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# World's biggest radio telescope to be launched in Chile

BY GIDEON LONG

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One of the most ambitious astronomy projects in the history of mankind will be launched Wednesday on a bone-dry plateau high in the Andes Mountains.

The Atacama Large Millimeter Array, better known as ALMA, is by far the largest radio telescope on earth.

"In fact, it's more powerful than all of the other radio telescopes in the world put together," says Andreas Lundgren, a Swedish astronomer who works here and gave a tour of the site on Tuesday.

Scientists will use the telescope to peer into the darkest corners of the universe — the parts where light does not reach and where optical telescopes are of no use. They hope ALMA will help them learn more about dark matter (which makes up most of the universe) as well as find new planets and understand how stars are born and die.

It might even eventually find signs of life on other planets.

"What we're starting to do with ALMA is to identify those parts of the universe that contain the ingredients for life," said Ewine van Dishoeck, a Dutch astronomy and professor of astrophysics at Leiden University in the Netherlands. "What ALMA can do is zoom into those areas where planets are being formed and see if those ingredients are present."

The \$1.4 billion project will eventually consist of 66 radio dishes, each weighing around 100 tones and measuring between 23 and 39 feet in diameter. Fifty-four are in place so far with the reminder expected by October.

The dishes, or antenna, pick up radio signals from outer space. Each dish can pick up signals in isolation but the beauty of ALMA is that the dishes work together. That increases the telescope's resolution dramatically, allowing it to peer further into space.

The dishes are on the Chajnantor plateau, in Chile's Atacama Desert, at the breathtaking altitude of 16,400 feet above sea-level. The air is so thin that visitors are given portable oxygen canisters to safeguard their health. The altitude is important. It allows the dishes to pick up clear signals, without the interference of moisture found closer to sea level.

Despite their size, the dishes are portable. Engineers transported them around the plateau on two giant flat-bed trucks. What the telescope picks up depends on where the antenna are positioned. The dishes collect analog signals that are then converted into images by one of the world's most powerful computers, known as "The ALMA Correlator." Engineers say it has the potential of three million household laptops.

Just as the inside of a camera must be dark to allow it to record images, so a radio receiver that listens to the faint signals coming from outer space must be "quiet." One of the best techniques for suppressing extraneous noise is to ensure the receivers are as cold as possible. The receivers inside ALMA's antenna are cryogenically frozen on site to within a few degrees of absolute zero.

Just building ALMA has been a challenge. Everything has had to be dragged up the bare mountainsides of northern Chile and assembled in the desert.

Michael Thorburn, the head of ALMA's department of engineering, says this is the second-highest man-made structure in the world, beaten only by a humble train station in the Tibetan Himalayas.

"Their station is higher than us but we're pretty sure that our operations center contains more computing power than theirs," he joked.

The decision to choose Chile as the site for ALMA is a feather in the cap for the Andean nation, which is rapidly emerging as a mecca for astronomers. President Sebastián Piñera plans to be at the observatory Wednesday for the launch.

Astronomers say that by 2025, around 70 percent of the image gathering capacity in the world will be located in Chile, eclipsing other sites, such as Hawaii and the Canary Islands. That's mostly because the north of the country is blessed with some of the world's clearest skies, but there are other considerations, too.

Being in the southern hemisphere, Chile's observatories are not in direct competition with those in the

U.S. and Europe that gaze out at different skies.

And Chile's political and economic stability is also a factor. Scientists say that there is perhaps no better place in Latin America to invest billions of dollars in a long-term astronomical project.

About 20 percent of the construction investment from big astronomical projects such as ALMA remains in Chile. The rest goes to high-tech companies in Europe, the U.S. and Asia. But once the telescope is functioning, the benefits for Chile rise. About 75 percent of the money spent on operating the observatories stays in country.

ALMA is also an example of global cooperation. Of the 66 radio dishes, 25 are from Europe, 25 from North America and the remaining 16 from Asia.