Fast facts

- ALMA is an array of 64 telescopes that will work together as a single instrument; each antenna's dish is 12 meters (39 feet) wide.

ALMA: Imaging Cosmic Dawn

- The telescopes that make up ALMA will help us learn about stars, galaxies, and other objects in the universe by collecting the millimeter wavelength "light" they emit.

- Astronomers won't look through the telescopes. Instead, electronic detectors and computers will take the millimeter wavelength signals the telescopes collect and turn them into pictures of the objects in space from which scientific information is extracted.

(NRAO/AUI photo by Bryan Butler)

Using the Global Positioning System to mark a location at the ALMA site.

- The superconducting receivers inside the ALMA antennas will operate at just four degrees above absolute zero (–269° Celsius); this technology means ALMA will be the biggest superconducting electronics system in the world.

- Each individual antenna can be moved, so the shape and size of the array can be changed. This will give ALMA a "zoom-lens" capability. At its largest, the array will be 14 kilometers (10 miles) wide; at its smallest, only 150 meters (500 feet).

- ALMA will be built in Chile's Atacama Desert, one of the driest places on Earth. This makes it a superb site for millimeter astronomy, which requires a dry sky.

- ALMA is a partnership between North America and Europe. Japan may join the project as a partner.

- When ALMA is completed (by 2012), it will be the largest and most capable imaging array of telescopes in the world.

A Site to Meet Demands

Since 1995, the U.S. National Radio Astronomy Observatory, the European Southern Observatory, and the National Astronomical Observatory of Japan have collected atmospheric and meteorological data at the Llano de Chajnantor site in northern Chile, which is at an elevation of 5,000 meters (16,500 feet). These studies show the sky above the site has the unsurpassed clarity and stability essential for ALMA. The site is large and open, allowing easy repositioning of the antennas over an area 14 kilometers (10 miles) in extent. An international highway provides access to the site and logistical support is available from the nearby village of San Pedro de Atacama.

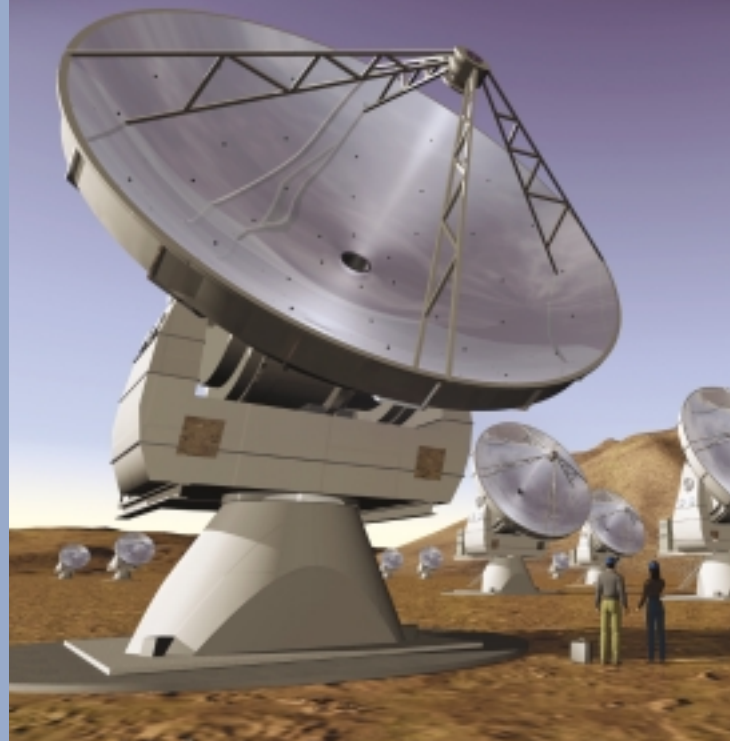
Visit us!

You don't have to go to South America to visit ALMA. Find us on the web at
http://www.alma.nrao.edu
http://www.eso.org/projects/alma
http://www.nro.nao.ac.jp/index.html

If you have questions about ALMA, write to us at almainfo@nrao.edu or almainfo@eso.org

ALMA

Atacama Large Millimeter Array



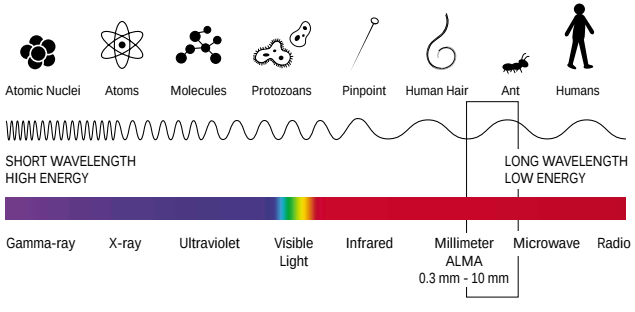
What is ALMA?

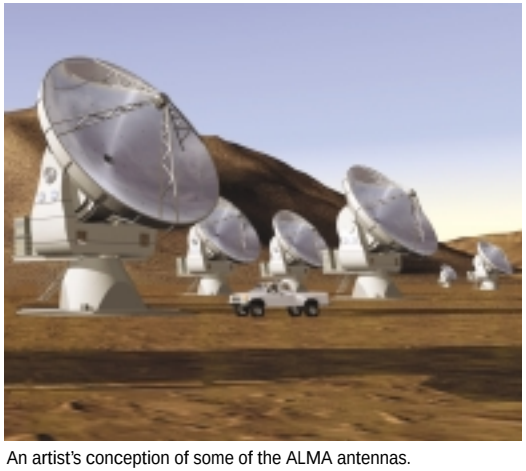
The Atacama Large Millimeter Array (ALMA) is a group of 64 radio-telescope antennas that will work together to study the universe from a high mountain site in the Atacama Desert of Chile. The ALMA antennas will collect the millimeter wavelength "light" given off by cool objects like the gas and dust near stars and galaxies.

ALMA is funded by an international partnership between the United States and Europe. Japan may join the project as a partner.

What is millimeter wavelength astronomy?

Objects that astronomers study, like stars and galaxies, give off many different kinds of light in addition to visible light. Some examples of these are radio waves, infrared waves, X-rays and gamma rays. But most of the energy in the universe is present in the millimeter portion of the spectrum. The millimeter waves that carry this energy are more energetic than radio waves, and less energetic than infrared waves (see diagram below). Until now, this abundant millimeter wavelength "light" has not been studied with the crisp resolution that ALMA will provide.



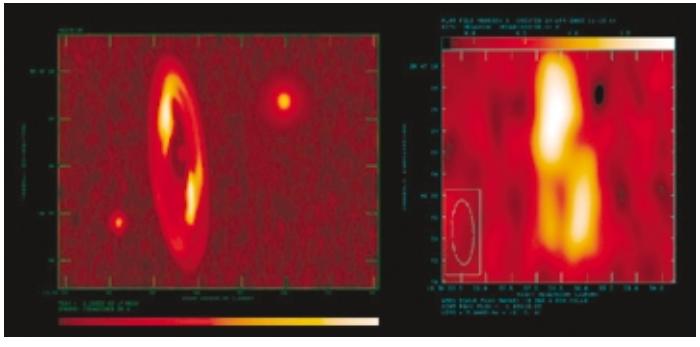


(ESO)

An artist's conception of some of the ALMA antennas.

What will ALMA study?

- Cosmology – the age of the universe, its size and structure
- The formation of galaxies (like the Milky Way) at the earliest times in cosmic history
- New planets forming around young stars in our Galaxy
- The birth of new stars in spinning clouds of gas and dust
- The Sun, planets, comets and asteroids of our solar system



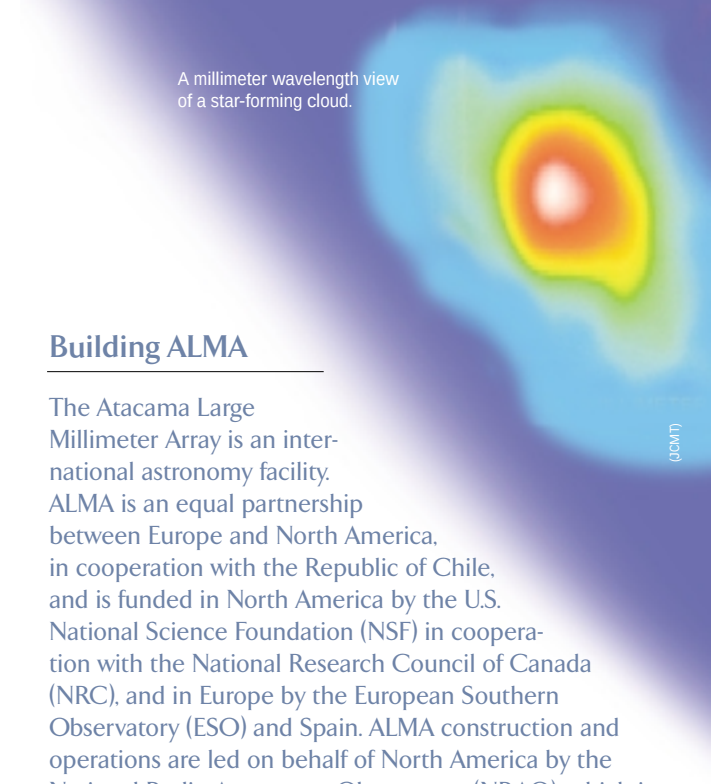
On the left, a simulation of what ALMA would see in its most compact array (resolution of about one arcsec at a wavelength of 1.3 mm) of the Vega debris disk. Today's most sensitive millimeter arrays have required twice as long to detect even the highest flux concentrations as demonstrated in the simulated image on the right. (NRAO/AUI. Wootten 2003)

How will ALMA work?

Cosmic millimeter waves are reflected from the surface of each dish up to the subreflector above the dish's center. From there they are guided down into a receiver inside the telescope. There the signals are digitized and sent along underground fiber-optic cables to a large signal processor in the control building. This specialized computer, called a correlator, will combine all of the data from the 64 antennas to make a super-sharp image.

Who will use the telescope?

Scientists from all over the world will use ALMA. They will compete for observing time by submitting proposals, which will be judged on the basis of scientific merit.

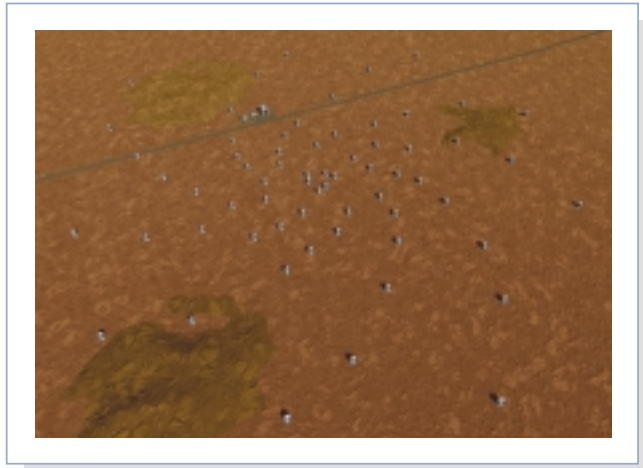


A millimeter wavelength view of a star-forming cloud.

(JCMT)

Building ALMA

The Atacama Large Millimeter Array is an international astronomy facility. ALMA is an equal partnership between Europe and North America, in cooperation with the Republic of Chile, and is funded in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC), and in Europe by the European Southern Observatory (ESO) and Spain. ALMA construction and operations are led on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI), and on behalf of Europe by ESO.



A possible arrangement of the 64 ALMA antennas. (ESO)