Mauna Kea Telescopes: Submillimeter Array

The Submillimeter Array, or SMA, currently is being constructed in "submillimeter valley," nestled 400 feet below the summit of Mauna Kea. It is due for completion in November.

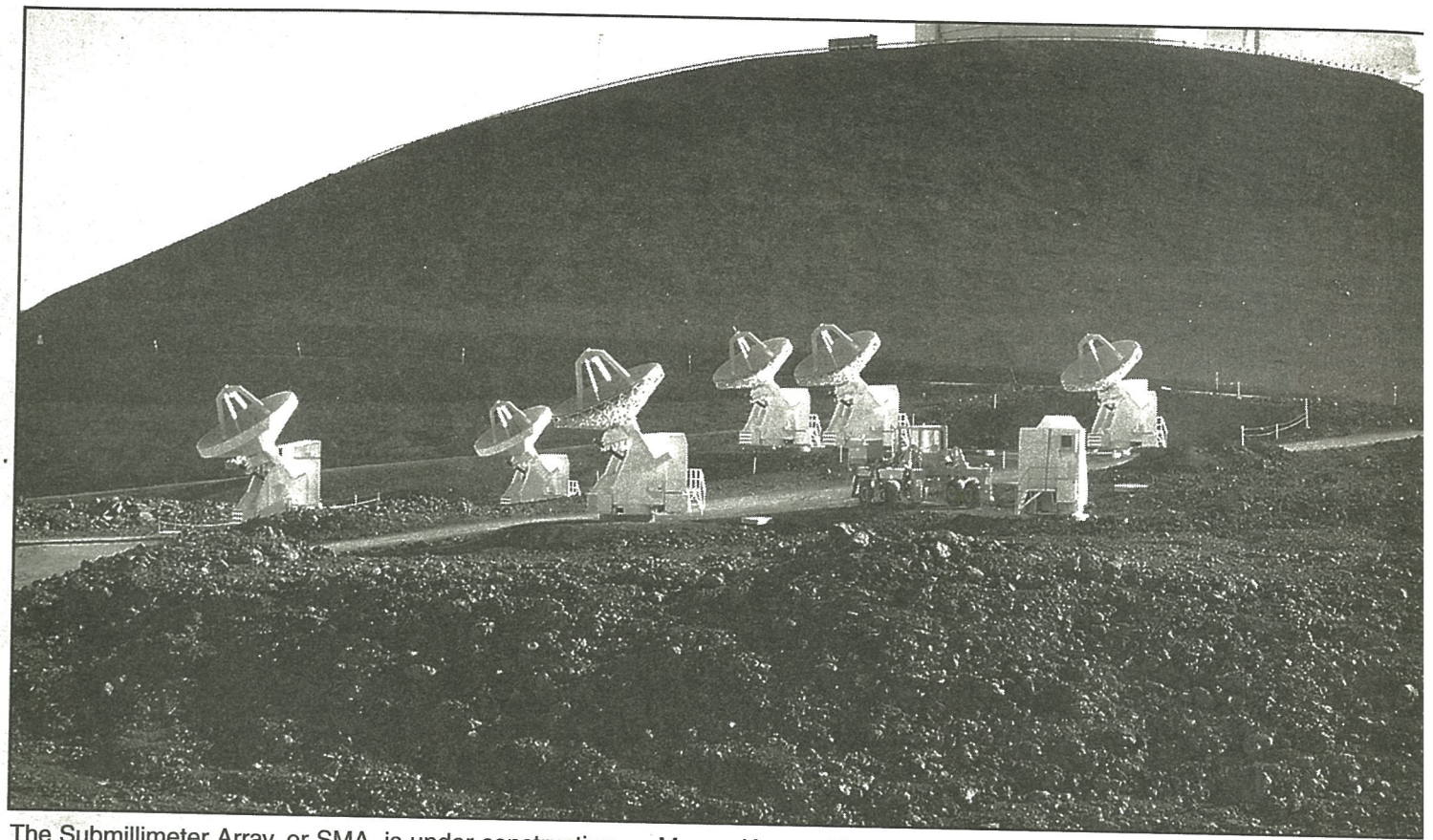
The SMA is the world's first interferometer dedicated to studying light with wavelengths between 0.1 and 1.3 mm (that's 0.005 to 0.05 inches).

What is so special about that? What can it do that other telescopes cannot? There are two aspects of the SMA that make it unique:

First, light in this wavelength range often originates deep inside large gas and dust clouds, which absorb the optical and infrared radiations. The sub-millimeter light is able to pass through these clouds, so we can see the early turbulent stages of the birth of stars, and possibly even of planets.

Secondly, an interferometer is a telescope made up of several antennas placed a known distance apart. The antennas all must point to the same object at the same time, and then the light detected by all of them is multiplied together, or "correlated." This produces a single image, which shows much greater detail than ever could be possible with just one antenna or mirror.

Interferometers greatly increase our ability to see small details. When placed at their widest separation, the SMA's eight antennas will act like a single giant telescope more than 1,600 feet in diameter, though each antenna is only 20 feet across.



The Submillimeter Array, or SMA, is under construction on Mauna Kea and is expected to be completed by November.

Observations at submillimeter wavelengths always have been difficult because water and other molecules in the Earth's atmosphere absorb much of the light before it ever reaches the ground. The high altitude and dry weather on top of Mauna Kea dramatically reduce this problem, and make it possible to see all kinds of astronomical objects, both in our galaxy and outside of it.

The combination of these features make the SMA a unique telescope, able to see objects and events no other telescope can. Even though the SMA is still under construction, scientists already are able to use it to make scientific observations. They have made exciting preliminary images of many types of astronomical objects, from nearby newborn stars to distant spiral galaxies.

Scientists at Mauna Kea also are also studying the distribution of carbon monoxide and other molecules in the atmospheres of the planets in our solar system. The first published result details variations in the brightness of the center of the Milky Way, which will lead to a better understanding of the massive black hole that resides there.

Soon after the dedication of the SMA, observations will be planned in conjunction with the nearby single-antenna telescopes of the Caltech Submillimeter Observatory and the James Clerk Maxwell Telescope to form a 10-antenna array for even higher resolution and more sensitive observations.

The SMA will be able to perform a huge range of new observations. One of the exciting aspects of this is that because there has never been a telescope quite like it, astronomers don't know exactly what they will find. The early data is just the tip of the iceberg.

For more information on the SMA, a collaboration between the Smithsonian Astrophysical Observatory and the Academica Sinica Institute of Astronomy and Astrophysics in Taiwan, visit its Web site at http://sma-www.harvard.edu.