Govert Schilling and Lars Lindberg Christensen

EUROPE TO THE STARS

ESO'S FIRST 50 YEARS OF EXPLORING THE SOUTHERN SKY

DVD movie inside

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EUROPE TO THE STARS

ESO'S FIRST 50 YEARS OF EXPLORING THE SOUTHERN SKY

Europe to the Stars —
ESO's First 50 Years of Exploring the Southern Sky

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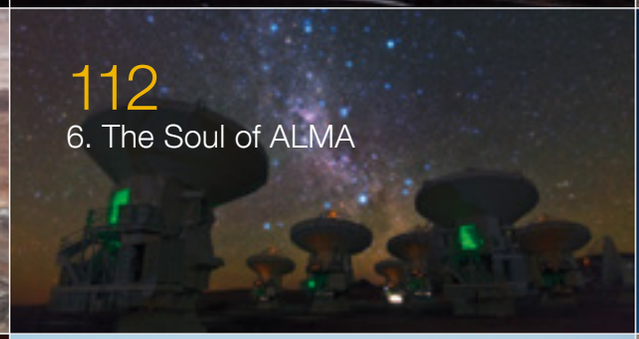
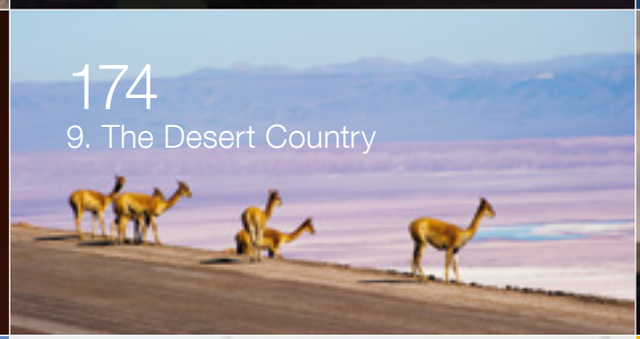
Cover and back
The VLT
This photograph taken by ESO Photo Ambassador Babak Tafreshi, captures the ESO Very Large Telescope (VLT) against a beautiful twilight sky on Cerro Paranal. A VLT enclosure stands out in the picture as the telescope is readied for a night studying the Universe. The VLT is the world's most powerful optical telescope, consisting of four Unit Telescopes with primary mirrors of 8.2-metre diameter and four movable 1.8-metre Auxiliary Telescopes, which can be seen on the back of the cover. Over the past 13 years, the VLT has had a huge impact on observational astronomy. With the advent of the VLT, the European astronomical community has experienced a new age of discoveries, most notably, the tracking of the stars orbiting the Milky Way's central black hole and the first image of an extrasolar planet.

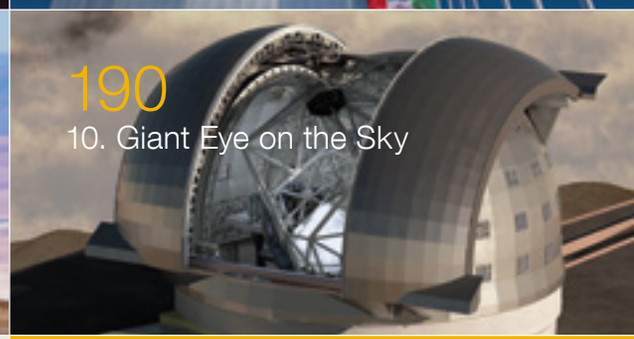
Back, top
Heavenly wonders
A selection of spectacular images made with ESO's telescopes.

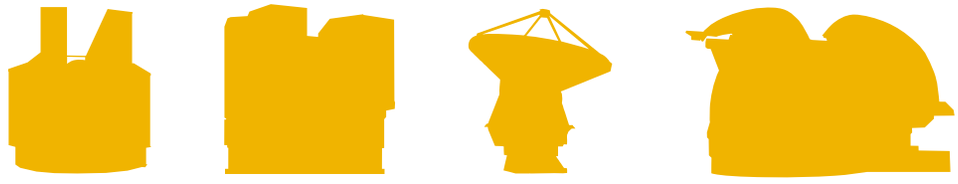
To ESO's unsung heroes

ESO — Reaching New Heights in Astronomy









Foreword

The signing of the ESO Convention in 1962 and the creation of ESO was the culmination of the dream of leading astronomers from five European countries, Belgium, France, Germany, the Netherlands and Sweden: a joint European observatory to be built in the southern hemisphere to give astronomers from Europe access to the magnificent and rich southern sky by means of a large telescope. The dream resulted in the creation of the La Silla Observatory near La Serena in Chile and eventually led to the construction and operation of a fleet of telescopes, with the 3.6-metre telescope as flagship. As Italy and Switzerland joined ESO in 1982 the construction of the New Technology Telescope, with pioneering advances in active optics, became possible, preparing the way for the next step: the construction of the Very Large Telescope. The VLT made adaptive optics and interferometry available to a wide community.

The decision to build a fully integrated VLT system, consisting of four 8.2-metre telescopes and providing a dozen foci for a carefully thought-out complement of instruments opened a new era in ESO's history. The combination of a long-term, adequately-funded instrument and technology development plan, with an approach where instruments are built in collaboration with institutions in the Member States, and with in-kind contributions in labour compensated by guaranteed observing time, has created the most advanced ground-based optical observatory in the world.

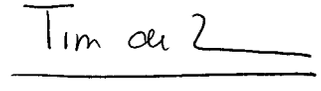
Today, in 2012, the original hopes of the five founding members have not only become reality but ESO has fully taken up the challenge of its mission to design, build and operate the most powerful ground-based observing facilities on the planet. On the Chajnantor Plateau in Northern Chile, together with North American and East Asian partners, ESO is developing the biggest ground-based astronomical project in existence, the Atacama Large Millimeter/submillimeter Array (ALMA). And ESO is starting to build the world's biggest eye on the sky, the European Extremely Large Telescope.

In 2012, our 50th anniversary year, we are ready to enter a new era, one that not even the initial bold dreams of ESO's founding members could have anticipated. It is undoubtedly a most exciting time that we live in. It is a pleasure to thank everyone involved in making the ESO dream come true: to the ESO staff for their professionalism, ingenuity and passion, to Council and Committee members and the former Directors General for leading the observatory to new heights in astronomy. And to the public, educators and media who on a daily basis take part in ESO's discoveries.

The year 2012 is also a time to congratulate all our Member States. The five founding members have been joined by Denmark (1967), Switzerland (1982), Italy (1982), Portugal (2001), the United Kingdom (2002), Finland (2004), Spain (2007), the Czech Republic (2007), Austria (2009), and Brazil, who will become the 15th, as well as the first non-European, Member State after parliamentary ratification of the Accession Agreement signed in December 2010. The Member States have adhered to ESO's courageous plans to lead ground-based astronomy, and offer us constant support and top-level people. Together these 15 countries contain approximately 30% of the world's astronomers, and by now ESO is the most productive ground-based observatory in the world supplying data for more than 750 scientific papers per year.

The scientific community is to be congratulated for keeping astronomy at the forefront of scientific research, as well as our supporters and international partners for believing in our ambitious projects. ESO owes its success in a large part to these collaborations!

Welcome to the world of ESO!



Tim de Zeeuw
ESO Director General
Garching, June 2012

The VLT at work
The Very Large Telescope with galaxies Messier 31 (left middle) and Messier 33 (top left) as backdrop.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Preface

As part of the celebration of its 50th anniversary, this book paints a portrait of the European Southern Observatory in accessible text and stunning images. Although it presents some historic detail, it is not meant to be a formal history of ESO. Rather, we have focussed on ESO's achievements — on the magnificent telescopes and instruments that enthral anyone visiting them, and on the scientific breakthroughs that they regularly produce. Our visual journey tries to give a feel for ESO as a scientific organisation and to present a cross-section of the many parts that combine in making it the successful endeavour that it is.

In a book like this, it is impossible to cover the topic completely, and also to describe the many wonderful scientific and engineering breakthroughs made outside the ESO-sphere. It is equally not possible to give proper credit to the many people who deserve it. The limited space has only allowed us to introduce the Directors General who have been at the helm of ESO. Anyone interested in a much more comprehensive history of ESO should read *Jewel on the Mountaintop* by Claus Madsen (see p. 254), published together with this book, as the other half of what can really be seen as a complementary set. We have however made space to show some of the many unsung heroes who usually remain invisible, but who represent the cement that holds the organisation together.

The last part of the book provides credits for the many images, further literature about ESO and also the first ever full overview of ESO's telescopes. These facts were collected as part of the anniversary efforts with the help of many ESO employees and especially volunteer Philip Corneille (FBIS/VVS) from Belgium. We are grateful for this assistance. We would also like to thank several individuals for thoughtful comments and corrections: Tim de Zeeuw, Bruno Leibundgut, Gero Rupprecht, Olivier Hainaut, Adam Hadhazy, Mathieu Isidro, Richard Hook, Douglas Pierce-Price, Sally Lowenstein, Mark Casali and Anne Rhodes.

A big thank you also goes to Andre Roquette, Francesco Rossetto, Jutta Boxheimer, Mafalda Martins and Kristine Omandap from ESO's education and Public Outreach Department for the wonderful design of the book, as well as to Mathieu Isidro for the hard work of updating ESO's timeline. Many other individuals from this department, including Hännes Heyer, have also made a major effort, and have helped to put together a treasure trove of more than 7000 photos online over the past four years. We are especially indebted to the world-class photographers who have provided material for this book, most notably ESO Photo Ambassadors Babak Tafreshi, Christoph Malin, José Francisco Salgado, Serge Brunier, Stéphane Guisard, Gerhard Hüdepohl, Gianluca Lombardi, Yuri Beletsky and Gabriel Brammer. These photographers have also in part delivered stunning time-lapse footage for the 60-minute movie that accompanies this book. Max Alexander took the wonderful portraits of unsung ESO heroes for the book, for which we are thankful.

Govert Schilling & Lars Lindberg Christensen
Amersfoort, the Netherlands & Garching bei München, Germany, June 2012

The Chilean night sky at ALMA
This image shows the night sky seen from the Atacama Desert. This photograph was taken from the site of the ALMA cultural heritage museum.

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Setting the Scene

Today's astronomers who venture south of the equator to stargaze are not the first. Some parts of the Universe can only be observed from the southern hemisphere. Ever since seafarers and explorers first marvelled at the splendour of the Milky Way and the Magellanic Clouds, scientists have been lured to southern latitudes, where unknown constellations held the promise of great discoveries.

"Where's Oort?"

The young Dutch astronomer Gart Westerhout hadn't seen his Leiden Observatory professor for at least fifteen minutes. His colleague, Fjeda Walraven, also had no clue as to the whereabouts of the famous scientist. And yes, that was worrisome, for Westerhout and Walraven were carrying out test observations in a pitch-dark field at Hartebeespoort in South Africa, with wild baboons and other animals wandering around the camp. And now, Jan Oort had disappeared, on his very first visit to the southern hemisphere.

Decades later, Westerhout vividly recalled his 1952 experience. *"We found you on the other side of a small hill,"* he wrote on the occasion of Oort's 80th birthday in 1980, *"flat on your back in the wet grass, risking pneumonia, with the centre of the Milky Way in the zenith. You could not be convinced to get up, and you shooed us off! I have never forgotten the impression this event made on me. Here was the man who was the first to unravel the structure of the Galactic System, twenty five years earlier, and who now saw it for the first time, as a natural phenomenon, of which man is a part."*

Jan Oort, who would later become the chief initiator of the European Southern Observatory (ESO), had never before witnessed such an impressive sight. Myriads of tiny, twinkling stars; shimmering clouds of nebulous gas, and wispy streaks of dark dust — all stretched out in a luminous band across the velvet-black sky. Nowhere in Europe, let alone in his small and densely populated home country, could the Milky Way be observed in such magnificent splendour. You just *had* to go south of the equator.

The southern sky at the coast of the Chilean Atacama Desert
Because of the humidity over the cold Pacific Ocean, clouds often cover the coast of the Atacama Desert only 12 kilometres from ESO's Paranal Observatory. The cold ocean keeps the so-called inversion layer very low, and the atmosphere above the clouds exceptionally dry and clear.

We have evolved on a small, rocky planet, orbiting an inconspicuous star on the outskirts of an undistinguished spiral galaxy

We have evolved on a small, rocky planet, orbiting an inconspicuous star on the outskirts of an undistinguished spiral galaxy. From the north pole of this tiny, rotating sphere, only half the Universe can be seen, and wherever you are located in the northern hemisphere, there's always a sizeable chunk of sky that remains invisible at all times — and this missing chunk of sky contains some of the most spectacular celestial sights.

Jan Oort
The chief initiator of the European Southern Observatory.

Ancient cultures in southern Africa, Latin America and Australia knew all about the beauty of the southern sky. They developed myths and legends concerning the Milky Way and its blazing centre; tales of the hazy patches of light that we now call the Magellanic Clouds, and the many bright stars that pepper the southern skies. But in the Near East and in Europe much of this cosmic scenery never rose above the horizon. Just as maps of the ancient world contained uncharted regions with ominous texts like *"Here be dragons"*, maps of the sky also had blank, unexplored spots.

Remarkably, the famous constellation of the Southern Cross *was* known in Europe. In the time of the ancient Greeks, it just rose above the southern horizon in Athens every April, its stars being considered part of the constellation of Centaurus. But because of an extremely slow change in the cosmic orientation of Earth's axis, first discovered by Hipparchus of Nicaea, the Cross has now disappeared from view for anyone living north of Cairo. It was rediscovered by Portuguese seafarers, and eventually ended up on the national flags of Australia, Brazil, New Zealand, Papua New Guinea, and Samoa.

As for the Magellanic Clouds, the larger of the two was first mentioned by Persian astronomer Abu al-Husan Abd al-Rahman ibn Omar al-Sufi al-Razi — usually referred to simply as al-Sufi — in his 964 AD treatise, *The Book of Fixed Stars*. The cosmic cloud was just barely visible from the southernmost point of Arabia. But here again, knowledge of the celestial fuzz was lost, only to be regained after European explorers set sail for distant shores and marvelled at the new vistas above their heads.

Named after Ferdinand Magellan, who was the first to circumnavigate the world in 1519–1522, the two clouds are now known to be satellite galaxies of the Milky Way. Compared to our home galaxy, the clouds are smaller, irregularly shaped, and have a relatively higher abundance of interstellar gas to spawn new stars. Nevertheless, they are galaxies in their own right, and the nearest ones that astronomers can study in detail. This scientific privilege, however, is only provided when you can set up your telescope equipment south of the terrestrial equator — the clouds are invisible from North America, Asia and Europe.

Pieter Platevoet, a Flemish astronomer, cartographer and clergyman who moved to Amsterdam in 1585, was not able to travel to the southern hemisphere himself. Instead, he taught Dutch seafarers Pieter Dirkszoon Keyser and Frederik de Houtman how to use a cross staff and an astrolabe — simple instruments for measuring stellar positions. Would Keyser and de Houtman be so kind as to map the unknown southern sky during their pioneering spice expedition to the East Indies? If so, Platevoet (better known by his Latin name Petrus Plancius) would finally be able to fill in the blank areas on the charts of the heavens.

The Small Magellanic Cloud over the Chilean landscape
Snow-covered trees under a magnificent night sky, at Torres del Paine National Park, southern Patagonia. Chile's magnificent desert skies are renowned for their clarity, but stargazing can also be impressive in the southern part of this long country. The two brightest stars in the prominent Milky Way band are Alpha (above) and Beta (below) Centauri.

Treasures of the southern sky

Many celestial treasures can best be observed from the southern hemisphere. For instance, the famous Trifid and Lagoon Nebulae in the constellation of Sagittarius (The Archer) never rise high above the horizon as seen from Europe. The same is true for the Rho Ophiuchi star-forming region and the globular cluster Messier 4 in Scorpius.

Even further south are the Carina Nebula and the R Coronae Borealis region — two other stellar nurseries. Omega Centauri and 47 Tucanae are the two most impressive globular clusters in the sky, and the Jewel Box in the Southern Cross is a serious competitor to the Pleiades in the beauty contest for the most impressive open cluster in the sky.

And while the centre of the Milky Way galaxy (middle, opposite page) and the two Magellanic Clouds — nearby satellites of the Milky Way — will never cease to impress, more distant spirals and ellipticals also claim astronomers' attention, like the beautiful spiral NGC 1232 in the constellation of Eridanus, the members of the Sculptor and Fornax clusters, and, last but not least, the distinctive active galaxy Centaurus A.

A 340-million-pixel Paranal starscape
This spectacular 34 by 20 degree-wide image shows one of the most interesting areas of cosmic real estate in the southern sky. Noteworthy objects are the centre of the Milky Way (in the dust lane left) as well as the Trifid, and Omega Nebulae (left) in the constellation of Sagittarius (The Archer). In Scorpius (right) we see the Rho Ophiuchi star-forming region and globular cluster Messier 4. The image was composed from 1200 individual photos taken by ESO engineer Stéphane Guisard.

The Southern Cross
Just as if they had been dotted on top of the myriads of glowing suns in the Milky Way, this image shows some of the brightest stars of the southern sky: on the right the four stars of the constellation of Crux, the Southern Cross, and at lower left, the two most brilliant stars of the constellation of Centaurus, The Centaur.

The expedition was a disaster. Of the 248 men who left the Dutch island of Texel on 2 April 1595, only 81 survived the two and a half year trip. Keyser died on Sumatra, but de Houtman returned to Amsterdam, carrying with him the sky positions of over 130 stars around the south celestial pole. Plancius grouped these into twelve new constellations, including the Bird of Paradise, the Toucan, the Goldfish, the Peacock and the Indian. Within a few years, the new southern constellations were firmly established by cartographers Jodocus Hondius and Willem Janszoon Blaeu, who depicted them on their celestial globes, and by the German astronomer, Johann Bayer, who adopted them in his famous 1603 star atlas *Uranometria*.

Abbé Nicolas Louis de Lacaille greatly extended the work begun by Plancius. In the middle of the 18th century, some 150 years after the invention of the telescope, this French astronomer sailed to the Cape of Good Hope, where he catalogued 10 000 stars in the southern sky. Lacaille also introduced thirteen new constellations, which he named after scientific instruments and equipment, like the Telescope (of course!), the Microscope, the Pendulum Clock, and the Oven. One constellation was called Mons Mensa (Table Mountain), for the location of Lacaille's observatory.

Lacaille was also one of the first to study the Magellanic Clouds in some detail. He noted that one particular star in the Large Magellanic Cloud, originally listed as 30 Doradus, was actually a small nebula. Only later did it become clear that 30 Doradus, also known as the Tarantula Nebula for its spidery filaments, is by far the largest star-forming region in the local Universe, measuring hundreds of light-years across. Hidden in its core is an extremely compact cluster of sizzling newborn stars, no more than two million years old. One of those, R136a1, is actually the most massive and most luminous star known, weighing in at 265 solar masses and pouring out almost nine million times as much energy as the Sun.

John Herschel, son of the legendary William Herschel who discovered the planet Uranus in 1781, knew nothing about the true nature of the Magellanic Clouds when he travelled to the Cape in November 1833. Thirteen years earlier, English astronomers had established the Royal Observatory at the Cape of Good Hope. But Herschel brought his own 46-centimetre telescope, set up a private observatory at the Feldhausen estate in Wynberg, and spent five years cataloguing double stars, star clusters and nebulae, to extend the work his father had begun in the northern hemisphere (actually, the very first southern hemisphere observatory was Georg Marcgrave's 1639 rooftop observatory in Recife, Brazil).

The advent of photography revolutionised the exploration of the night sky. Scottish astronomer David Gill, who was appointed Her Majesty's Astronomer at the Cape

Terra Incognita of the heavens
For many centuries, maps of the southern sky, like this 1515 star chart by Albrecht Dürer, showed extensive blank areas — the *Terra Incognita* of the heavens.

Observatory in 1879, set out to photograph the entire southern sky, using the 61-centimetre McClean telescope. Measuring the positions — and, in many cases, the slow progress across the sky — of 454 875 stars on Gill's glass negatives was a tremendously tedious task, carried out over a period of four years by the Dutch astronomer Jacobus Kapteyn, who would later be Jan Oort's teacher. The resulting *Cape Photographic Durchmusterung* was the first star catalogue based on astrophotography.

By now, scientists all over the world were very much aware that the scarcely populated, arid scrublands of South Africa represented everything an astronomer could ever dream of. Dark skies, cloudless nights, perfect *seeing* — a measure of the lack of atmospheric turbulence — and of course a splendid view of the Magellanic Clouds, the centre of the Milky Way with its countless star clusters and nebulae, and the stars and galaxies of the southern constellations. Staying at home in the northern hemisphere would be like standing on a mountaintop and only enjoying the view in one direction, without ever turning around to admire the much more impressive scenery behind your back.

"Venturing south" was the astronomical mantra throughout the 1920s, it seemed

The Royal Observatory at the Cape of Good Hope
The British were the first to construct a permanent astronomical outpost in the southern hemisphere. The Royal Observatory at the Cape of Good Hope was founded in 1820.

New observatories had already been erected in South Africa. While the Natal Observatory in Durban lasted only from 1882 to 1911, the Transvaal Observatory (later renamed the Union Observatory and the Republic Observatory), was established in 1903 in Johannesburg, and remained operational until the early 1970s (just like Radcliffe Observatory in Pretoria, which was constructed in 1939). Also, a number of American and European universities decided to build their own "southern station" in South Africa. "Venturing south" was the astronomical mantra throughout the 1920s, it seemed.

The Yale–Columbia Southern Station in Johannesburg was the first of these in 1925, sporting a 66-centimetre refractor. Two years later, the University of Michigan constructed the Lamont-Hussey Observatory near Bloemfontein, with a similar-sized telescope. And around the same time, the Harvard College Observatory moved its Boyden Station with its 61-centimetre Bruce telescope from Arequipa, Peru, to Bloemfontein, because of the better weather conditions there.

So what about Jan Oort and his Milky Way encounter in Hartebeespoort? Well, after studying in Groningen with Kapteyn, Oort had worked at Yale for two years before accepting a position at the Leiden Observatory in 1924, so he was well aware of the potential of an astronomical foothold in South Africa. But the Dutch played it a bit differently: In 1923, they had struck a deal with the Union Observatory, providing astronomers from both institutions with access to each other's instruments. Not surprisingly, given the generally poor weather in the Netherlands, many more Dutch astronomers travelled south to observe in Johannesburg than South Africans came north.

In 1929, Leiden sent its own Rockefeller twin 40-centimetre telescope plus a permanent staff member to the Union Observatory. By the early 1950s, however, the increasing light pollution from Johannesburg became too severe for serious observations, and Dutch astronomers started to scout for a better site. This is why, in 1952, Gart Westerhout and Fjeda Walraven ended up with their test equipment in Hartebeespoort, west of Pretoria. Two years later, the Leiden Southern Station would start operations there, and in 1957, the 90-centimetre Dutch Flux Collector would become one of the largest telescopes in South Africa.

So where was Oort?

Physically, the 52-year old astronomer was lying flat on his back in the wet grass, captivated by the incredible view of the Milky Way. But in his mind, he may have been decades away, in a distant era where European countries would join forces and work together in exploring the southern sky. A few months later, back in the Netherlands, Oort opened discussions with fellow astronomers that would eventually lead to the birth of the European Southern Observatory.

Director General Otto Heckmann

Director General Otto Heckmann
Painting of Otto Heckmann, ESO Director General between 1962–1969.

Name: Otto Heckmann
Year of Birth: 1901
Nationality: German
Period as Director General: 1962–1969

Heckmann died on 13 May 1983. This "interview" is based on his 1976 book *Sterne, Kosmos, Weltmodelle* (see Further Reading on page 252 below).

What was the greatest challenge during your ESO career?

The greatest challenge came at the very beginning of my career. I started as Director General in 1962 with the most important goal of finding a location for the observatory. From Hamburg Observatory I was used to leading an organisation where all the framework — administration, personnel etc — was already in place. The house was already furnished when I moved in, so to speak. With ESO we had only the Convention to lean on and had to start from scratch with everything. It is hard to describe the working conditions but it was a real challenge and what happened later must be seen in that light.

In 1963 I had been asked by the ESO Council to clarify the relations with the Chilean government, and with AURA in the US, with whom we were discussing collaborating [see p. 25]. In October of that year I flew to New York for discussions with AURA. The disappointment was great as it turned out that we had big differences in our view of how the foundation of ESO should be set up. AURA wanted to work with the universities in Chile and we with the Chilean government. During a chat with Prof. Erich Heilmeier, astronomer in Santiago, in downtown New York that same day, it became clear that we could either continue the — presumably lengthy — discussions with AURA, and then later discuss with the Chilean government, or take the simpler and faster route: we could simply bypass the Americans and talk to the Chileans directly. At the end of October I went to Santiago and talked to the minister for interior relations. Greatly helped by the existing agreements they had set up with the United Nations Economic Commission for Latin America and the Caribbean (CEPAL), a full, but provisional agreement between ESO and Chile was quickly written. Advised by the German ambassador, I signed the agreement on 5 November 1963. In retrospect it was clear that without discussing this agreement with Council, I had overstepped my jurisdiction. It was naturally an extreme risk for me to unilaterally sign ESO up to setting up the observatory in Chile — Council could have fired me from my post only a year after taking up duty — but I believe it was necessary. ESO would never have taken off without this quick decision of mine. At the next Council meeting just nine days later I was reprimanded, but luckily there was no real doubt that Chile was the right home for ESO's telescopes, so soon we could focus on the next steps.

How do you see ESO's future?

Today [in 1976] ESO stands at a turning point. Over the past almost 25 years [since the first discussions in the 1950s], ESO has been going through a period of significant development. The 3.6-metre is now nearly ready and it has finally been decided that ESO should have a real headquarters building in Garching — in my opinion a decision that has come too late. ESO is now growing out of the *Observatoire de Mission* idea where an observatory just operates telescopes. It is becoming an organisation with the power to work closely with industry to develop technologies that do not exist. By bringing astronomical capacities together — people, equipment, infrastructure — a momentum can be gained which was not possible before. It will however be necessary to strengthen the training of young people, to have inspiring working conditions with lively exchange of ideas and to keep attracting young, bright minds. My vision is to follow the example of the Niels Bohr Institute in Copenhagen, which was so important for atomic physics in the 1920s and 1930s.

2

The Birth of ESO

European astronomers took sixteen years to turn a visionary idea into solid reality. But thanks to their commitment and perseverance, the European Southern Observatory was officially inaugurated at Cerro La Silla in northern Chile on 25 March 1969. Could Europe regain its leading role in ground-based astronomy from the United States?

In 1948, just four years prior to Jan Oort's first encounter with the southern sky, American astronomers had inaugurated the majestic Hale Telescope at Palomar Mountain in California. Its huge mirror, measuring five metres across, provided unprecedented views of planets, nebulae and galaxies. In the preceding decades, other US telescopes, notably the 2.5-metre Hooker Telescope at Mount Wilson, had already revolutionised the science of the cosmos by revealing the true nature of spiral nebulae and the expansion of the Universe. For at least half a century, America had been in the driver's seat of astronomical research.

In many ways, Europe is the cradle of astronomy. Thousands of years ago, Greek philosophers studied the skies and the motions of the planets. They charted the constellations, predicted eclipses of the Sun and the Moon, and measured the circumference of the Earth. Their fundamental premises may have been wrong — they believed that the Earth occupied the centre of the Universe, with all celestial bodies revolving around it — but this geocentric world view, written down by the great astronomer Ptolemy around 150 AD, survived with some minor additions and adaptations from Persian scientists for fourteen centuries.

Star trails over the site-testing station in South Africa
In the mid-1950s site-testing in South Africa was at its peak. An aluminium hut gives shelter during the night and is used to store the site-testing telescope during the day.

Europe is also the birthplace of the telescope

And when Ptolemy's world view was overthrown, it was another European who brought about this scientific revolution. In 1543, Polish astronomer Nicolaus Copernicus published his heliocentric model, with the Sun at the centre of the Universe. Within a few decades, Johannes Kepler from Germany, using precise measurements from the Dane Tycho Brahe, deduced the laws of planetary motion. He thus paved the way for Isaac Newton's law of universal gravitation, published in England in the second half of the 17th century. Meanwhile, it became clear that the Sun was just one of many stars in the Universe.

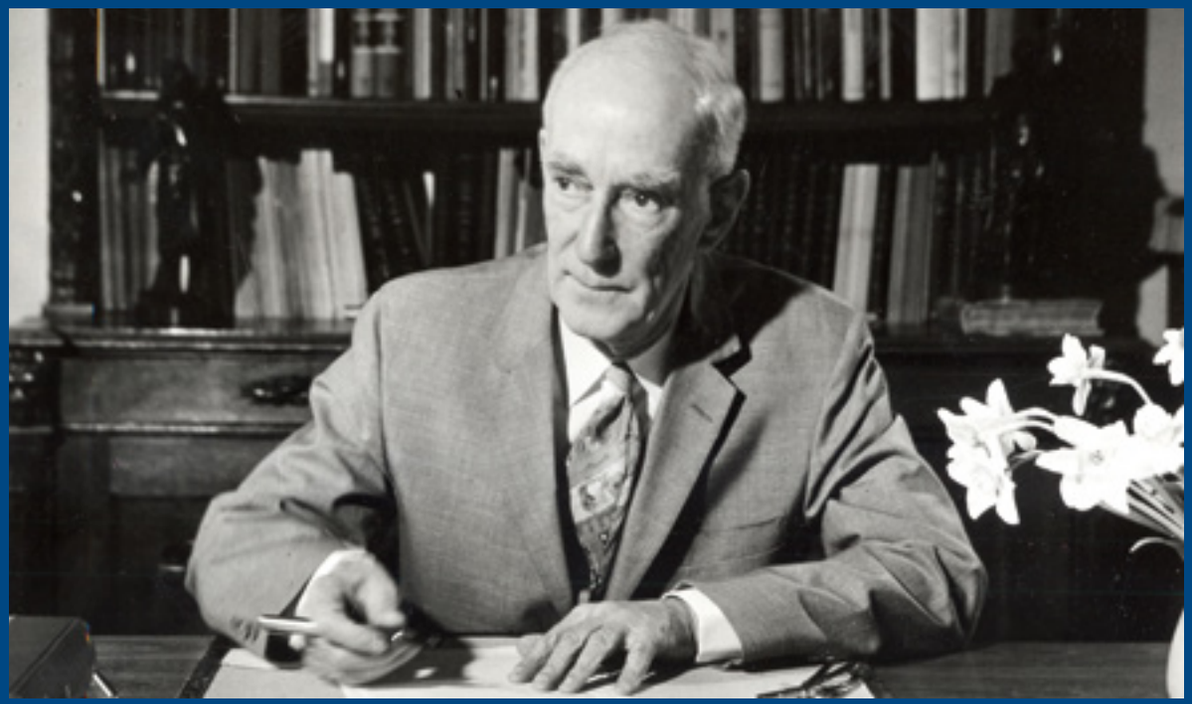
Europe is also the birthplace of the telescope. In 1608, when most of the United States was still unexplored, Dutch spectacle makers Hans Lipperhey and Zacharias Jansen built the very first "tubes to see far", and within eighteen months, the Italian physicist and astronomer Galileo Galilei discovered mountains on the Moon, dark spots on the Sun, the phases of Venus, the major satellites of Jupiter, and millions of faint stars in the Milky Way. Greatly improved by scientists like Christiaan Huygens in Holland (who discovered the rings of Saturn) and Isaac Newton in England (who invented the reflector), the telescope soon became the most important instrument in the study of the Universe.

Telescopes collect and concentrate starlight using convex lenses or concave mirrors. Size does matter: larger lenses or mirrors reveal fainter stars and more detail. Thus, by building larger and larger telescopes, European astronomers were able to bag one scientific breakthrough after another: the proper motion of stars, the discovery of Uranus (by William Herschel), the first estimate of stellar distances, and the spiral nature of many nebulae. Universities all over Europe established their own observatories — Leiden in the Netherlands was the first, in 1633 — and dedicated amateur astronomers like William Parsons in Ireland constructed the largest telescopes in the world.

But about a century ago, things started to change. Europe has always been a politically fragmented continent, with individual city states and kingdoms fighting for their own supremacy and prosperity; and in the field of astronomy and telescope building, no single European country could compete with the United States. There had been examples of international cooperation (the discovery of asteroids in the early years of the 19th century was the result of a pan-European search programme), but eventually, America took the lead, building bigger telescopes and attracting brilliant astronomers from the Old World.

Birth of ESO in 1953
During a boat trip in the Netherlands, Kourganoff, Oort and Spencer Jones discuss the idea of a joint European effort in astronomy.

Jan Oort and the birth of radio astronomy



Jan Oort
Oort was also fascinated by radio waves from the Universe and played a major role in starting the new field of radio astronomy.

Leiden astronomer Jan Oort not only paved the way for the birth of the European Southern Observatory; he also played an instrumental role in the birth of radio astronomy — the study of long-wavelength radio emissions from the Universe.

While the pioneering observations of cosmic radio waves were carried out in the 1930s by Karl Jansky and Grote Reber in the United States, Oort was the first to realise that radio observations might open up a whole new window on the Milky Way, partly because radio waves are not absorbed by interstellar dust clouds. In 1944, Oort's student Henk van der Hulst discovered that cold, neutral hydrogen atoms — a very important, but invisible component of the Universe — should emit at a radio wavelength of 21 centimetres. This made it possible to map the gas in the Milky Way galaxy.

The 25-metre radio telescope in Dwingeloo, the Netherlands, built on Oort's initiative in 1956, was the largest in the world for over a year. Fourteen years later, in 1970 — just a year after the inauguration of the La Silla Observatory — Queen Juliana opened the Westerbork Synthesis Radio Telescope, which is still one of the largest radio interferometers in the world. Ever since, the Netherlands has played a leading role in the field of radio astronomy, most recently with the construction of LOFAR, the Low Frequency Array.

Site-testing station in South Africa
An ESO site-testing station, likely at Zeekoegat, South Africa, in 1961.

Two World Wars didn't help either. In 1938, at the sixth General Assembly of the International Astronomical Union in Stockholm, the newly-elected President, British astrophysicist Arthur Eddington, remarked that *"in international politics the sky seems heavy with clouds, [but] such a meeting as this […] is as when the Sun comes forth from behind the clouds. Here we have formed and renewed bonds of friendship which will resist the forces of disruption."* Within a few years, though, Europe would indeed be torn apart for the second time in the 20th century. Yet progress did resume.

In the spring of 1953, at the University of Leiden, Jan Oort discussed the future of European astronomy with the German–American astronomer Walter Baade, who had been invited by Oort to come to the Netherlands for a couple of months to prepare a conference on galactic astronomy in Groningen. That same year, European physicists were drafting the CERN convention, for close cooperation in the field of nuclear research and particle physics. Might a similar approach be fruitful in astronomy? Sixty-year-old Baade, famous for his discovery of two distinct stellar populations in the Milky Way, was enthusiastic. Before long, Oort was writing to colleagues in Belgium, France, Germany and Sweden.

On 21 June, and during the Groningen conference, the plan was discussed by leading astronomers from all over Europe, including the British Astronomer Royal, Sir Harold Spencer Jones. It sounded so obvious: a big, European observatory in the southern hemisphere — to gain access to the centre of the Milky Way and the Magellanic Clouds — equipped with a 3-metre reflector, a photographic Schmidt telescope, and a number of smaller instruments. Seven months later, on 26 January 1954, twelve astronomers from six countries met in the stately Senate Room of Leiden University to sign a statement expressing their desire to establish a European observatory in South Africa.

For European astronomers, South Africa was a logical choice. But none of the existing sites there were seriously considered as viable locations: they were all too close to major cities, and the joint European observatory not only needed good seeing, but also ultra-dark skies. In October 1955, four observers set sail to Cape Town, carrying portable 25-centimetre telescopes, and over the next couple of years, a number of new potential sites were tested, from the Johannesburg–Pretoria area in the north to the Great Karoo semi-desert in the south.