

GLOSSARY:

ALMA: (The Atacama Large Millimeter/submillimeter Array) One of the largest ground-based astronomy projects for observations in the millimeter/submillimeter regime. It will enable transformational research into the physics of the cold Universe, probe the first stars and galaxies, and directly image the formation of planets. When completed, ALMA will be comprised of a giant array of fifty 12 meter antennas.

Array: An assortment of telescopes combining signals, simultaneously receiving images from the same source, allowing astronomers to see more detail and thus more accurately pinpoint the source. This ability depends on a technique called radio interferometry. When signals from two or more telescopes are properly combined, they act effectively as small pieces of a single huge telescope.

Electromagnetic Spectrum: The entire range of electromagnetic radiation. At one end of the spectrum are gamma rays, which have the shortest wavelengths and high frequencies. At the other end are radio waves, which have the longest wavelengths and low frequencies. Visible light is near the center of the spectrum. Hubble Telescope: A telescope launched into orbit around the earth in 1990 to provide information about the universe in the visible, infrared, and ultraviolet ranges.

Interferometry: 1. Optics: A device that separates a beam of light into two ray beams, usually by means of reflection, and that brings the rays together to produce interference, used to measure wavelength, index of refraction, and astronomical distances. 2. Astronomy: An instrument for measuring the angular separation of double stars or the diameter of giant stars by means of the interference phenomena of light emitted by these stars.



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Show Me Science Advanced

Radio Astronomy - The Alma Telescope

K4576DVD

Advanced Teachers Guide

SYNOPSIS:

The Atacama Desert of northern Chile is one of the world's best sites for observational astronomy because of the high altitude, nearly non-existent cloud cover, dry air, and lack of light pollution and radio interference due to small populations.

The Atacama Large Millimeter/Sub-millimeter Array, or ALMA, is a vast array of radio telescopes and the most powerful observatory of its kind. ALMA peers into previously hidden regions of space with unprecedented sharpness and sensitivity.

CURRICULUM UNITS:

- Astronomy
 - Engineering
 - Physical science
 - Physics
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CAREER OPPORTUNITIES:

- Astronomer
- Chemist
- Computer engineer
- Electrical engineer
- Mechanical engineer

PROGRAM OVERVIEW:

All ordinary matter in the Universe gives off light. Some of it is in colors our eyes can see. The rest, from short wavelength gamma rays to long wavelength radio waves, requires special instruments to detect. The Atacama Large Millimeter/Sub-millimeter Array, or ALMA, uses radio telescopes to operate in the radio frequency portion of the electromagnetic spectrum where they can detect and collect data.

Radio telescopes are typically large parabolic dish antennas used singly or in an array. Radio observatories are preferentially located far from major centers of population to avoid electromagnetic interference (EMI) from radio, TV, radar, and other EMI emitting devices. This is similar to locating optical telescopes to avoid light pollution, with the difference being that radio observatories are often placed in valleys to further shield them from EMI as opposed to clear air mountain tops for optical observatories.

ALMA is an advanced tool for studying the first stars and galaxies. These objects now are seen at great cosmic distances, with most of their light stretched out to millimeter and submillimeter wavelengths by the expansion of the Universe.

ISSUES & CRITICAL THINKING:

1. Compare and contrast the Hubble Space Telescope and the ALMA Telescope.
2. Compare and contrast the Very Large Telescope (VLT) and the ALMA Telescope
3. Discuss with students how radio telescopes work.
4. Prior to viewing this program, have students do a K-W-L on astronomy and telescopes. Divide a piece of paper into 3 columns. Title one column "know", the next "Want to know" and the third column "Learned". Students fill out, individually or in pairs, what they know about the topic. Next, they brainstorm questions they have and write them under the "want to know" column. After the program, they write down what they learned under the third column.