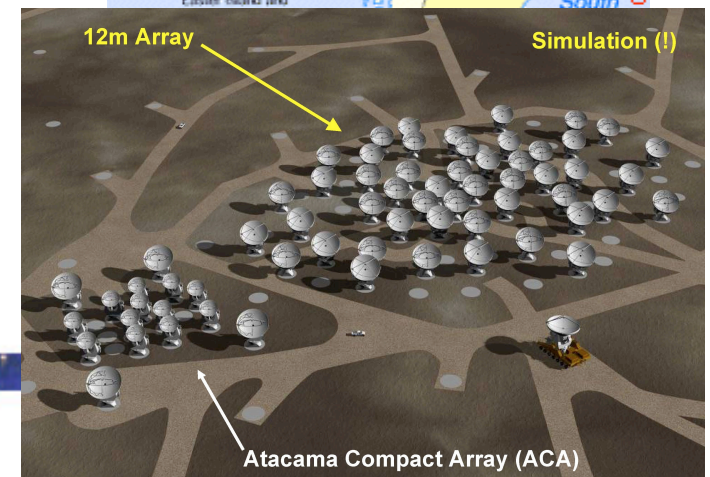
- A global partnership to deliver a transformational millimeter/submillimeter interferometer

North America (US, Canada, Taiwan)

Europe (ESO)

East Asia (Japan, Taiwan)

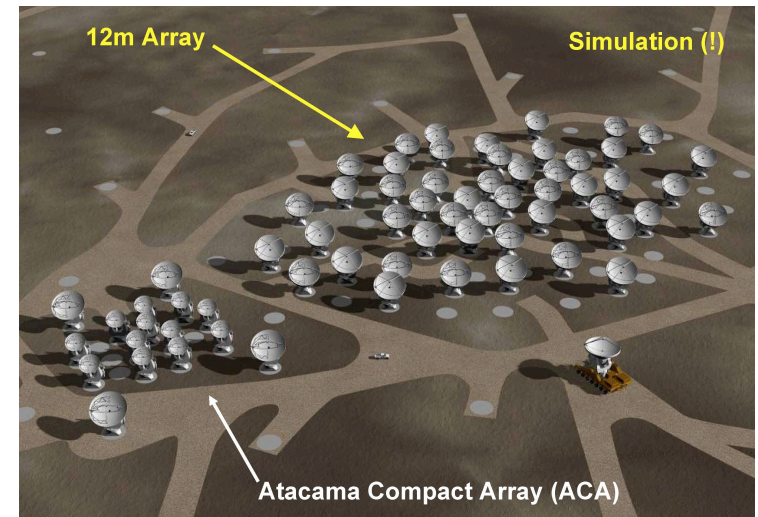
- 5000m (16,500 Ft) site in Chilean Atacama desert
- Main Array: 50 x 12m antennas (up to 64)
 - + Total Power Array 4 x 12m
 - + ACA: compact array of 12 x 7m antennas
- Total shared cost ~1.3 Billion (\$US2006)



ALMA in a Nutshell

- Baselines up to ~15 km (0.015" at 300 GHz) in “zoom lens” configurations
- Sensitive, precision imaging 84 to 950 GHz (3 mm to 315 μm)
- State of the Art low-noise, wide-band receivers (8 GHz bandwidth)
- Flexible correlator with high spectral resolution at wide bandwidth
- Full polarization capabilities
- Estimate 1 TB/day to be archived

- A resource for ALL astronomers



ALMA will be 10-100 times more sensitive and have 10-100 times better angular resolution compared to current millimeter interferometers

ALMA Early Science Pre-announcement

1st Call Expected End March

At least:

- 16 antennas
- Receiver bands 3, 6, 7, 9 → 100, 230, 345, 670 GHz
- Baselines up to 250m
- 21 Correlator Modes
- Additional capabilities **may** be announced with the call (limited mosaicing and polarization, somewhat longer baselines)

Process:

- Due date ~3 months after the call, observing begins Fall 2011
- Observing expected to span 9 months, with ~600 hours available
- A single international Proposal Review Committee, chaired by Neal Evans
- Off-line data reduction necessary
- User support from ALMA Regional Centers ARCs



The North American ALMA Science Center

- Three ALMA Regional Centers: ARCs
 - NA: Charlottesville, VA, USA
 - EU: Garching, Germany
 - EA: Mitaka, Japan
- North American ARC: US - Canada (7.25%) partnership for core support

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



- Proposal Help and Submission
- Observation preparation
- Data archive
- Data processing



NAASC community support programs

- Science workshops, tutorials and summer schools
- Face-2-Face visitor support
- Publication page charge support
- Post-docs and students

Upcoming NAASC Supported Workshops & Tutorials

Training Tutorials

- Jan. 18: Victoria, BC (following "Extending the Limits of Astrophysical Spectroscopy")
- Feb. 24-25: Hands-on Tutorials (NRAO-CV)
- March 11: Santa Fe, NM (following "Building on New Worlds, New Horizons")
- April 26-27: Hands-on Tutorials (NRAO-CV)
- May 9-10: Hands-on Tutorials (NRAO-CV)
- May 22-26: Boston, MA (218th AAS Meeting)

→ <http://science.nrao.edu/alma/training.php>

ALMA Community Days

- Regionally located/organized and NAASC supported ALMA training workshops
- One or more per month leading up to the call
- Proposal deadline Feb. 1; see announcement: <http://science.nrao.edu/alma/>
- Proposals received from Harvard-Smithsonian, Caltech and Hawaii, interest by several others – looking forward to more proposals!



Science Workshops

- 5th annual meeting next week

A poster for the 'Spectroscopy 2011' workshop. The title 'SPECTROSCOPY 2011' is in large, bold letters, with 'EXTENDING THE LIMITS OF ASTROPHYSICAL SPECTROSCOPY' in a blue banner below it. The poster includes the website 'www.almatelescope.ca/Spectroscopy2011/', the location 'National Research Council of Canada • Victoria, British Columbia', and the dates 'January 15 - 17, 2011'. It features images of ALMA radio telescope dishes and a green race car. Text on the poster describes the capabilities of the new ALMA Large Millimeter/Submillimeter Array (ALMA) and lists specific focus areas for the conference.

The capabilities of new ALMA Large Millimeter/Submillimeter Array (ALMA) instrumentation will be highlighted at this meeting, including advances in astronomy, astrophysics, and astrochemistry.

Over the next several years, National Radio Astronomy Observatory (NRAO) research facilities will provide the scientific community with unprecedented advances in high spatial resolution and broadband observing capabilities. ALMA will be capable of recording more than 2 GHz of frequencies, bandwidths in high spectral resolution and will routinely deliver high fidelity high resolution astronomical images. Spectroscopy is a vital tool to improve our understanding of the Universe, enabling scientists to probe physical and chemical environments, measure kinematics and dynamics, and explore the high redshift Universe while also obtaining abundances, concentrations, and temperatures of exotic molecular species.

Specific focus areas for this science conference will include:

- The Atomic Universe: Atomic Spectra as Probes of Cool Gas
- The Molecular Universe: Dense Star-forming Gas
- Isotopic Variety in Interstellar Medium
- Our Molecular Origins: Prebiotic Molecules

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- Announcement soon for next year's meeting

Overview of the Session

- The Canadian Node and the ALMA Primer – James di Francesco
 - ALMA in Canada
 - The ALMA Primer: where to start for an introduction to ALMA
 - Science proposal examples for the Early Science array
- The Path to Early Science with ALMA – Al Wootten
 - Construction status and completion timeline
 - ALMA capabilities in Early Science and with the full array
 - A call for future ALMA development studies

Overview of the Session

- The Software Tools – Kartik Sheth
 - The Observing Tool & the Sensitivity Calculator
 - Simdata: Simulating ALMA observations
 - Splatalogue: a spectral line database
 - CASA & Casaguides: reducing and analyzing ALMA data
 - The Project Tracker and the Archive
- ALMA does Circumstellar Disks – David Wilner
 - ALMA Early Science capabilities for circumstellar disks
- ALMA does Galaxies! – Jean Turner
 - ALMA Early Science capabilities for Extragalactic Science
- Summary & Further Questions – Tony Remijan



Job Openings

A number of positions with the NAASC & JAO are advertised at the NRAO Careers page:

<https://careers.nrao.edu/>

NAASC

- Postdoctoral Fellows (2 positions)

Joint ALMA Observatory, JAO

- ALMA System Astronomer (2 positions)
- ALMA Operations Astronomer
- Head of the JAO Program Management Group
- Deputy Head of the JAO Program Management
- Deputy Manager of the ALMA Data Management Group



Summary

- Amazing scientific promise
- Tremendous progress in construction: 9 antennas at high site
- 1st Call for Early Science at the end of March,
 - already more collecting area and spectral coverage than current arrays
- Many training events coming up and proposals for ALMA community days being accepted
- One-Stop for community support at NAASC <http://science.nrao.edu/alma/>
- At the NRAO booth:
 - ALMA Primer, version of December 2010
 - Mouse pads and flash drives

This afternoon at AAS

- 5:30PM RM304 Splinter Session: “Early Science Proposal Preparation Tutorial”





www.almaobservatory.org

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership among Europe, Japan and North America, in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere, in Japan by the National Institutes of Natural Sciences (NINS) in cooperation with the Academia Sinica in Taiwan and in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC). 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).

