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Astronomy: Sterile spot is ideal to search for life

By Gideon Long

Sensitive antennas: the Atacama Large Millimeter Array will soon be the most powerful network of radio telescopes in the world

When Hollywood director Marc Forster chose Chile's Atacama Desert as a backdrop for his James Bond film *Quantum of Solace*, he did so, he said, because its sterile, unforgiving landscape reflected Bond's stony, emotionless character.

And yet, amid the lifeless rocks and sand of the Atacama, two gigantic projects are under way that are all about life: on planets other than our own.

The first is the Atacama Large Millimeter Array (Alma), soon to be the most powerful network of radio telescopes in the world.

Engineers have assembled the first of 66 enormous radio dishes on the Chajnantor plateau, near the border between Chile, Bolivia and Argentina at a breathtaking altitude of 5,000m. All the dishes should be in place by 2013.

The second project is the construction of the European Extremely Large Telescope

(ELT) at the Paranal observatory, where much of the Bond film was shot. Work will begin next year and is due to finish in 2021.

The telescope will be the size of a football stadium with a mirror larger than a tennis court. It will be the world's most powerful eye on the sky.

With these two projects, Chile is cementing its reputation as an astronomer's paradise. If life is discovered elsewhere in the universe, there is a very good chance it will be spotted from here.

"By 2020, more than 70 per cent of the image and data collecting power in the world will be here in Chile," says Massimo Tarenghi, director of the Santiago office of the European Southern Observatory (ESO), which is involved in both projects.

Tim de Zeeuw, head of ESO, says Alma and the ELT promise to be "as transformational for science as the Hubble space telescope".

The centrepiece of the ELT will be its 42m wide mirror – four times bigger than the mirrors on any existing telescope.

It is impossible to produce a single concave, high-precision mirror of that size, so engineers in Europe will make up to 1,000 small hexagonal mirrors that will be shipped to Chile and fitted together.

The telescope will cost €1bn ($1.36bn) and weigh more than 5,000 tonnes. Astronomers say the images it produces will be 15 times sharper than those sent to earth by Hubble.

So, what is so special about Chile for stargazers?

Much of the reason lies in the desert skies, which are among the clearest in the world.

Altitude is also important, particularly for Alma. Radio telescopes pick up wavelengths from distant space, but the signals are often distorted by vapour in the earth's atmosphere. By building at altitude, in dry air, engineers can get above some of that moisture.

There are other considerations too.

Being in the southern hemisphere, Chile's observatories are not in direct competition with those in the US and Europe that gaze out at different skies.

The country's political and economic stability is also a factor.

If you are going to invest €1bn in a long-term project, there is perhaps no better place in Latin America in which to do it.

"We've always had great co-operation from the government, regardless of which government it's been," says Mr Tarenghi, an Italian who first came to Chile in 1976.

"One of the highlights of this country is the way they support astronomy."

Mr Tarenghi estimates that 20 per cent of the construction investment from big astronomical projects finds its way into Chilean pockets.

The rest goes to high-tech companies in Europe, the US and Asia.

Once the telescope is functioning, the benefits for Chile rise. About 75 per cent of the money spent on operating the observatories stays in the country.

Traditionally, the scientists and engineers who work at Chile's observatories have been European and North American visitors, but that is changing and a homegrown astronomical community is emerging.

Santiago's two most prestigious seats of learning, Universidad de Chile and Pontifical Catholic University of Chile, both offer pre- and postgraduate studies in astronomy, and Santiago's private universities, such as Andrés Bello, are starting to take a keener interest in astronomical research.

"My dream is that the state goes on from here to establish a national institute of astrophysics," says Mario Hamuy, a professor of astronomy at the Universidad de Chile. "That is the logical next step."

But is there anybody out there?

Mr Tarenghi says the new telescopes will help astronomers fill in gaps in their knowledge about the nature of dark matter and the expansion of the universe.

Startlingly, he also predicts they will find evidence of life on other planets within little more than a decade.

"The day that happens – and I forecast it will be before 2025 – it will be a significant event in the history of humanity," he says.

"It will be like Columbus discovering America – another place, another world.

Humanity will change. Knowing that we're not unique will alter our view of how important we are."

Simply building these telescopes in the forbidding landscape of northern Chile is a challenge, not least because the area is prone to earthquakes.

But the engineers at ESO insist that even if a big quake strikes, Alma and the ELT will be shaken but not stirred.

Mr Bond would surely approve of that.

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Telescopic treats for tourists

Scientists are not alone in flocking to Chile to stare at the stars.

Increasingly, tourists are coming here to crane their necks, gaze up at the heavens and try to learn something about the cosmos.

Visitors to the Paranal observatory in northern Chile need to book in advance and can only visit on the last two Saturdays of every month.

Ever since the James Bond film *Quantum of Solace* was shot there in 2008, it has had an extra allure.

Information on visits can be found at: www.eso.org/public/about-eso/visitors/paranal.html

Further south, visitors can go to the oldest observatory in the southern hemisphere at Cerro Tololo near La Serena in the Elqui Valley.

Guided tours are offered in Spanish and English and last approximately two hours.

Again, you have to make reservations in advance: www.ctio.noao.edu/misc/travel.html

Perhaps the easiest observatory to visit is Mamalluca, also in the Elqui Valley. Its telescopes are smaller than at Paranal, but still powerful enough to allow you to see the rings around Saturn.

There are nightly visits with presentations by astronomers. Reservations, while recommended, are not always necessary: www.mamalluca.org

The closest telescopes to Santiago, the capital, are at the Andean Astronomical Observatory (OAA), less than an hour's drive away.

Night visitors can look at the universe through nine telescopes, while, during the day, tourists can peer at the sun through three solar telescopes with special filters: www.oaa.cl

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