

Mata ki te Rangi

Edward Picton-Turbervill

The people of Easter Island sometimes referred to their island as *Mata ki te rangi*, which means 'eyes looking to the sky'. The hundreds of Moai, statues of the ancestors, stood on platforms called *Ahu*, leaning slightly backwards, so that their white coral eyes swept protectively over the island, looking up to the stars beyond, and the voids between the stars.

Some years ago, I had the good fortune to travel to Easter Island. I was able to plan an itinerary that took in ALMA, the famous radio telescope on the Chajnantor plateau in the Atacama Desert. I had the feeling that there was some deep metaphor at play between the Moai of Easter Island, and the telescopes high in the airless mountains.

I arrived in dusty St Pedro, which was chosen as the location for ALMA because it is one of the driest places on the planet, in the midst of an enormous thunderstorm. Indeed, I arrived right at the tail-end of the rainy season, when enormous thunderclouds race down the slopes of the green and gold Andes into the salt depression of the Atacama, carrying rain fresh from the Amazon. All the roads had been destroyed by the rains, and I barely saw the stars for clouds.

The telescope itself sits high up on the Chajnantor Plateau, which in the language of the indigenous Atacameño people means 'the place of landing'. The name of the telescope, ALMA (the Atacama Large Millimetre/sub millimetre Array) is pregnant with meaning. ALMA could be taken to mean 'water' in Arabic, and 'soul' in Spanish, and according to the Atacameño, the stars are the souls of the dead swimming across the sky.

When the authors of Genesis looked upwards, they thought that the stars were set into the firmament, the vaulted hemisphere which God created to shield the Earth from the tremendous pressure of the waters above. The darkness that they observed was the water of chaos, and their God sat somewhere high upon the waters. The Inca believed in two different types of constellation - the light and the dark. Their dark constellations, which were animate, were seen in the darkness between the stars.

We now believe that this darkness is made up of immense voids in the cosmic web. Many of the pinprick points of light in the night sky, which we long assumed to be individual stars, are in fact galaxies, or galactic superstructures - clusters, superclusters, sheets, walls and filaments. And in between these superstructures are voids, spaces without galaxies. Of course, the voids only appear to be empty to our eyes. The entire universe is filled with the cosmic microwave background, and if you look at the voids with a radio telescope, you can witness the smoldering embers of the early universe, which was an opaque, white-hot fog. When we look with a radio telescope, the entire universe, even the starless void, still glows. To quote the Psalmist:

Yea, the darkness hideth not from thee; but the night shineth as the day: the darkness and the light are both alike to thee.

Generally, humans have looked upwards to encounter God, and found Divinity on the high mountaintops. Moses climbs up Mount Sinai to meet with God, and returns with his face shining. But it seems to me that it is within the darkness, the voids and the chasms, the cracks and the gaps and the hollow spaces that we are most likely to encounter the Divine. If I were to build a Church, I would build it over a mineshaft. The spire of the church would be a great void in the central aisle, leading down into the darkness. And there we might find God, walking in search of the Deep.

It is hard not to view ALMA as a sacred site. On cold nights, the incredibly dry air of the Atacama causes water to sublimate, forming thin structures of ice called 'penitentes'. They acquired this name because they resemble a crowd of people kneeling to do penance. The telescopes are surrounded by worshippers, all bowing towards those enormous dishes. The mountains that surround ALMA were viewed as sacred by the Atacameño. At the top of many of the nearby mountains are temple sanctuaries, all of them now deserted, some with woodpiles still intact. It is hard to imagine what an immense pilgrimage it must have been to reach the top of one of these mountains in the past, and ALMA is burnished with the same sense of the sacred. Before I ascended to the telescopes, our guide measured the concentration of oxygen in my blood to ensure that I would be able to withstand the altitude.

ALMA is located in the Atacama Desert because it is there that the band of water vapour, which clouds our sight and shields us from the stars, is thinnest. But not all observatories have to be above the surface of the earth. If you want to look for neutrinos, you need to go somewhere that is pitch black. Though trillions of neutrinos pass through the Earth every second, they scarcely interact with matter at all. When they do, they emit the ghostly blue glow of Cherenkov radiation, a shockwave of light. To see this radiation, you must go where it is utterly, completely dark. In the shadow under the glacier, and in the deep ocean, in the hollow of your lungs, and the marrow of your bones, the darkness is sometimes illuminated by near-weightless particles from outside our galaxy.

The Psalmist has it right:

Whither shall I go from thy spirit? Or whither shall I flee from thy presence? If I ascend up into heaven, thou art there: if I make my bed in hell, behold, thou art there. If I take the wings of the morning, and dwell in the uttermost parts of the sea; Even there shall thy hand lead me, and thy right hand shall hold me. If I say, Surely the darkness shall cover me; even the night shall be light about me.

Christian mystics taught that only by passing through the divine darkness, the Cloud of Unknowing, may we apprehend the Divine. As we are told in Psalm 18:

He set darkness for his refuge and his tabernacle round about him; Darkness of waters, thick clouds of the sky.

Outside of the earth's atmosphere, ten times as many stars are visible than you could ever hope to see on Earth, and astronaut Ed Mitchell describes how 'there is a sense of being swaddled by the universe'. It is a devastating thought that our atmosphere, which protects us from the ravages of stellar radiation, also shields us from the full beauty of the stars. Because ALMA is a radio telescope, it looks into the patches of darkness in the night sky, the voids between the stars. It can see that which we cannot. ALMA stares into the darkness, bearing witness to the cold, dark clouds of matter in the far distant universe, the shattered remnants of the first stars.

ALMA itself is made up of 66 'antennae', large dishes, each of which focuses photons onto a mirror, which reflects them into the 'feed horn', a dark hole at the centre of the dish. The feed horn is the equivalent of the pupil in the human eye, and it was striking to me the visual resemblance between the telescope dishes and the eyes of the Moai on Easter Island. We are used to seeing the Moai with blank sockets, shadows roiling beneath their heavy brows, but in 1979, it was discovered that many of the Moai would have had white coral eyes, with pupils of black obsidian. Both the telescopes at ALMA and the eyes of the Moai are a blank, featureless expanse of bone white, with a ravenous black pupil at the centre, drinking in the dark waters of the heavens.

When observing, ALMA remains perfectly still; on a rock that bucks and shrugs and wobbles, as it orbits a star on the arm of a galaxy, the telescopes point fixedly towards the astronomical zenith, the point on the celestial sphere directly above the observer. This point sweeps day and night across galaxy filaments and superclusters, walls, nodes and voids, structures that are unimaginably vast. This patient stillness of vision does not come naturally to us, but it is the mode of sight that we must cultivate if we are to be truly awake to the world around us. As George Mackay Brown says:

*Fix on one star at last
Any star in the circling star blizzard
That star will take you
Whithersoever to Death and Birth and Love.*

There is a long tradition of trading eyes for wisdom, or blindness as a metaphor for extraordinary vision. Odin traded his eye for wisdom, and Tiresias was blind. Milton's blindness has been posited as an explanation for the incredibly potent portrayal of light and darkness in *Paradise Lost*, and the loss of sight often results in Charles Bonnet Syndrome, where the brain compensates with startlingly realistic yet fantastical visions.

The blocking stone which seals the tomb of Maes Howe on Orkney was designed to be opened and closed from the inside. It is thought that the Neolithic Tomb Builders would shut themselves in the darkness with the bones of their ancestors, in order to meet their Gods. What would we see if we walked into the tomb of Maes Howe, and shut the blocking stone from the inside, and stared into the darkness for an hour, a day, a week, a month? Would we see the souls of the dead, or God walking in search of the Deep? Would we see ancient clouds of dust in the voids between the stars? A torrential rain of neutrinos? Fires burning in the waters above the

firmament? Wheels covered with eyes? The Lord sitting upon a throne, high and lifted up? We would emerge, blinking, into the sunlight, dazzled by the darkness and burning with reflected glory.

When ALMA looks into the shadow, it looks at objects that existed thirteen billion years ago, shortly after the Big Bang, in what is now the far-distant reaches of the universe. It looks at a great cloud of cold dust, which we call A2744_YD4. This cloud was made of the remnants of the first generation of stars, and radiated photons across the night sky in every direction. All that remains of that cloud is now a hollow, luminous sphere with a radius of thirteen billion light years. A thread of these photons was emitted in the direction of Earth.

In the very final moments of the photons' thirteen-billion-year journey in a straight line across the billowing universe, an astronomer requested an image of the dark patch of sky in which A2744_YD4 is located. At the top of the world, 66 antennae were laboriously shifted into a rough spiral across 16km of desert. Complex algorithms spun all 66 dishes to point directly at the cloud as it passed through the astronomical zenith. And at that precise moment, those particles were *observed*. That stream of photons, from a dust cloud that had long since collapsed into stars, fell onto fertile ground. Using the precise location of those 66 telescopes, and a vast stream of binary, humans looked on at the birth of stars that burnt out many billions of years ago.

In a clockwork universe of constant motion, for those few hours, there was a direct line of contact between ALMA and that dust cloud, thirteen billion light years apart. It reminded me of TS Eliot:

*At the still point of the turning world. Neither flesh nor fleshless;
Neither from nor towards; at the still point, there the dance is,
But neither arrest nor movement. And do not call it fixity,
Where past and future are gathered. Neither movement from nor towards,
Neither ascent nor decline. Except for the point, the still point,
There would be no dance, and there is only the dance.*

The stars revolve above us, raining down photons like ash, begging for our attention. Every particle in the Universe calls to every other particle, and our desire to look up to the stars is the immense gravitational pull of a hundred billion galaxies. If we could only insulate ourselves from the jealous Earth, if we could only *look*, we would be swept up into the cosmos.

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In the Atacama, and on Easter Island, those two great gatherings of blind eyes, empty sockets pointed at the skies, stare into the darkness for wisdom. They whisper to us that the world is not

remotely as it appears, but infinitely deeper and stranger, and that the darkness burns with the glory of God.