

Extending Vision

Key Note Presentation

Dr Felicity Spear



Deakin University

– Symposium –

Art, Visualisation and the Cosmos in Education

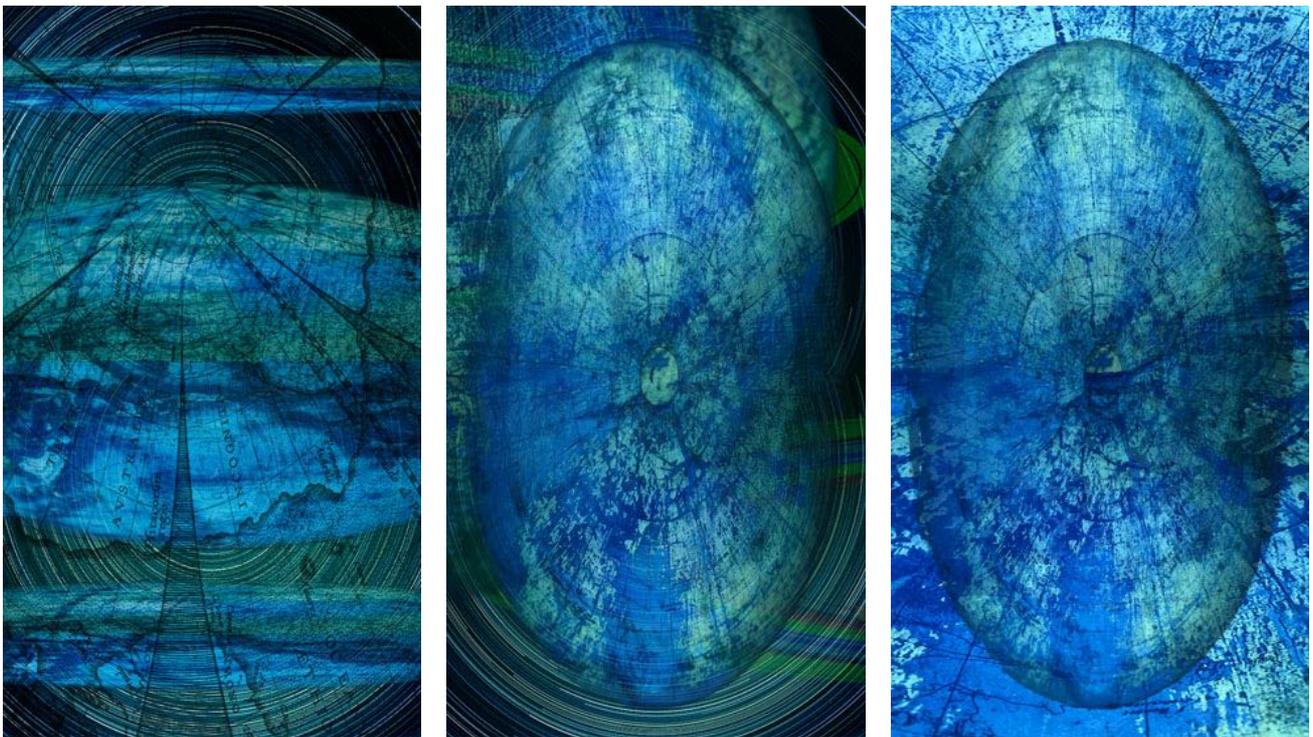
Thursday 5 and Friday 6 December 2019

Deakin Downtown – Level 12, Tower 2, Collins Square,
727 Collins Street, Docklands VIC 3008

Presented by Dr Felicity Spear www.felicityspear.com

During this presentation, I will be showing you documented images which have been selected from some of the exhibitions I have curated, or from artists working in the same milieu. I invite you to make connections between the images and my text. To begin, I'll give you some background about these activities.

In 2007 I completed a doctorate at Monash University. It was titled *Extending vision; mapping space in light and time*. My interest was focused on the way in which the language of art, and technologies associated with light, might stimulate our engagement with the physical world, and by extension the cosmos. I selected as my models astronomy, and the mapping of the night sky. During this research I experimented with a diverse range of media and ideas. This included a mural sized installation of digitally manipulated inkjet prints, a group of paintings, an immersive sound work, (created from star radio frequency samples), a large scale artists book of digital prints (now in the Rare Book Collection at the State Library of Victoria), and a video work. This is documented on my website.



Felicity Spear, *Bi-polar 1,2,3* digitally manipulated inkjet prints on paper, each 40 x 80 cm.

Source material: Star Trails, North and South Celestial Poles, David Malin, Anglo Australian Observatory. Map section Verhaer, *Novus Typus Orbis* 1614, Crux Collection, Rare Maps, State Library of New South Wales. Ultraviolet glove x-rays, Paper Conservation National Maritime Museum Greenwich, U.K. Cassini-Huygens image Saturn's rings courtesy NASA JPL



Gulumbu Yunupingu, David Malin, Felicity Spear, *Beyond Visibility – Light and Dust*, 2009,
University of Technology Sydney Gallery, N.S.W.

In 2009, to coincide with the *International Year of Astronomy*, I curated the exhibition *Beyond visibility: light and dust*. This took place at Monash Gallery of Art in Melbourne, and the University of Technology Gallery in Sydney. It brought together my own work, the work of astronomer and pioneering scientific photographer, David Malin, and that of the late and celebrated Australian Aboriginal artist, Gulumbu Yunupingu. Later I will discuss this exhibition in greater detail.



Felicity Spear, *South – Crux*, digitally manipulated inkjet print, sheet size 230 x 112 cm.

Source material: Analemma. Star trail images , astro-photographer David Malin. Fragments of a17thC. section of Corsali map *Ovalle Historia - Reyno de Chile* 1646 RB2422, Crux Collection of Rare Maps, State Library of New South Wales. Infra red x-ray of 16th C. Hondius globe , Paper Conservation Dept. National Maritime Museum, Greenwich, U.K.

To commemorate the *International Year of Astronomy* in 2009, the National Gallery of Victoria mounted the exhibition titled *Shared Sky*. The exhibited works were principally from the NGV's diverse collection of prints, drawings and indigenous artwork. I was also included and exhibited the digitally manipulated inkjet print *South – Crux*, and the sound installation created from star radio frequency samples titled, *Out there: in light of remote possibilities*.



Group Installations - *Sky Lab* 2015 Counihan Gallery Melbourne and *Sky Lab – Kepler's Dream* 2016 LaTrobe University Visual Arts Centre, Bendigo.

In 2009, I also embarked on the curation of the first of six group exhibitions with the generic title *Sky Lab* and a number of solo exhibitions. These took place over a period of ten years, coinciding this year with the 50th anniversary of the Apollo 11 Moon landing, and humans' first steps on the Moon, This was celebrated in a number of public galleries in Australia in which my work was included. The *Sky Lab* projects emphasised the diversity of contemporary responses by visual artists to the subject of sky situated knowledge and the cosmos.

Although interested in science, these artists do not attempt to emulate ideas in science in some literal way. Rather, they look for overlapping insights, or pose questions about the cosmos and the nature of reality. They reference various systems of knowledge, and relationships between the natural and constructed worlds. These include the history and properties of the lens and telescope, photography, the shared ground between abstraction, mathematics and science, the virtual world of technology, the remote sensed mapping of space, the possibilities for alternative or fictional worlds and the extension of human consciousness, the reciprocity between earth and sky, and between humanity and the natural world. During this time I have also held a number of solo exhibitions including *The Observatory*, *Orbit* and *Umwelten – ecofields and other universes*. I also curated the group shows *Future Tense*, *Fossil – a slow acting violence* and *Parallel Universe*.



Felicity Spear, *Umwelten – ecofields and other universes*, 2019, oil on wood work on paper, Stephen McLaughlan Gallery, Melbourne.

So what happens when artists and scientists share a field of inquiry? We know that art and science are not the same thing. But both pursuits are driven by curiosity, observation, imagination, speculation and chance. Both engage in fields of research which involve the use of analogy and metaphor, the testing of ideas, and finally the remaking of experience. Astronomers and artists also share an interest in the fundamental physics of time, light, space, geometry and matter. Increasingly it seems our thinking is determined by a set of interacting processes and relational fields where space and time are purely relative phenomena, and matter and energy are interchangeable. Is it possible to imagine that art and science are able to uncover *overlapping* insights about the nature of the cosmos?



* 44. STUDIES OF THE MOVEMENTS OF THE HUMAN FIGURE.
RED CHALK, C. 1495.
WINDSOR CASTLE, ROYAL LIBRARY



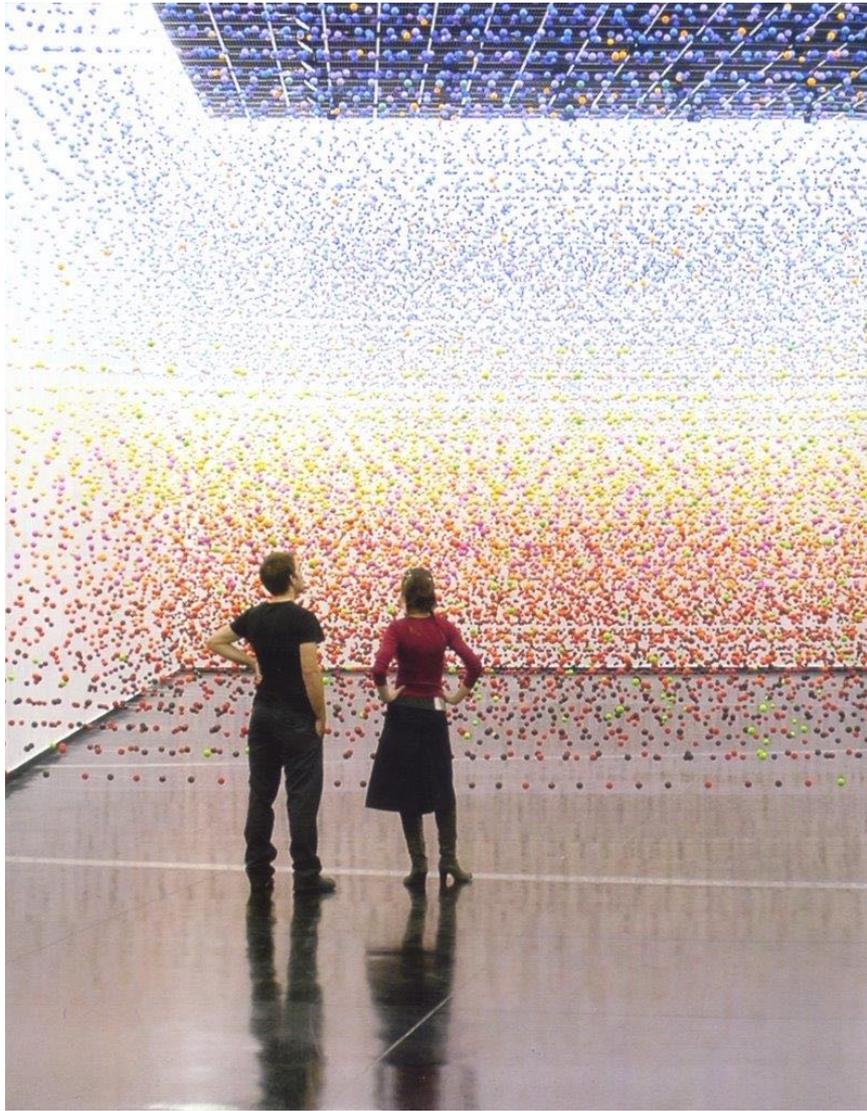
* 45. STUDY OF THE MOVEMENTS OF THE HUMAN FIGURE.
RED CHALK, 1495.
LONDON, VICTORIA AND ALBERT MUSEUM

Leonardo da Vinci , *Studies of the movements of the human figure*, c 1495, red chalk, Windsor Castle Royal Library, Victoria and Albert Museum, London.

2019 marks the 500th anniversary of the death of the renowned Renaissance polymath Leonardo Da Vinci . The ‘rebirth’ of interest in Middle Eastern, and Classical Greek and Roman culture, provided fertile ground for the emergence of the scientific revolution. Leonardo, artist and a scientist before science, was an auto-didact. He received no formal education. He gained experience in workshops, as an apprentice, learning various arts and crafts. Curious and imaginative, observant and experimental, he used the skills of hand and brain, drawing, making, inventing and experimenting to acquire knowledge. He believed art was indisputably connected with science and nature. While it takes years to achieve technical skills, it also takes years to achieve a way of thinking. So what might we learn from Leonardo ? Don’t limit yourself to one field of study. Find new ways of saying things that seem appropriate for the way we live now. See learning as a life-long process.

Recently I heard a radio interview with Jean Sebastian Jacques, the CEO of the international mining company Rio Tinto. He was describing what he thought the new breed of educated workers might look like, accounting for the rapid changes in technology. He spoke about attracting young people into STEM. To do this he emphasised the need for a broader education. He suggested that on the end of STEM there should be an A for art.

The recent development of the Global Science Gallery Network reflects this thinking. This initiative, in its own words, aspires to 'encourage the development of creative, agile thinkers and doers for the 21st century – perceptive problem solvers, who can bring together insights from diverse disciplines by moving effortlessly between these core areas.' A fine and aspirational ideal which demands that we re-think the way we educate young children. Establishing thematic connections between different fields of knowledge at a very early age might break down the current barriers which limit a child's accessibility to wider knowledge. And teaching children how to communicate effectively should be part of the process.



Nike Savvas, *Atomic: full of love, full of wonder* 2003 (detail), painted polystyrene balls, nylon, wire, electric fans, Australian Centre for Contemporary Art Melbourne.

Science, evidence based and peer reviewed, is generally regarded as our most reliable knowledge system for understanding the physical world. However, no good scientist believes that their research offers the last word on a given subject. Of course this is also true for artists who reference the physical world. However, artists search for insights which allow for subjectivity. Artists are not inclined to be constrained by the evidence, as would scientists. We do however, like them, speculate about the possibilities for other dimensions of reality, which might reveal insights about ourselves and the environment we inhabit. Artists tend to 'point to an idea' rather than demonstrate it. This makes possible the observation of things outside 'art', to be seen in new ways and in different contexts. It could be said that artists create another dimension of the real, while offering something different from real life. It is in this context, that I believe we can benefit from conversations between art and science.



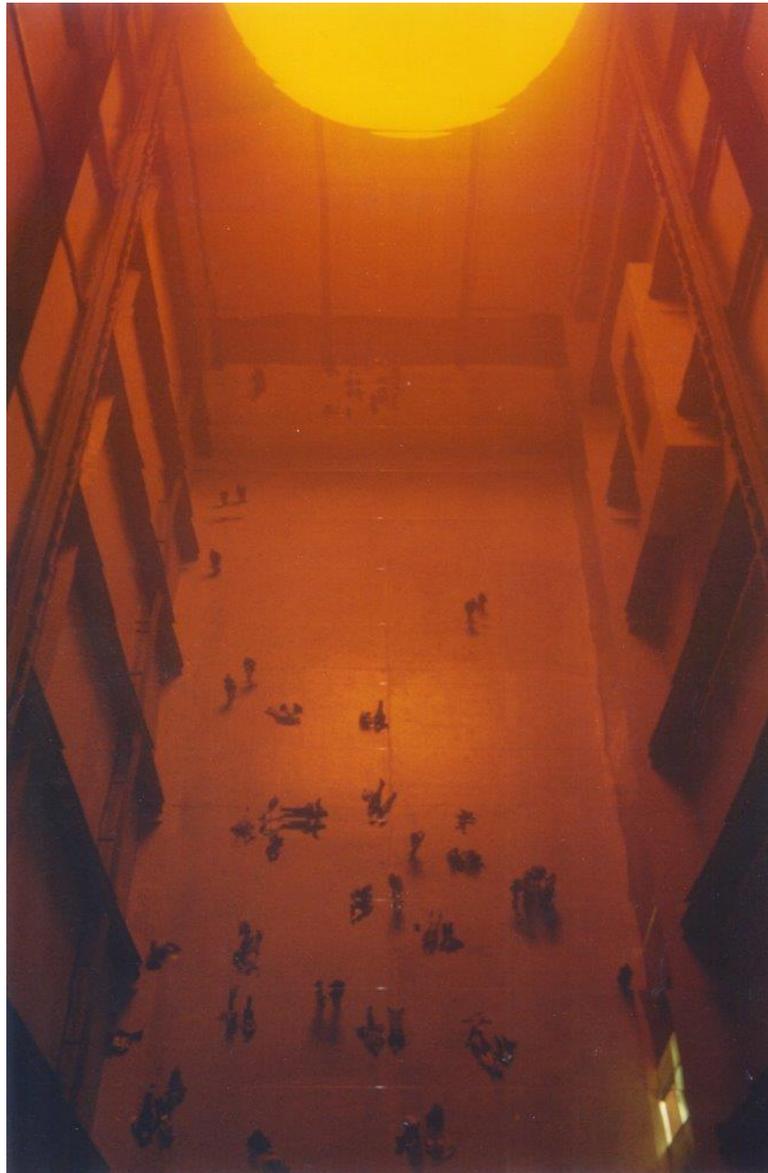
Felicity Spear *Somnium- Kepler's Dream*, 2016, inkjet print, Sheet size 30.9 x 110 cm.

Photograph total Moon eclipses, (Queensland – April 2014, Victoria – April 2015).

Other images: (Northern Territory, European Arctic, Western Australia).

Deakin University Art Collection.

So what sparked my interest in this field of inquiry ? As a child I lived in the country. There, the night sky could be viewed with clarity and wonder, far away from the glow of city lights. As a ten year old, I peered into the night to see Sputnik One, Earth's first artificial satellite. It was a tiny constant light, gliding across the sky, like no other heavenly body seen before. In my early twenties, I witnessed humans walking on the Moon. Fifty years later in 2019, the film *Apollo 11* replayed it all. In recent times I've developed the habit of photographing the Moon and sometimes I use these images in my work.

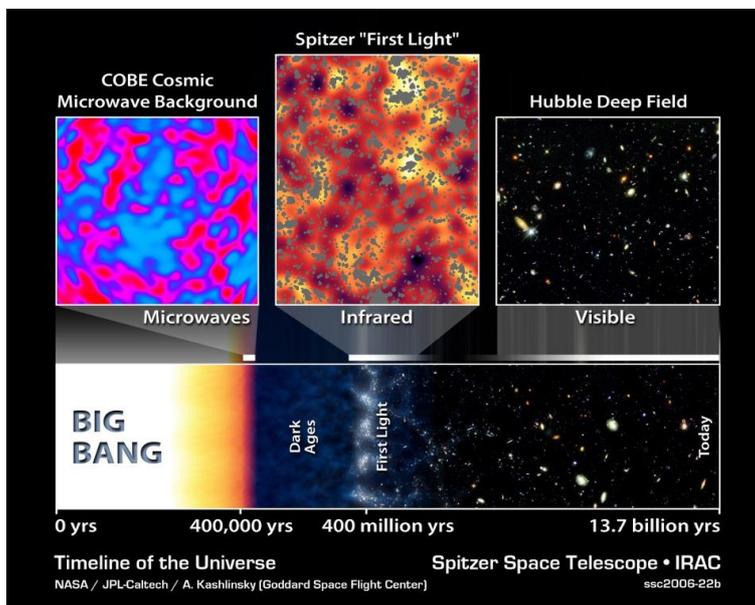


Olafur Eliasson, *The Weather Project* 2003 (detail), light, mirrors, Tate Modern London.
Photo Felicity Spear.

From a cosmic perspective, science tells us that Earth is a totally insignificant speck of dust, in an expanding and accelerating Universe, which may eventually disappear. The knowledge that we *Earthlings* are made from that dust, and part of something unbelievably bigger than ourselves, requires another way of thinking. In his book *The Artful Universe*, cosmologist John Barrow makes the observation that, 'we feel like the Universe's only child, and that feeling has many consequences'. [1] John D. Barrow, *The Artful Universe*, (Oxford: Clarendon press, 1995), p.44. What if we *Earthlings*, travelling through the Universe on *Spaceship Earth*, are destined to cosmic solitary confinement with no one else to talk to and nowhere else to go? But over time, and with new technologies, the dividing line between *out there* and *back here* is becoming increasingly blurred. It's changing our understanding of time and space.

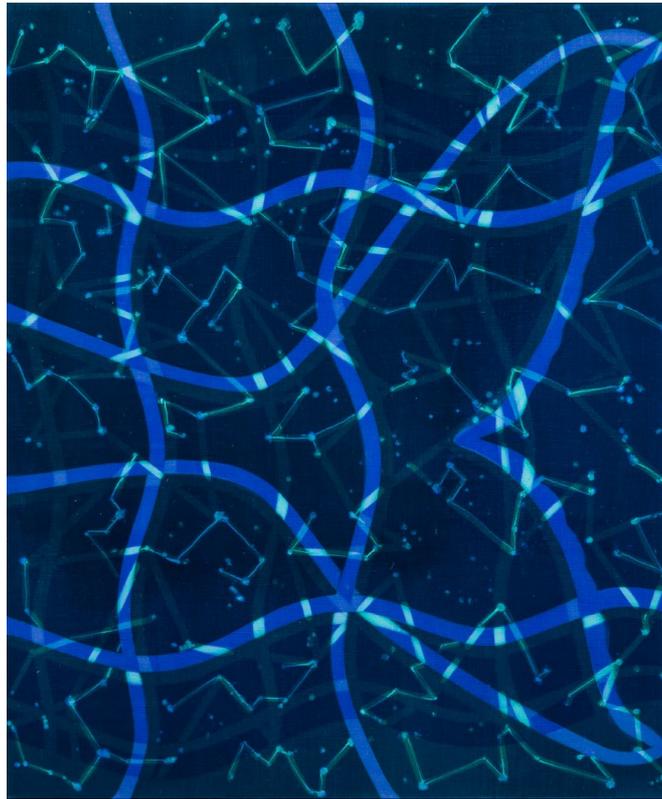


Cornelia Parker, *Cold, Dark Matter: an exploded view*, 1991, Tate Modern, London.

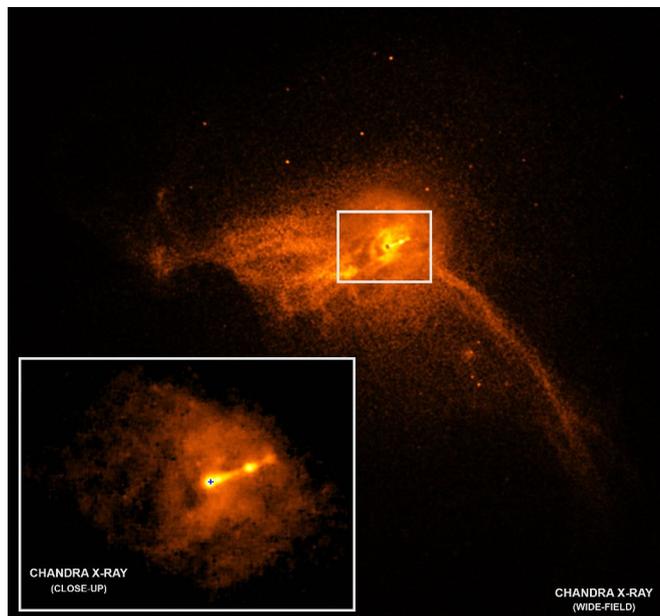


Big Bang -Timeline of the Universe, courtesy NASA.

Let's fast forward 500 years, from Leonardo and the Renaissance, through the European Enlightenment, and the Scientific Revolution, to 2019. We are witnessing a rapidly changing technological and expanding world. Early in the 20th century, our understanding of the cosmos changed irrevocably. We now live in an evolving Universe, no longer a static one. Georges Lemaître proposed the big-bang theory, observationally confirmed by Edwin Hubble, Einstein developed the theory of relativity and an extra dimension of space as time, and Hawking developed his theory of cosmology, hoping to unite the general theory of relativity and discoveries in quantum mechanics, into a unified theory of physics.



Felicity Spear, *String Theory*, 2013 oil on linen, 76 x 90 cm.
Geelong Gallery Collection.



Black Hole 2019, courtesy NASA.

Not to be daunted, Hawking, in his attempt to find a single mathematically persuasive theory of everything, drew on earlier research about String Theory. String theory suggests that the tiniest levels of particles are fundamentally like little loops of string, vibrating at different frequencies. They reveal the behaviour of space-time on a miniscule

scale, in quantum terms. Hawking's theoretical predictions about the existence of black holes and the particle activity at their edge, has advanced this theory.

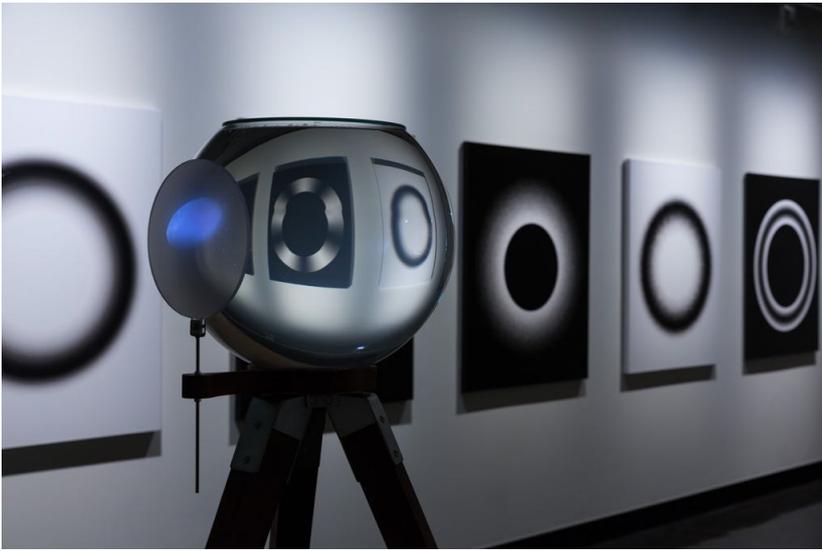
In Hawking and Mlodinow's book *The Grand Design*, I tuned in to a comment made about model-dependent realism. This proposes that if two models accurately predict the same events, one cannot be said to be more real than the other: rather we are free to use whichever model is most convenient, each of which is a good description, to some extent, for a range of situations. This not only applies to scientific models, but also to our conscious and subconscious mental models, having in mind that observing and perceiving are shaped by the interpretive structure of the human brain. The best one can say is that something is probable.

Model dependent thinking suggests to me the overlapping territory between art and science today. We make models in science, in art and in everyday life, but just as there is no flat map that is a good representation of the earth's entire surface, there is no single theory that is a good representation of all observations, in all situations. Certainty has been challenged by quantum physics, which argues that at any particular point in time, nothing is certain, anything is possible. There is always a spectrum of possibilities. Whether we're aware of it or not, this knowledge is changing the way we see ourselves.

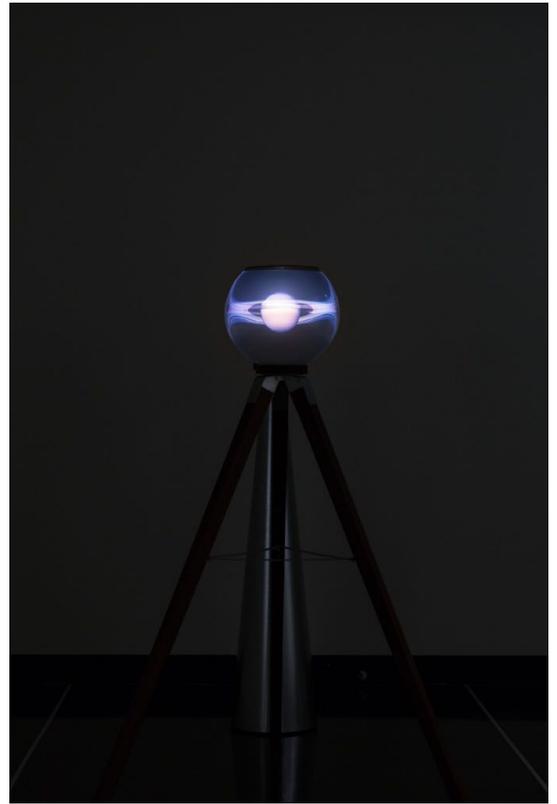
Although the ineluctable fact remains that our bodies are our referents, direct experience cannot account for phenomena beyond the visible. Through computer simulations physical space seems to be dematerializing, mapping a new form of reality generated by electronic data. What is required of the artist, or the scientist, is the creation of models or mental constructs which, sometimes in an abstract way, are able to become projections across space and time. The artist and writer Vik Muniz says of the model:

'[i]t marks the turning point between mind and matter. While artists create models that expand our picture of the world beyond its physical reality, scientists make models that expand our understanding of the physical world beyond the limits of perception. In both cases a mental image is tested against material – but while the artist adapts matter to his imagination, the scientist adapts his imagination to what he discovers about matter.' [2]

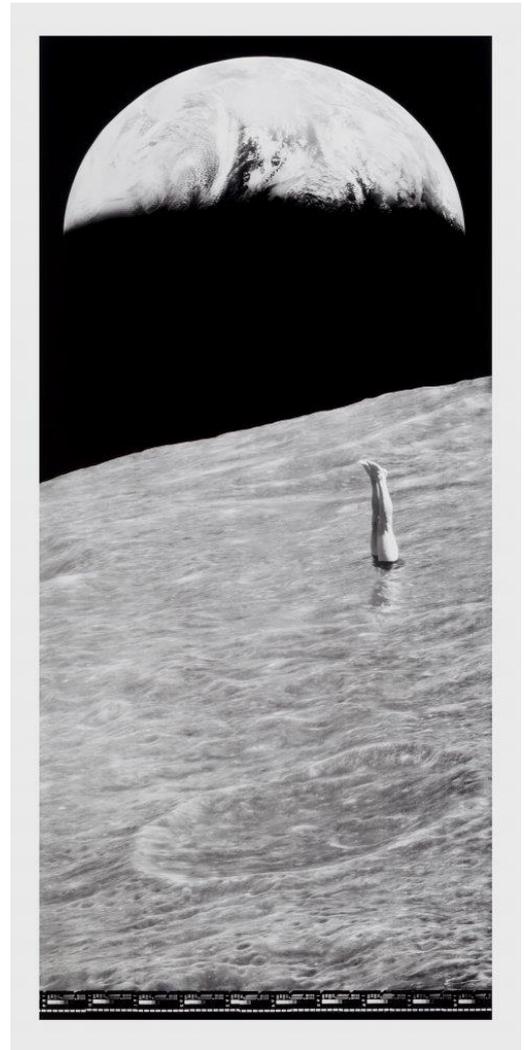
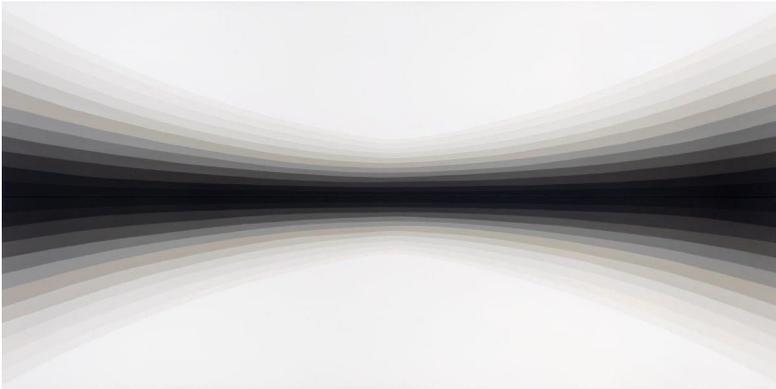
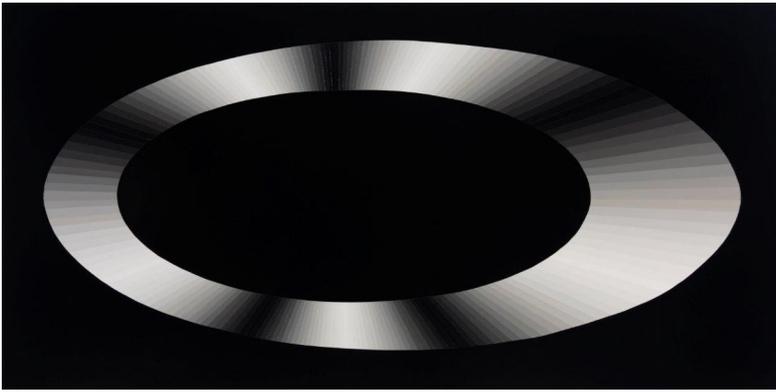
– Vik Muniz, *Reflex A Vik Muniz Primer* (New York: Aperture Foundation, 2005, p. 177.



Daniel Armstrong, *Aqua Optica – Planet x*, mixed media,
Magda Cebokli, *Probability Monochrome*, acrylic on linen,
installation detail, Sky Lab 2015 Counihan Gallery,
Melbourne.



Throughout history an understanding of light, optics, space and geometry has evolved to reveal greater knowledge of the cosmos, and our place within it. What interests me is the significant paradigm shift which took place in 17th century European culture. This period is often described as the age of observation. The earliest known telescope appeared in the Netherlands in 1608. A revolutionary invention, extending human vision beyond the naked eye. Italian astronomer Galileo, with this *optik tube*, then mapped an unseen part of the night sky, confirming Copernicus' theory of a heliocentric planetary system. The understanding of light, time and space underwent a seminal shift. We too easily forget how much more of the Cosmos is visible to us now, several hundred years later.



Magda Cebokli, *Foci* 2016 & *Kepler's Horizons* 2016, acrylic on linen, 72 cm x 154 cm.

Felicity Spear, *Somnium – Kepler's Dream* 2016, pigment inkjet print, 100 x 219 cm. (Original images - *Diving Man* - Denmark, 2014, photograph F. Spear. Restored: *First Image of the Earth from the Moon*, Lunar Orbiter 1, 1966, Credit: NASA/LORP. Lunar Orbiter Image Recovery Project, 2008.)

Of the many thinkers who have developed our knowledge of the Cosmos, I think Johannes Kepler, the 17th century German mathematician and astronomer, is a star. A key figure in the scientific revolution, he found himself caught between two worlds of thinking, the rational and the mystical. He struggled with religious dogmatism and its rejection of science, the echoes of which are still reverberating in our post- modern world. Refuting the Classical notion that planets orbit around the sun in perfect circles, he developed his revolutionary theory of the elliptical orbits of planetary motion. As we all know, this remains prescient for Space exploration today.

Kepler wrote many scholarly books on astronomy, but I'm interested in his fictional narrative titled *Somnium*, (*The Dream*). It was in a sense a 'science fiction'. Written as a guide for an adventurous lunar expedition, he suggested a possible future by imagining from his observations and calculations, a way in which humans might travel to the moon. He reasoned, that by taking people to the moon vicariously and having them stand stationary there, he could show them the Earth in motion, and demonstrate the Copernican theory and Galileo's findings.



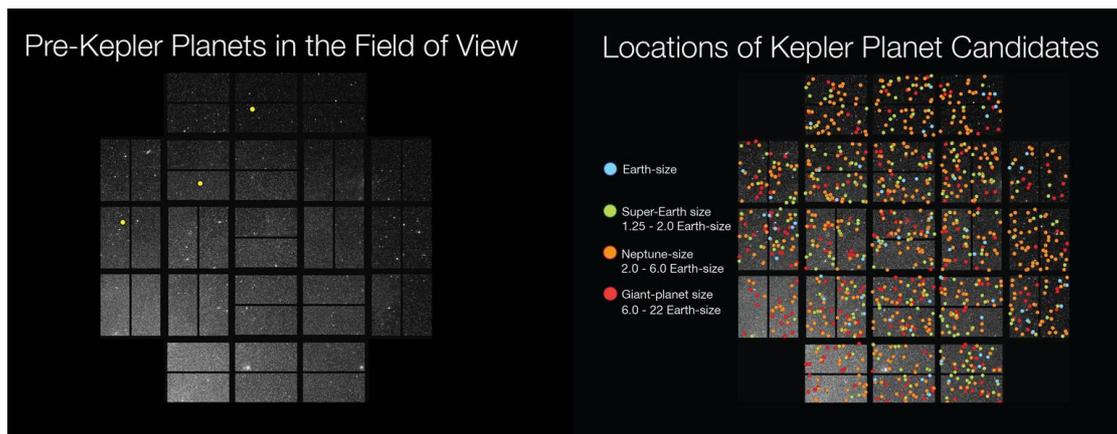
Sam Leach, *Proposal for Owl Lunar Extravehicular Helmet* 2019, oil and resin on wood, 50 cm x 50 cm, in group *Parallel Universe* 2019. Courtesy Sullivan and Strumpf Gallery, Sydney. NSW.

Sam Leach, *Simplified Asteroid*, 2014, 30 cm x 30 cm oil, resin and 3d print based on NASA asteroid data.

Today, projected space stations and dreams of bases on the Moon and Mars, create the possibility of humans escaping the confines of the Earth, and becoming an *inhabitant* of the sky. Scientists are suggesting that it might even be possible one day to *terra-form* or *Earth-shape*, by modifying the atmosphere of a planet like Mars, or a moon, in order to make it habitable for humans. Such propositions remind us of the role that science fiction plays in conceiving all kinds of alien life forms and possible worlds existing in other parts of the Universe. There's now a small but growing community of aspiring space colonists prepping for life on Mars.



Paul Uhlmann, *Camera Obscura*, and detail of projected image, 2016, *Sky Lab – Kepler’s Dream* 2016, LaTrobe University Arts Centre, Bendigo.



21st Century Kepler Telescope (courtesy NASA).

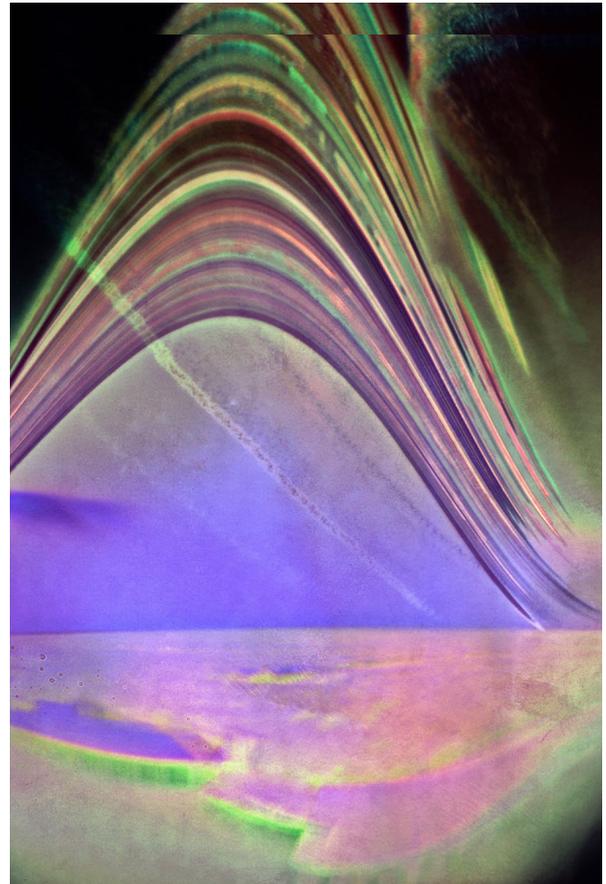
Kepler’s studies of optics using a ‘camera obscura’, and his observations of light and lenses, revolutionised the design of the earliest telescopes. And by extending our view he gave us a sense of belonging to the Cosmos and to the physical world. In the 21st century, it’s been rewarding to see NASA paying homage to Kepler with the development of the Kepler Mission. The Kepler telescope has revealed our night sky to be filled with billions of hidden planets, in, or near, the habitable zone of our Milky Way Galaxy. Perhaps we are not alone?

The invention of more complex telescope technology has not only advanced the mapping of the cosmos, but also the politics of commerce and colonisation which continues to this day. For artists, these new instruments for seeing linked painting to the study of vision, the effects of light and life-like appearances. Naked eye, camera obscura, lens, mirror, telescope, all became techniques for ‘picturing’ the world.



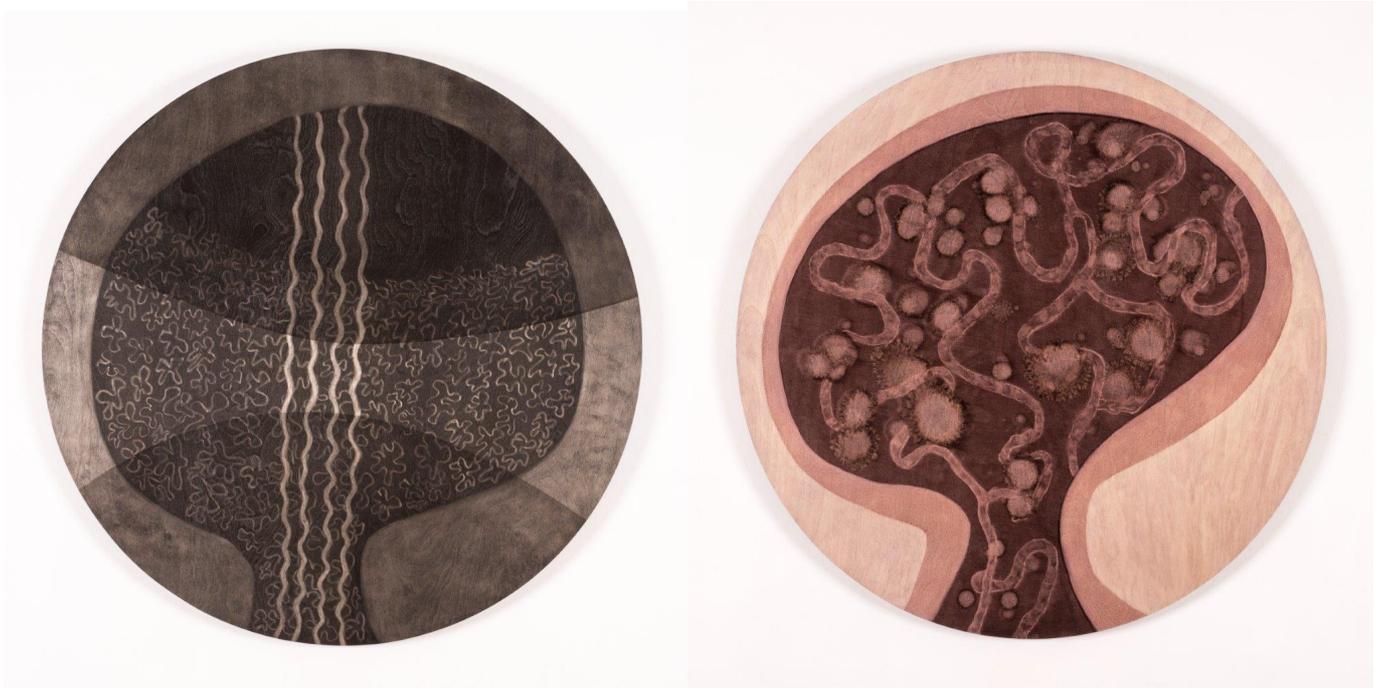
Lesley Duxbury, *Night Vision(s) – Aurora Borealis* (detail) 2016, inkjet print of photograph on aluminium, 200 x 300 cm.

Tarja Trygg, *Motion / Rotation of the Earth*: 2015, pigment inkjet print of solargraph. Pinhole exposure 6 months, Namibia, Africa.
Image 106 x 148.58 cm.



Through technologies associated with observation and image-capture, light shapes human consciousness. The camera's ability to illuminate the otherwise imperceptible is especially evident in the field of astronomy.

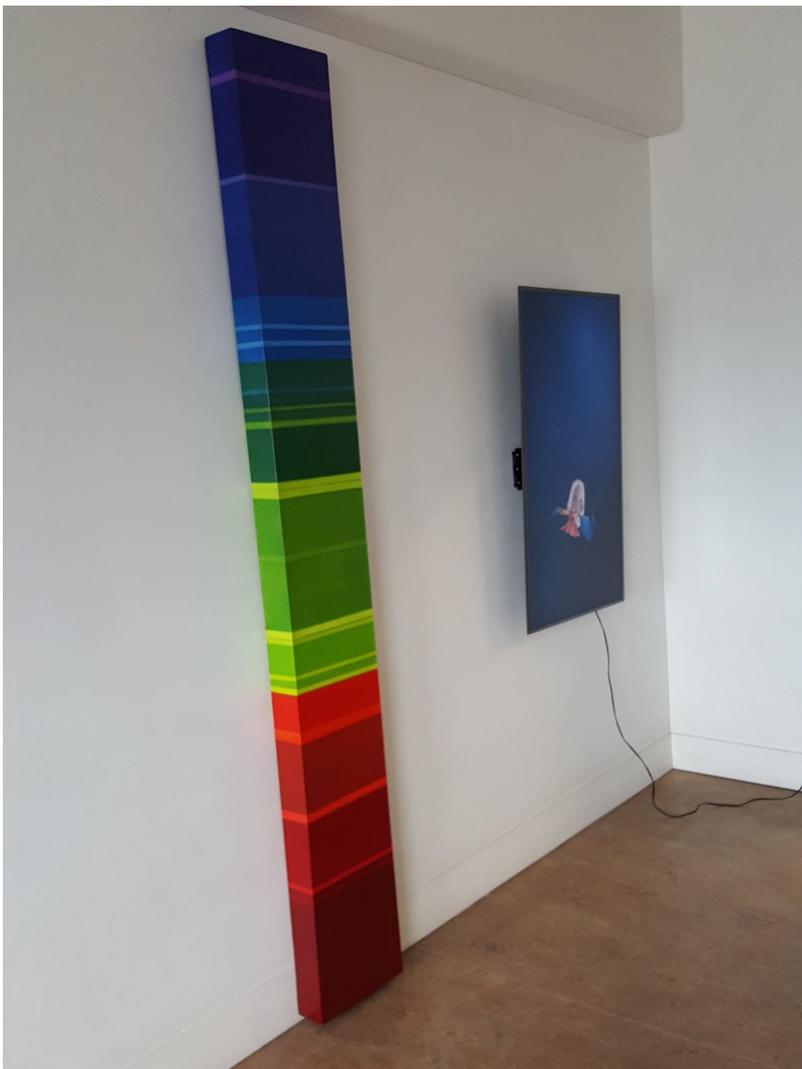
Imaging has come a long way. From the creation of Kepler's camera obscura, to the telescope, the analogue camera using light sensitive film, and now, emerging from Einstein's research into the photo-electric effect, images captured with remote sensing technology and the charge couple device.



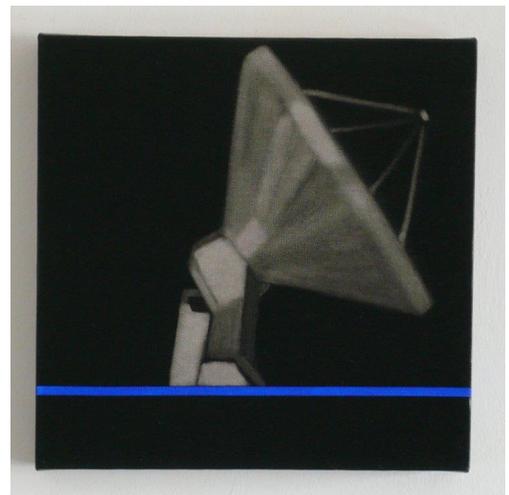
Felicity Spear, *Umwelten – ecofields and other universes*, 2019, oil on wood, diam. 90 cm.
Courtesy Stephen Mc Laughlan Gallery.

We accept the reality of the world with which we're presented. But so much is beyond the full range of our senses. Our brains are tuned to detect an extremely small fraction of the surrounding reality. Different animals in the same ecosystem tune in to different environmental signals. These are fundamental to their communication and signification. The human sensorium is enough for us to get by in our own ecosystem, but it does not approximate the larger picture.

We humans could be described as carbon based bipeds. Life as we know it could not have begun without the formation of carbon, the physical basis of all living organisms. It is electronic data, remote sensing and computer simulations which are allowing astronomers to examine and map the characteristic fingerprint or barcode which these elements reveal in the light coming from stars. It is the forensic evidence for our existence here on Earth. Our reality, once tangible for all our senses, is now understood as a pin point in an unfolding and much greater remote sensed reality.

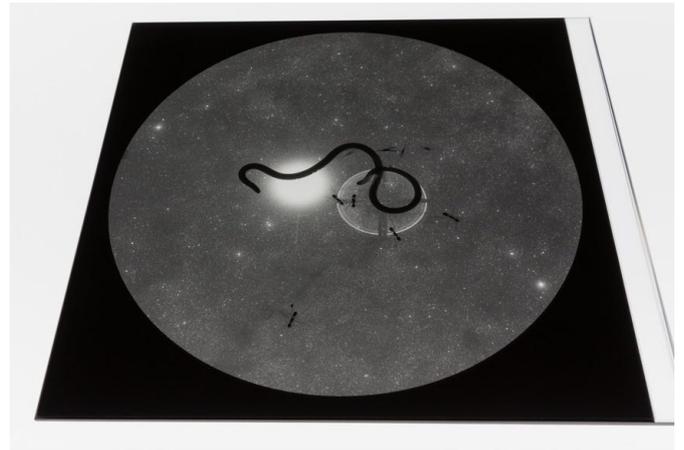


Felicity Spear *Atomic-my carbon copy* 2011, oil on linen, 240 × 30 × 10 cm.
(Short-listed Geelong Contemporary Art Prize).



Expanding Spectrum, oil on canvas,
90 × 76 cm.

How does the artist translate human sensory experience into a world observed with instruments? The position of 'painting', has been the subject of ongoing debate, virtually since the end of the nineteenth century. Then, photography emerged as a strong competitor in the depiction of reality. These influences have shaped contemporary extensions of the idea of painting, both in content and in choice of medium. The act of looking, seems now to be also the act of analysis. The invisibility of phenomena is revealed through the filter of a machine-produced visibility, where computerized imaging processes reveal the elusive materiality of light.

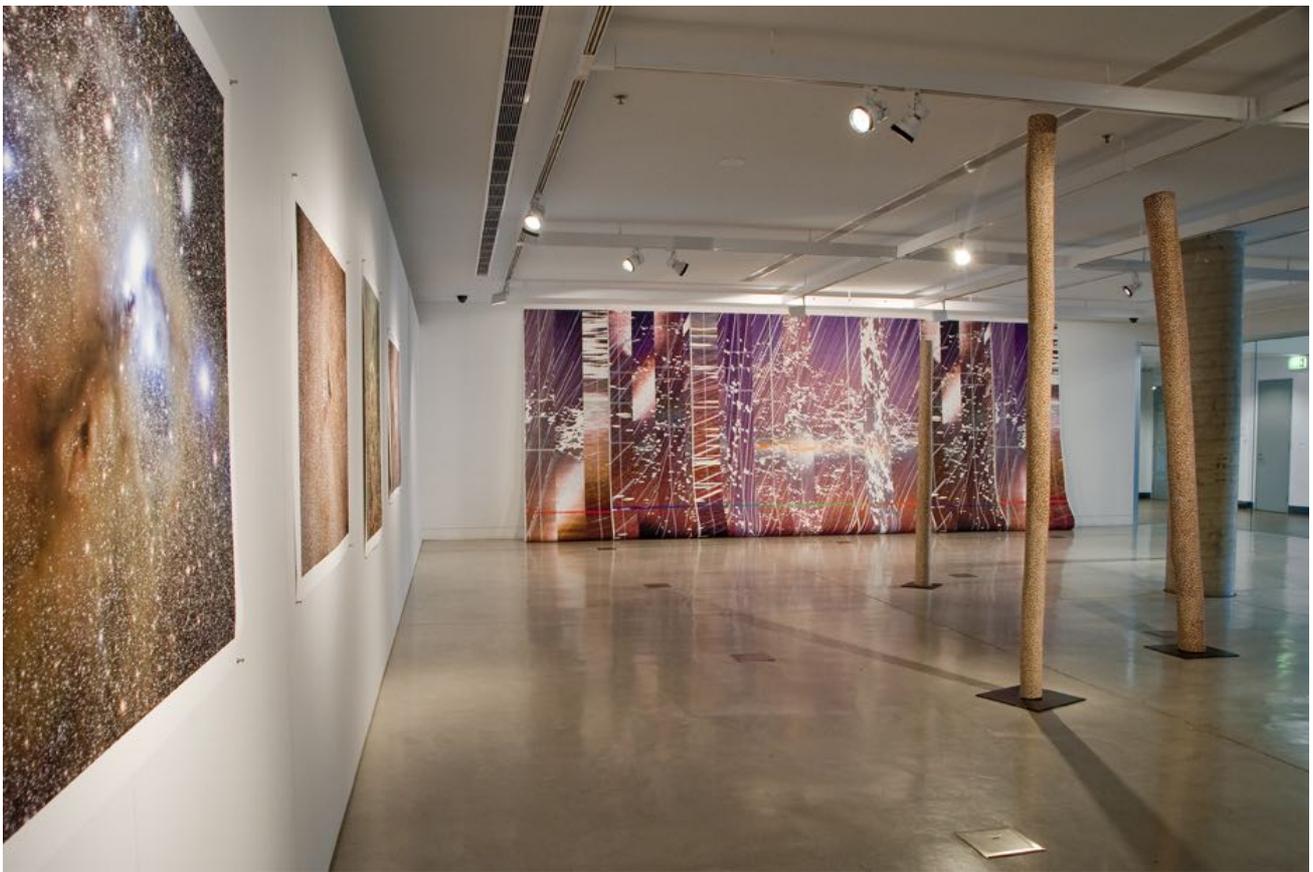


Syzygy 1/Transit of Alpha Centauri 2011, two plates, camera-less toned gelatin silver 'shadowgram' images created by exposure to ambient starlight falling on dry bed of Lake Tyrrell in the Victorian, mounted on starfire glass pane. 33m x 35m x 4m. Sky Lab, Counihan Gallery, Melbourne.

Harry Nankin *The Age of Loneliness 3 (Damselfly nebula)*, 2018 ink jet print, (plein air silver gelatin film photogram), 111 x 104 cm.

So what do we make of the cosmic signs in our everyday world? Do we see Earth as a planet, with all its complex biodiversity, or merely an amalgam of human-designated territories? My interest in the physical world identifies with Kepler's. It was Kepler's overriding desire that through an awareness of the physical world, and by observing the movements of the cosmos about them, humans would come to realize the odds against them, in the grip of the vast forces shaping their environment. Artists who are inspired by scientific interpretations of Nature, are inevitably confronted with ecological concerns. Can we keep remaking the natural world on the basis of new understandings, or is Nature, for all its resistance and infinite depth, headed for defeat?

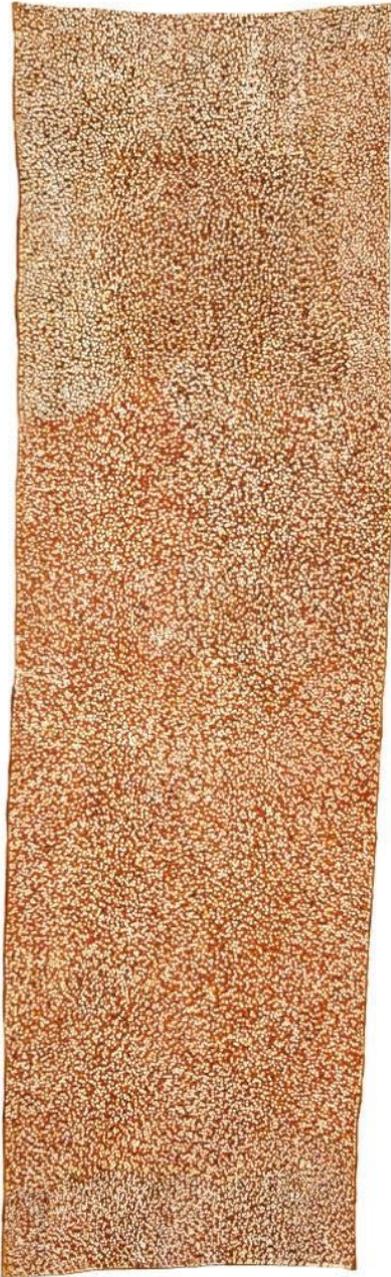
Sixty years ago, in 1959, C.P. Snow delivered his famous Rede Lecture, *The Two Cultures*, drawing our attention to the growing divide between the humanities and sciences. He stressed the need for a greater degree of literacy, in both scientific and cultural respects. The increasing specialization and complexity of science, has meant that in general the public mind sees science as inaccessible. This has taken place in the context of a technologically driven and rapidly changing globalised world. As our perspective changes and we find ourselves challenged by the urgent problem of sustaining life and biodiversity on Earth, new conversations between art and science, in both Western and Indigenous cultures, have the potential to contribute to new thinking.



David Malin, Felicity Spear, Gulumbu Yunupingu, *Beyond visibility: light and dust* 2009, mixed media, University of Technology Sydney Gallery.

Photo Paul Pavlou

With this in mind, and returning to 2009, the *International Year of Astronomy*, I'll describe the exhibition *Beyond visibility: light and dust*. It brought together my own work, the work of astronomer and pioneering scientific photographer, David Malin, and that of the late and celebrated indigenous Australian Aboriginal artist, Gulumbu Yunupingu. Each of us created work which focused on the history of human efforts to make pictures of whatever lies beyond Earth's atmosphere. Together, these works reveal how various systems of knowledge have sought to make sense of the cosmos, and our place within it.



Gulumbu Yunupingu, *Garak – the Universe*, 2008, natural pigments on wood, installation detail, Monash Gallery of Art.

Gulumbu Yunupingu was an elder member of the indigenous Yolgnu people of North East Arnhem Land, situated on the edge of Australia's Gulf of Carpentaria. For this exhibition, Gulumbu constructed bark paintings and *larrakitj* or memorial poles, titled *Garak – the Universe*. For indigenous Australians, the Earth is reflected symbolically in the sky. Aboriginal cosmologies identify certain celestial bodies, as well as the spaces of darkness in between them, to be significant precursors of ancestral knowledge. The evidence of this knowledge is then embedded in sacred objects. The idea that meaning exists beyond visible perception, is a grounding principle of ancestral revelation, and one that is transposed into Yolgnu aesthetics. Just as the darkness in the sky represents knowledge beyond the visible, these objects, often protected from public view, represent revelations of ancestral law.



Gulumbu Yunupingu *Garak*, Felicity Spear *Deep Field*, installation detail, Monash Gallery of Art.

Like an x-ray view, Gulumbu's intricately detailed surfaces, painted in natural pigments, suggest the invisible depths of the Universe. They also represent the metaphorical mapping of the cycles and atomistic interconnectedness of all life. As we wander through this forest of hollow logs, wrapped around with subtly layered variations of patterned star forms and dot-like particles of paint, it seems as if we are immersed in the wide expanse of the night sky, as in a forest of stars and galaxies. For Western eyes, they suggest subliminal mathematical relationships which link art to science, metaphysics and epistemology, and to the universal and the culturally specific. With a humanist eye, Gulumbu focused her meditations about the Universe on the links between people on earth, and the night sky.



David Malin, *Beyond visibility: light and dust* 2009, mixed media, installation detail,
University of Technology Sydney Gallery.

Photo Paul Pavlou.

In this exhibition David exhibits six large-scale inkjet prints of his astronomy photographs, wide field views of deep space objects. They are celestial phenomena found in the southern sky. They map the vast multitudes of starfields in the Milky Way and, between them, dark clouds of dust, like particles of sand, from which we and the stars are made. They were selected not only for their relationship to our own Milky Way galaxy, but also because, when seen in the context of Gulumbu's work *Garak*, and my own work *Deep Field*, they create links philosophically, intellectually and aesthetically.

While working as a photographic scientist at the Anglo-Australian Observatory, David developed innovative imaging processes. These enabled considerable enhancement of celestial bodies, most of which represent phenomena beyond the human eye. These pioneering analogue photographs captured the first true-colour images of deep space. Taken with a prime focus camera mounted in a cage at the Observatory, David explains the process in his book *The Man Who Colours The Stars*:

'[they are taken] with three black and white exposures through separate coloured filters of red, green and blue. These are then superimposed onto photographic film, resulting

in images of stars with their actual colours, thus giving an indication of their age, size, temperature and evolutionary history.'

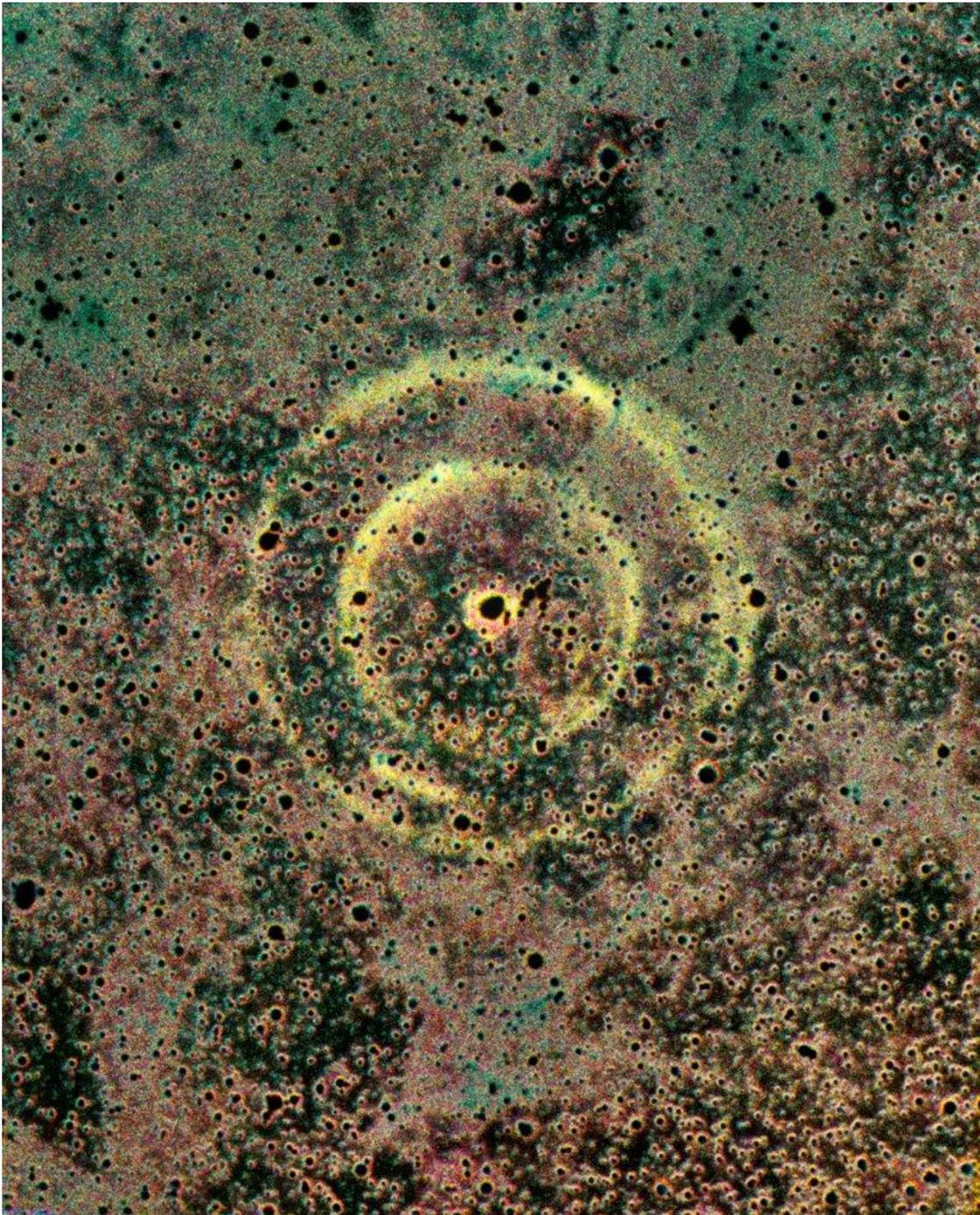
[3] David Malin, *The Man Who Colours The Stars*, <http://hoa.aavso.org/postermalin.htm> p.1-2, [accessed 25/08/2006].

Over twenty years, and with an allotment of telescope time usually 5-8 nights a year, David captured fewer than 200 pictures, some of which have taken years to produce. Since the early 1990s, when silver – based astrophotography was largely superseded by digital sensors, many of the technical advances Malin introduced to the field, have been carried over to processing astrophotography on computers.



David Malin, *uks 037a Corona Australis reflection nebula* 2008, pigment inkjet print.

Of the image *Corona Australis reflection nebula*, with its globular cluster NGC 6723 , 30,000 light years distant in Sagittarius, David points out that: ' almost all the nebulosity in the image is starlight, reflected from minute grains of dust, some of which gather into darker condensations, 'molecular clouds' blotting out the background stars while the brighter ones are embedded in it.'



David Malin, *aat 066 Light echo of supernova 1987A* 2007, pigment inkjet print.

In the image, the *Light echo of supernova 1987A*, David has captured a self-destructing star in the large Magellanic Cloud close by our Milky Way galaxy. Describing it he says : 'It exploded in a brilliant flash of light visible to the naked eye. Some light was deflected by two sheets of dust near the star. These light echoes, recorded in a series of six images, (the last being about five years after the appearance of the supernova), appear to expand with time. This light has taken 170,000 light years to reach us and was at its brightest in May 1987.' When we look into these images we are looking at things as they were then, not as they are now.



Hubble Deep Field 1996 Image courtesy NASA.

In *Beyond visibility: light and dust*, I exhibited a seven-panel mural-sized work of inkjet prints on paper. The title of my work, *Deep Field – interconnected euphoria or the overview effect*, is both a homage and a playful reference to this iconic photograph the *Hubble Deep Field* (1996), see www.hubblesite.org. This image revealed for the first time a core sample of the extent of the Universe's observable limits. It was captured by the famous Hubble Space Telescope's Wide Field and Planetary Camera. This changed the way we see ourselves in relationship to our history and our place in the cosmos, just as Galileo's telescopic evidence had four hundred years earlier.



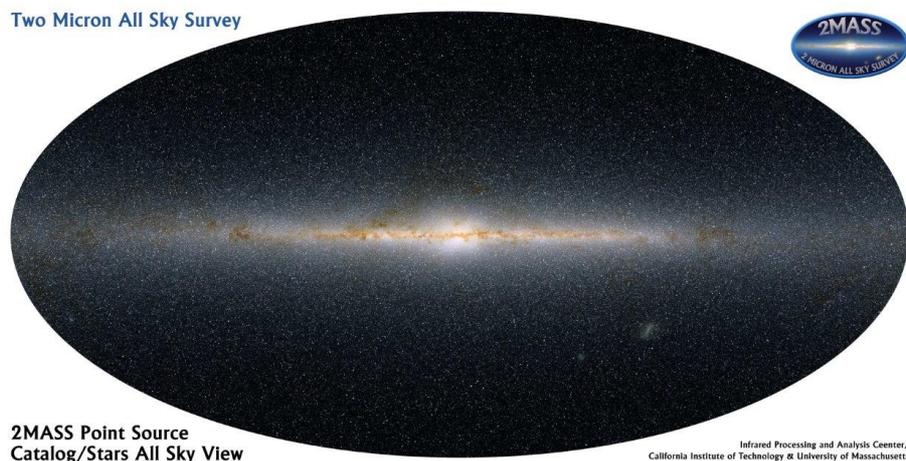
Felicity Spear, *Deep Field – interconnected euphoria or the overview effect*, 2007, 7 inkjet prints, 700 x 350 cm. University of Technology Sydney Gallery.

As technology stands in for first-hand sense experience, so mapping stands in for space. It gives a form of visible reality (the map), to an invisible reality (the space being mapped). *Deep Field* revisits the idea of a seventeenth century mural of the heavens, or alternatively an all-encompassing fifteenth century *mappae mundi* or world map, in which different conceptual frameworks and ideas were explored. This work is a speculative and imaginary map of the depths of the cosmos seen at vastly different distances from Earth. The images have been created from layers of time lapse star trail photography, computer images from NASA, and visualized maps of hidden phenomena found at different radiations, and depths, in the night sky.

Like a photographic 'still', frozen in time, everything is seen simultaneously through the layers of data at different magnifications and different dimensions.

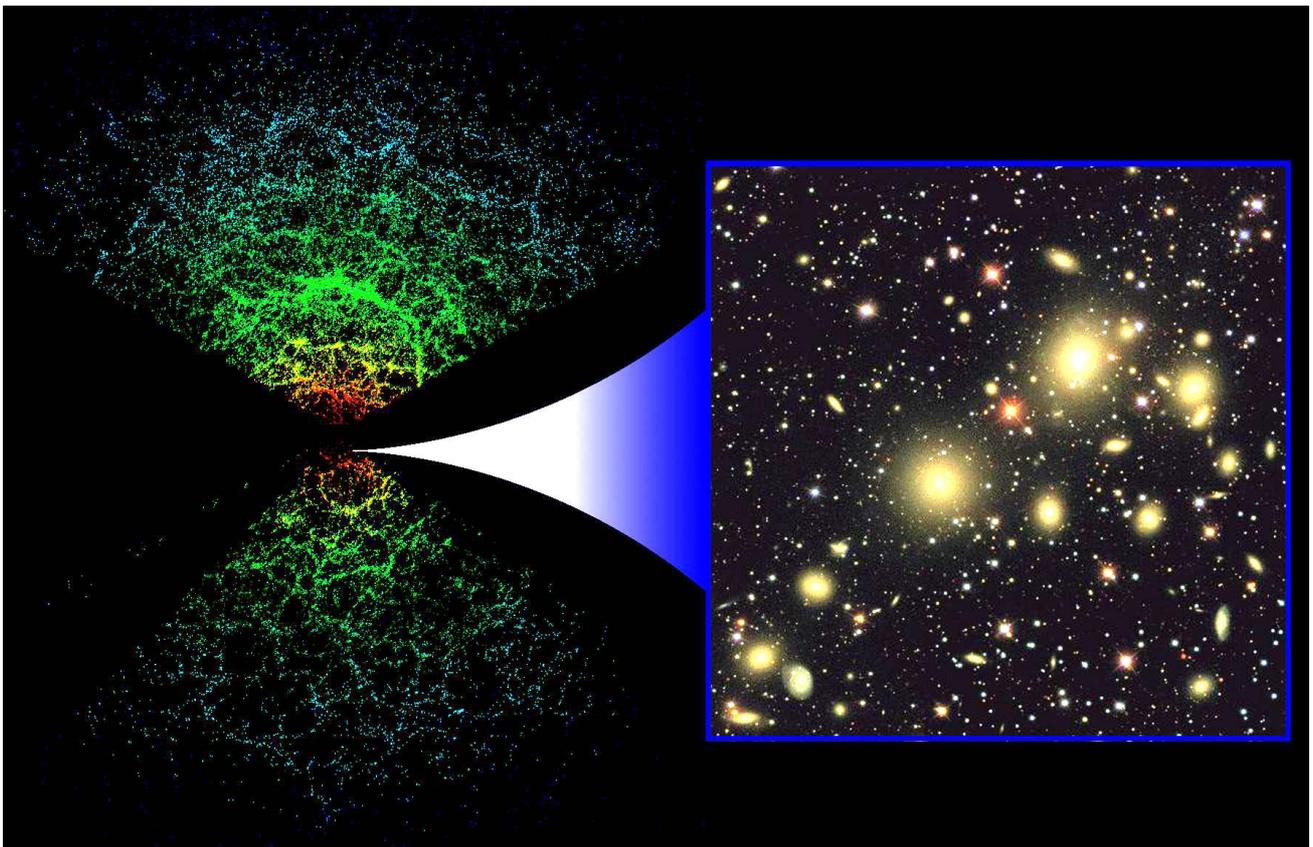


Felicity Spear, *Deep Field 2007* (detail), pigment inkjet print.



Two Micron All-Sky Survey, *Edge-on view of the Milky Way Galaxy 2003*, image courtesy of JPL / Caltech/NASA.

Across the centre of *Deep Field* I have inserted a telescopic image of the *Edge-on View of the Milky Way Galaxy 2003*. This image was captured by the Two Micron All-Sky Survey (2MASS), using twin infra-red telescopes in Arizona and Chile. The 2MASS project mapped the entire sky to look at the large-scale structure of the Milky Way and the local Universe. Here, on Earth, we sit inside the flat spiral disc of the Milky Way, and most of the Galaxy that we see with the naked eye appears as a tenuous band of light stretching cross the sky. These infra-red telescopes allow us to see objects normally hidden by the thick dust of our Galaxy. Visible in this false-colour, edge-on, inside-out view of the Milky Way, is a thin disc of stars (white), as well as the central bulge or nucleus, surrounded by huge clouds of interstellar dust (yellow), which block our view of the galaxy in visible light. Although not visible to the naked eye, this image takes us deeper into space by, in effect, bringing us closer.

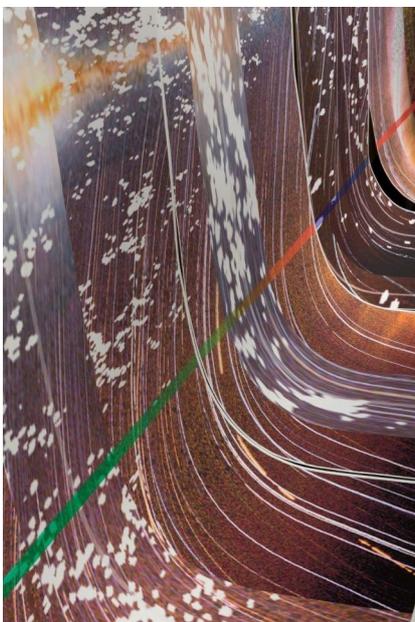


Sloan Digital Sky Survey 3-D Universe Map
<http://apod.nasa.gov/apod/apo31028.html>.

Spreading out over much of *Deep Field* from a suggested apex, is a wedge-shaped pattern reminiscent of the foam formed by waves as they wash up on the beach. It references the *SDSS 3-D Universe Map*, the wedge shaped slice of the cosmos detected by the Sloan Digital Sky Survey from ground-based, wide-field telescopes in New Mexico. By mapping one quarter of the entire sky, the survey reveals the variations in the distribution of galaxies, the large scale structure of the sky, the origin and evolution of galaxies, the relation between dark and luminous matter, the structure of the Milky Way, and the properties and distribution of the dust from which stars like our Sun were created.



Felicity Spear, *Deep Field* 2007, with artist. (detail) — *Deep Field* 2007 (detail), pigment inkjet print.



My intention with this work, was to immerse the viewer in both the process of mapping and the map itself. As if manipulating a camera lens or a mouse, I invite the viewer to imagine zooming in and out, at different distances from the surface of the work, drawing the viewer into an illusory space curving out from the wall, as if warped by gravity. Embedded in this surface are manifestations of coloured light, captured in streaks, flashes and pixels, patterns, flecks and dots capturing an atomistic and undulating space of foaming and flickering surfaces.

Deep Field privileges the subjective, sensuality and aesthetics over the cool rationality of science. At the same time it immerses the viewer in an experience of the night sky which would not be possible without scientific and technological knowledge and innovation. This speculative map represents parallel phenomena revealed through art and science.

Every shift in technology has required us to rethink our ideas about what is meant by reality. As technology stands in for first-hand sense experience, so mapping stands in for space. It gives a form of visible reality (the map), to an invisible reality (the space being mapped). The mapping process can reveal the changing relationships between the observer and the observed, and ideas within our culture which reconstruct nature for our purposes. Not only representing space, but constructing new models of space. But it is well to remember that the map itself is always embedded in the subjective conditions of human thinking.

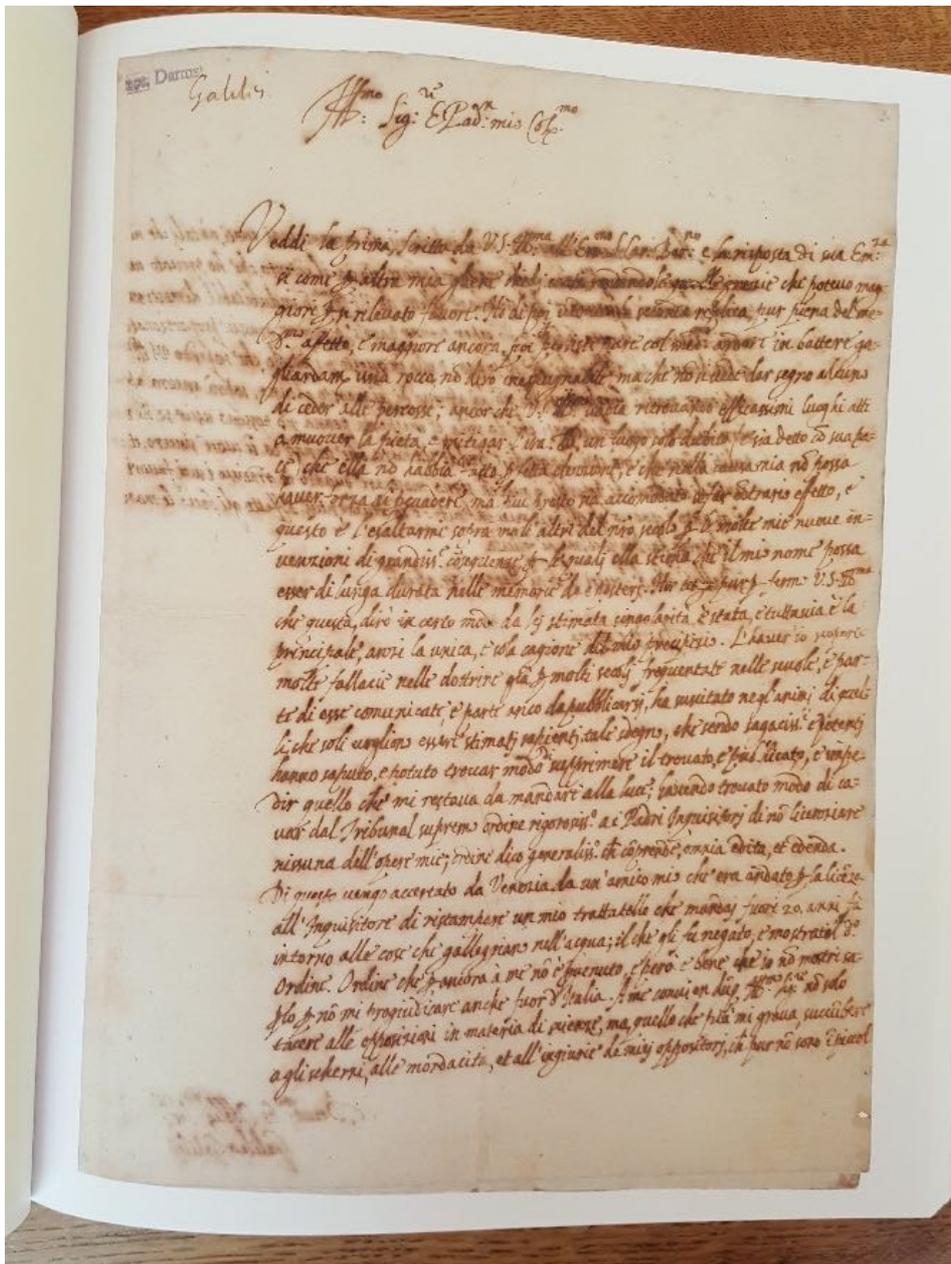


Felicity Spear *Moon* 10-09-2019, Photograph

Apollo 11 courtesy NASA.

In 2019, various public galleries in Australia celebrated the fiftieth anniversary of Apollo 11 landing, and humans' first steps on the Moon. In Victoria, the Geelong Gallery and the Gippsland Art Gallery, mounted major exhibitions commemorating this event. I exhibited in both contributing photographic works from the group exhibition I curated in 2016 titled *Sky Lab – Kepler's Dream*. These works pay homage to Kepler's fictional story *Somnium*.

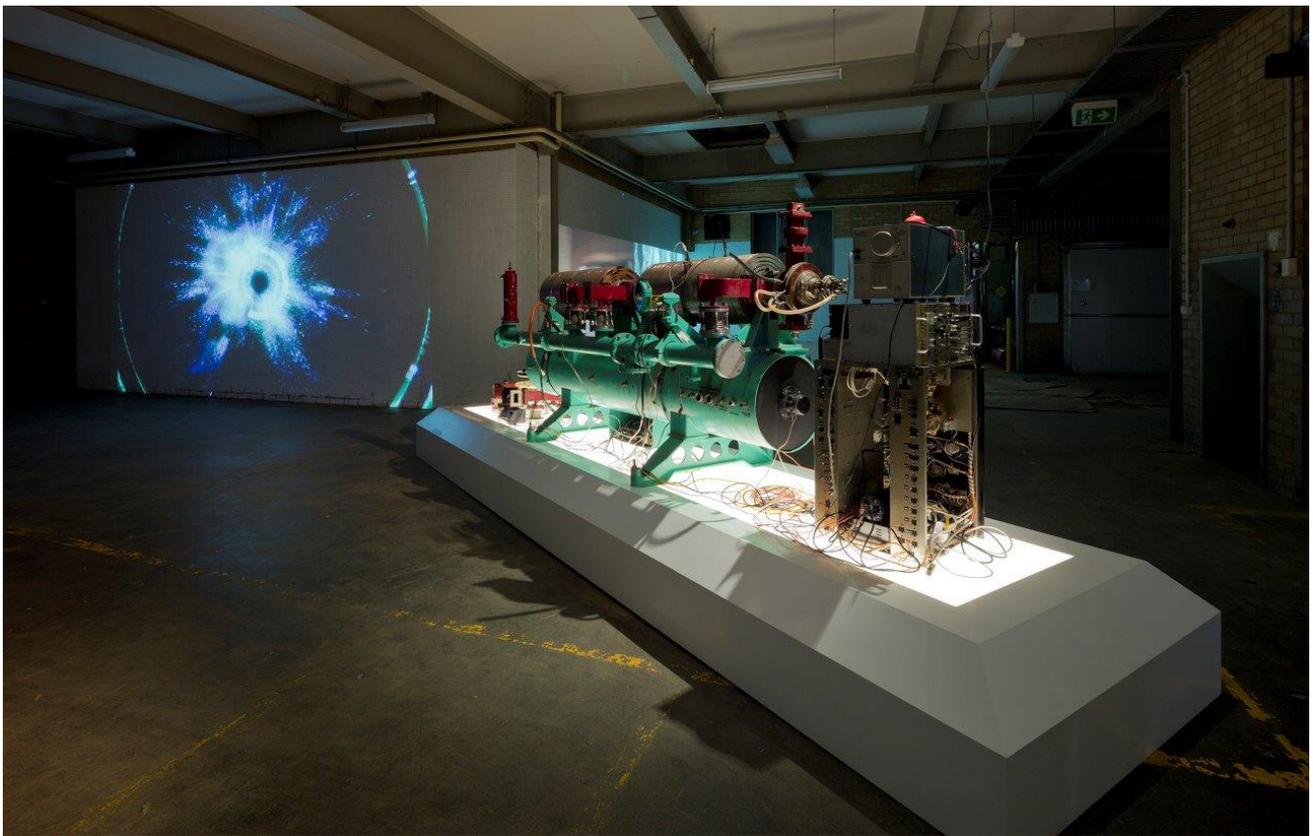
Recently I've noticed a new flicker of interest when the word 'astronomy' is mentioned. No doubt the popularising of Space exploration through the media has contributed. Considering the enormous cost of such projects, and the need to finance them, organisations such as NASA need plenty of positive publicity. But like 17th century Europe, the politics surrounding such technologies perpetuate enduring questions. Is technology an extension of human consciousness? If so will we use it to conquer or cooperate?



Galileo's original letter to Nicolas-Claude Fabri de Peiresc, French astronomer and his former student, written on March 16 1635 thanking him for his support against the Inquisition.

From *Handwritten – ten centuries of manuscript treasures*. Staatsbibliothek Berlin .

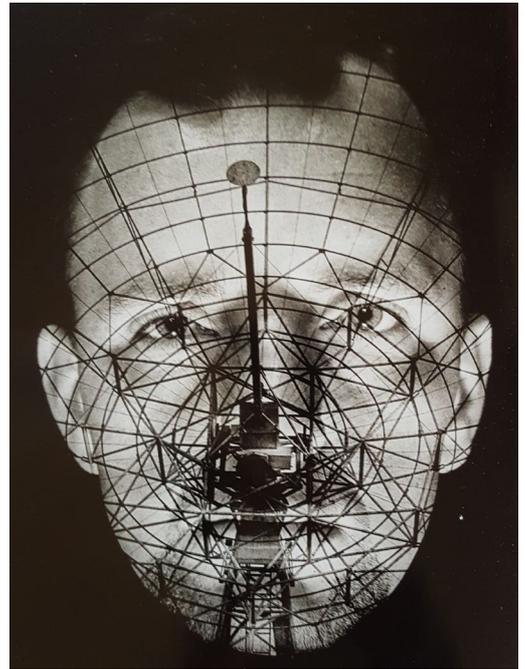
In recent years I've given papers at a number of gatherings which acknowledge the fact that astronomy is increasingly entering public consciousness. These included in 2010 the INSAPVII interdisciplinary conference on the *Inspirational of Astronomical Phenomena*, organised by the University of Wales at Bath in the UK. In 2012 I was invited to speak at the National Library of Australia in Canberra, celebrating the *Enlightenment Festival*. This coincided with its intriguing exhibition from the Staatsbibliothek Berlin, titled *Handwritten – ten centuries of manuscript treasures*. Fellow speakers were Professor Brian Schmidt, Nobel Prize winning astrophysicist, and celebrated writer and artist Michael Leunig.



Chris Henschke, *Song of the Phenomena*, 2017 mixed media, in *Morbis Artis* RMIT.

There are a number of artists with science backgrounds currently making art about science. ACMI, the Australian Centre for the Moving Image in Melbourne, mounts exhibitions which immerse the public in sensory experiences and creative and innovative ideas which hover between the two. Artists such as Lynette Wallworth, Joyce Hinterding, and David Haynes have devoted their careers to exploring physics. Traditionally there has been a cross-fertilisation of art and science through the exploration of materials, light and optics.

Chris Henschke, originally a science student, is an Australian artist who works at the pointy and more technical end of digital and analogue media, sound, light, and high-energy physics. Originally a science student, he moved on to make art because of his interest in music and physics, and the way we think about, or use devices, which mediate between humans and nature. Henschke has completed residencies at the Australian Synchrotron facility and at CERN European research centre. A key component of his practice is in interdisciplinary and collaborative projects. An increasingly common practice in both fields.



Felicity Spear *Chelyabinsk 15-02-2013*, oil wash, pastel, ink on paper, 70 ×100 cm. Solo exhibition
Orbit – the Kepler Suite 2016.

Raymon De Berquelle, *Where do you come from? Planet Earth (self portrait with radio telescope)*,1968, in *Light Years*, NGV 2009.

The natural world is continually being remade on the basis of new understandings. Knowledge of the cosmos is deciphered through the lens of cultural attitudes and beliefs that change over time. The structure and nature of the universe is a mystery we are still unveiling. Together the art works discussed in this presentation demonstrate how the mystery of the night sky, and ideas in art and science, are modelled and imagined through continually unfolding and fragmented theories and imaging technologies. These are analogous to the complex pieces of a puzzle which may never be completed.

Dr Felicity Spear.