Speeches Given at
ALMA Groundbreaking Ceremony
San Pedro de Atacama, Chile
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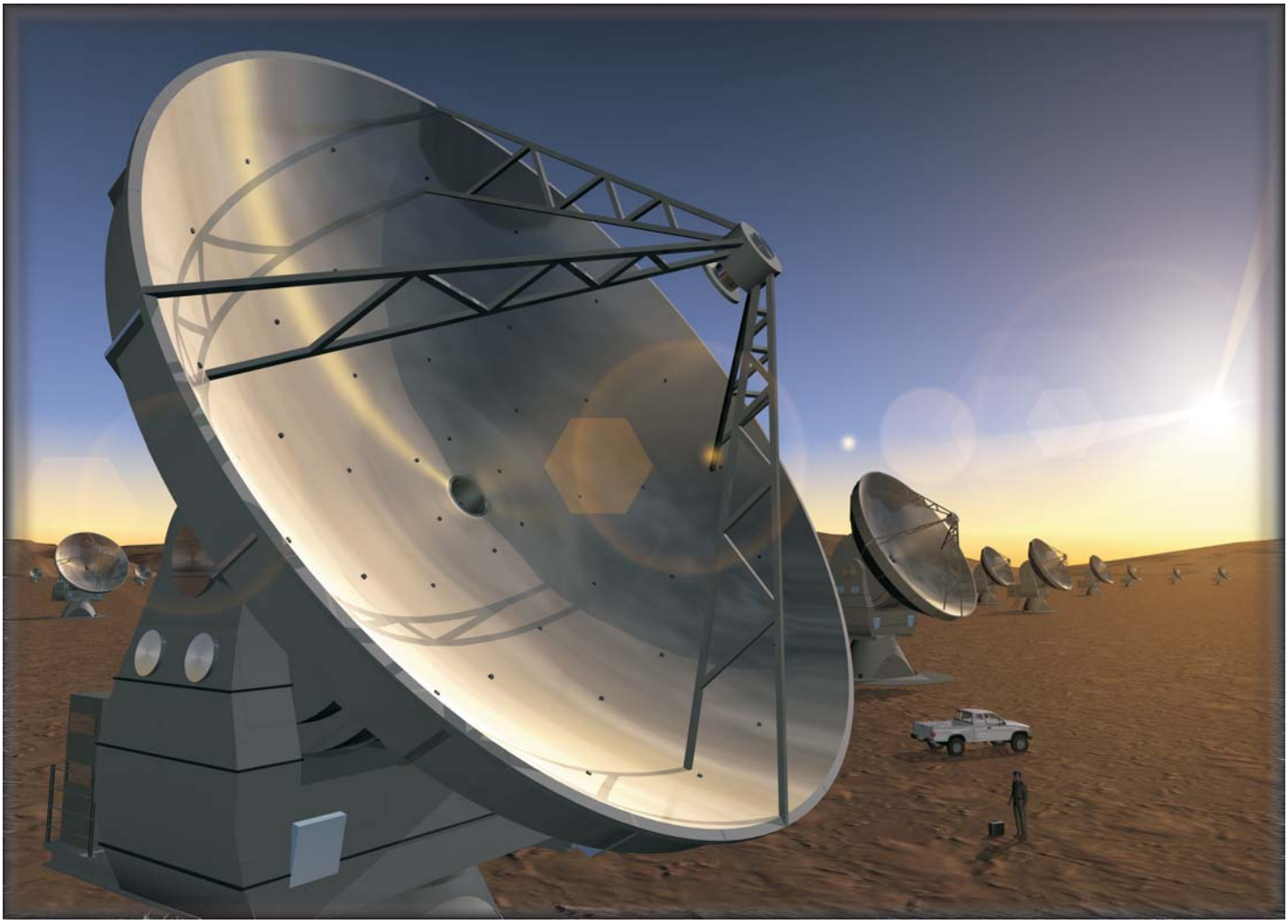
Groundbreaking for the ALMA Project

Green Bank Telescope Enhancements



Also in this Issue:

Atacama Large Millimeter Array (ALMA)

Groundbreaking for the ALMA Project

On November 6, 2003, at the site of the future Operations Support Facility (OSF) for ALMA at an altitude of 9600 feet, ground was broken by ALMA Director Massimo Tarenghi, NSF Division of Astronomical Sciences Director Wayne van Citters, and ESO Council President Piet van der Kruit at a ceremony attended by dozens of distinguished guests. Only a little more than 30 years after the first detection of interstellar CO by the NRAO 12 Meter Telescope, construction of ALMA, a telescope capable of detecting the first CO molecules in the Universe, had begun.

Flags of the ALMA participant countries fly beside the new road to the array site, which lies beyond Cerro Negro (background).

Some 50 special guests in a convoy of 17 vehicles participated in a site visit on the previous day, the largest crowd of visitors so far. All remained well during the trip indicating that the site is quite accessible to the uninitiated when adequate precautions, such as the use of the provided bottled oxygen, are taken.

From around the world and from across Chile, guests began to arrive just before noon on the newly constructed ALMA road from Chilean highway 23 between San Pedro de Atacama and Toconao through the OSF site to the 16,500 foot Llano de Chajnantor, the site of the ALMA telescopes. At the OSF, the original concept which was developed by Mark Gordon and Robert Brown, guests mingled in the stunning weather, meeting newcomers near a display of the flags of the ALMA participant nations. As people approached the splendid white tent, the center of festivities, members of the press interviewed the various ALMA principals. Far below, the vista extended for dozens of miles, dominated by the great Salar de Atacama stretched along the horizon to the village of San Pedro. In the foreground, the temporary camps for construction workers and ALMA personnel were already in place. Peering over the northern horizon, the upper reaches of Licancabur dominated the skyline. Up the mountain, the new ALMA road wound through the rocky landscape beside Cerro Negro toward the high site. Slowly guests made their way toward the tent, sampling refreshments along the way. Cries of 'Hola!' rang out as arriving old friends greeted one another to the sounds of Atacameñan music.

Massimo Tarenghi and Fred Lo with ALMA workers.

By a quarter past twelve, most had arrived at the tent to seek their assigned tables. Each table had been given the name of a Chilean wildflower; a photo marked

Dr. Lo addresses the participants in the Groundbreaking ceremony.

each. Thus familiarized with the local flora, guests met their tablemates and took their seats. At each place lay a mysterious dark felt bag. Projected high above the speakers was the new ALMA logo—a Southern Cross above an array of radio telescopes. Event organizers and Masters of Ceremonies Daniel Hofstadt and Eduardo Hardy (ESO and AUI/NRAO representatives in Chile, respectively) introduced an array of speakers.

Leading off, ESO Council President Piet Vander Kruit outlined the scientific promise of ALMA. "We are children of the Universe. Actually, we are children of the Universe in a very strict sense. Look at our bodies. By weight we are made up of about a quarter or so of hydrogen. The rest is in other chemical elements, of which carbon, nitrogen and oxygen are the major contributors. In contrast, the Universe, when it was about three minutes old and sufficiently cool that atomic nuclei could exist, consisted of three-quarters of hydrogen and one quarter of helium. There was no carbon, no nitrogen, no oxygen or any other chemical element except a trace of lithium and boron. We now know that the chemical elements that make up most of our bodies were formed by nuclear reactions in heavy stars that live for a very short while and blew themselves up as supernovae and release the heavy elements into the interstellar gas so that new planets and possibly life can be formed. We are stardust. In spite of progress in the twentieth century, such as understanding nucleosynthesis, there are still fundamental questions left. Some important ones among these are the following. When and how did galaxies form and in what way did early star formation and chemical enrichment take place? How do planets form around young stars? To completely solve all aspects of these and other problems we absolutely need to be able to observe at millimeter and sub-millimeter wavelengths."

Building on the theme of international cooperation, the Director of the Division of Astronomical Sciences of the U. S. National Science Foundation Wayne van Citters delivered a message from Rita Colwell, the Director of NSF. In her message, Dr. Colwell said: "The plateau where ALMA's antennae will rise is one of the most starkly beautiful places on Earth. It's not enough for the scientific community to identify an outstanding site for astronomy; we rely also on the generosity and cooperation of a willing host. Chile has a long history of opening regions of exceptional scientific merit to the world community. The Atacama Large Millimeter Array will expand our vision of the universe with 'eyes' that pierce the shrouded mantles of space through which light cannot penetrate. ALMA's 64 radio telescopes will serve as windows through which scientists and the curious public will 'see' back in time and far away, to where the earliest and most distant galaxies were forming." van Citters noted "how far we have come in our understanding, our ambition, our sheer scientific audacity in less than one professional lifetime." From debating whether sufficiently bright detail would support baselines as long as 100 m on fledgling arrays, or whether extragalactic molecules could possibly be bright enough, to the present, he continued, where we "await ALMA's ability to map molecular gas in the first generation of galaxies; this gas already contains elements heavier than hydrogen that were forged in the first generations of stars to form, less than a billion years after the origin of time itself."

Arthur Carty, President of the National Research Council of Canada, noted that as a chemist by training, he had "come to appreciate the value of astronomy not only as a fundamental and important scientific discipline, but also as a unique vehicle for encouraging national and international cooperation and for turning our young people on to science and technology."

Riccardo Giacconi, President of AUI, noted the great scientific promise of ALMA.

Noting that the date was exactly the fortieth anniversary of the signing of ESO's first agreement with Chile, ESO Director-General Catherine Cesarsky noted "here, on Chilean soil, in the great emptiness of the Atacama desert and closer to the sky than ground-based astronomers have ever been, we are now embarking upon an ambitious exploration of new and unknown celestial territories. We do so in the service of science and society, ultimately for the benefit of humanity."

NRAO Director Fred K. Y. Lo recalled the long road leading to the ALMA groundbreaking in his remarks. "We are here celebrating the realization of the aspirations of many astronomers for more than twenty years to build a powerful array that can let us peer into the beginnings of the Universe, galaxies, stars and planets and perhaps life itself," he noted. "There are many people on the NA side to recognize for bringing ALMA into reality, but I would like to mention three names. The first is Bob Dickman at the NSF. He has been the champion of ALMA within NSF for many years and continues to play an important role by serving on the ALMA Board. Second is my predecessor, Paul Vanden Bout. Without his persistence for more than 15 years to get the MMA, and later ALMA, funded, his genius of forming international alliances, and many other efforts including the selection of Chajnantor as a site, we would not have ALMA today. Last but not least, AUI President Riccardo Giaconni. As ESO Director General, he signed the key international agreement with Paul Vanden Bout that led eventually to the Bilateral ALMA that we are celebrating today. Now that he has joined the NA side, he is making sure that we do not deviate from getting ALMA built on time and on budget."

Intendente Jorge Molina welcomed ALMA to the Second Region of Chile and made reference to the interest of the Region in becoming the "astronomy world capital" now that both the VLT and ALMA are located there. He also referred to the impact ALMA will have on the local community, in particular after the signature on 28 October of the agreement between ALMA and the Intendencia that benefits the San Pedro Commune.

Mayor of San Pedro de Atacama Sandra Berna echoed Intendente Molina's remarks, noting that San Pedro was the capital of Chilean archaeology and that now it may become a capital of science as well. Finally, the Bishop of Calama, Obispo Guillermo Vera Soto, blessing the beginning of the ALMA construction work, used biblical imagery in referring to the astronomical aims of the project.

A reflection on ALMA science was given by the President of AUI, Riccardo Giacconi, winner of the 2002 Nobel Prize in Physics. Dr. Giacconi shared his vision of the scientific significance of ALMA, elaborating on themes of particular interest. "ALMA will have

NSF's Robert Dickman christens a block with Chilean wine as Eduardo Hardy, Fred Lo, Massimo Tarenghi, Catherine Cesarsky and Daniel Hofstadt (l-r) look on.

unsurpassed sensitivity and imaging capabilities for molecular spectroscopic study of external galaxies and will be able to detect the first galaxies formed through their dust emission at $z > 20$. It will be able to study star formation cores in nearby galaxies and assess the role of morphology and environment in their dynamic and chemical evolution. The setting of ALMA in the southern hemisphere will permit detailed studies of the large and small magellanic clouds. The study of organic molecules in interstellar space will provide indispensable clues to the origin of life in the universe".

Project Director Massimo Tarenghi expressed the ALMA team's feelings about reaching this milestone. "We may have a lot of hard work in front of us," he said, "but all of us in the team are excited about this unique project. We are ready to work for the international astronomical community and to provide them in due time with an outstanding instrument allowing trailblazing research projects in many different fields of modern astrophysics."

After a punctual and successful ceremony many guests returned to the task of finishing the construction in a similarly timely fashion.

H. A. Wootten

Detailed Remarks of Speakers

Rita R. Colwell
Director, National Science Foundation

The U.S. National Science Foundation joins today with our North American partner Canada, and with the European Southern Observatory, Spain, and Chile to prepare for a spectacular new instrument. The Atacama Large Millimeter Array will expand our vision of the universe with "eyes" that pierce the shrouded mantles of space through which light cannot penetrate.

I extend both my congratulations and my regret for not being able to join you. As you break ground for a new observatory, I will join the President at a ceremony to recognize scientists and engineers who have broken ground with far-reaching observations throughout their careers. They will be receiving the distinguished National Medal of Science.

The plateau where ALMA's antennae will rise is one of the most starkly beautiful places on Earth. It's not enough for the scientific community to identify an outstanding site for astronomy; we rely also on the generosity and cooperation of a willing host. Chile has a long history of opening regions of exceptional scientific merit to the world community.

Last year, I participated in the official opening of Gemini South near La Serena. Gemini is but one in a long line of facilities that have taken advantage of the observing conditions in Chile and paved the way for one more.

Today marks the official start of construction. But the ALMA partnership also breaks ground with a novel collaboration that ensures equal access by astronomers on at least three continents. International partnerships are quickly becoming the norm of the millennium, enabling

organizations and nations to combine funds to achieve greater scientific capability. NSF is proud to participate in the creation of an instrument that will provide unprecedented power for science and immeasurable knowledge for all.

ALMA's 64 radio telescopes will serve as windows through which scientists and the curious public will "see" back in time and far away, to where the earliest and most distant galaxies were forming.

Our investments in ALMA's educational programs will be as important as our outlays for construction, operations, and scientific research. With our ALMA partners, we will engage a younger generation of scientists and engineers in bonds that leap national borders and integrate education with research.

We at NSF extend our best wishes for the speedy completion of ALMA and for a lifetime of spectacular achievements.

Wayne Van Citters
Director, NSF Division of Astronomical Sciences

It is a great personal pleasure for me to be here with friends from Chile, Europe, North America, and Japan at this historic occasion. As I was thinking about this ceremony on the plane flight down to Chile, it reminded me of the first site visit I held on coming to NSF almost 25 years ago. We were reviewing the fledgling millimeter interferometer built by Caltech in the Owens Valley of California. One of the major points of discussion at the time was whether it was scientifically cost effective to expand the baseline (the distance between the two antennas) from 50 meters to 100 meters. There was a substantial body of thought that this would not be worthwhile, for after all, surely there would not be any source that would be bright enough on such small scales to be detected. Today we break ground for a millimeter interferometer that will have baselines measured in thousands of meters.

Very soon the question turned to one of whether it was worthwhile to use millimeter telescopes, and millimeter interferometers in particular, to observe molecular gas in external galaxies. Surely there would not be any detail visible at the necessary brightness. Today we eagerly await ALMA's ability to map molecular gas in the first generation of galaxies; this gas already contains elements heavier than hydrogen that were forged in the first generations of stars to form, less than a billion years after the origin of time itself.

How far we have come in our understanding, our ambition, our sheer scientific audacity in less than one professional lifetime.

The scientific promise of ALMA is compelling and its contributions to our comprehension of the Universe and our place in it will be profound. As Rita noted in her remarks, the questions to which we seek answers transcend national boundaries and cultural divides. So in addition to breaking ground for a powerful scientific instrument today, let us also pledge to respond to a powerful challenge put to the American Astronomical Society by Arthur Carty last year in Nashville. Let the ALMA partnership use the universal appeal of astronomy to bind us together across oceans and between continents.

I believe that a world pursuing a global strategy to discover how the beauty that surrounds us today came to be, including we who are enjoying it, that world must ultimately put aside suspicion, hatred, racism and greed. Let us dedicate ALMA as an instrument of understanding, not only of scientific fact but also of ourselves. Through ALMA let us leave a legacy of mutual respect, of free and open inquiry, and of love of the truth to our children - indeed to the children of the world community.

K. Y. Lo
Director, NRAO

Distinguished guests, ladies and gentlemen,

On behalf of the National Radio Astronomy Observatory, the North American (NA) Executive of the ALMA Project, I welcome you to this ground breaking ceremony. Today, we are celebrating the realization of the aspirations of many astronomers for more than twenty years to build a powerful array that can let us peer into the beginning of the Universe, galaxies, stars and planets, and perhaps even life. ALMA is truly one of the cornerstones of major ground-based telescopes in the many decades to come.

In the US, the beginning of ALMA went back to 1982 when the NSF Committee on the Future of Millimeter-wave Astronomy headed by Professor Alan Barrett of MIT recommended the building of a national millimeter-wave array, called the MMA. Over the years, I remember participating in many workshops on the development of the MMA.

As a member of the NRAO Visiting Committee, I visited the Plano de Chajnantor, Pampa la Bola and Rio Frio in 1996. They were at that time potential sites for the MMA, the Large Millimeter and Sub-millimeter Array of Japan, and the Large Southern Array of Europe. I remember distinctly thinking at that time: the rational thing was for the three very similar projects to become one, but for practical and political reasons, it would never happen. Here we are today, commemorating basically the merging of the US and European projects, and we are fully expecting the final step of merging with the Japanese project in 2004. How wrong I was, but what a triumph for astronomy and international relations!

For making the North American participation in ALMA possible, I must thank the US National Science Foundation for supporting the ALMA and the Canadian National Research Council for contributing to the project. In addition, we are very honored to have both the US Ambassador Brownfield and Canadian Ambassador Giroux joining us in this ceremony.

There are many people on the NA side to recognize for bringing ALMA into reality, but I would like to mention three names. The first is Bob Dickman at the NSF. He has been the champion of ALMA within NSF for many years and continues to play an important role by serving on the ALMA Board. Second is my predecessor, Paul Vanden Bout. Without his persistence for more than 15 years to get the MMA, and later ALMA, funded, his genius of forming international alliances, and many other efforts including the selection of Chajnantor as a site, we would not have ALMA today. Last but not least, AUI President Riccardo Giaconni. As ESO Director General, he signed the key international agreement with Paul Vanden Bout that led eventually to the Bilateral ALMA that we are celebrating today. Now that he has joined the NA side, he is making sure that we do not deviate from getting ALMA built on time and on budget.

As NRAO Director, I have the heavy responsibility to ensure our Observatory will do its part to get this very complex telescope array built by 2012. Of course, much of the work is borne by the NRAO ALMA Team. There are too many to name, but I would like to recognize a few key members who are here today: our ALMA Division Head, Darrel Emerson, Project Manager Marc Rafal, Project Scientist Al Wootten, AUI Vice President Pat Donahoe, Eduardo Hardy our representative in Chile, and Simon Radford who has worked on preparing the site here for almost ten years.

Finally, I would like to thank the Chilean government at all levels, our Chilean astronomy colleagues, and the citizens of Region II, all of whom so graciously allow ALMA to be built in their beautiful country.

I look forward next to the ALMA dedication ceremony in 2012 and to making my first image with the array.

Thank you very much for joining us in this celebration.

Riccardo Giacconi
AUI President

I have been asked to make a brief statement about the scientific significance of the event we celebrate here today. The exciting discoveries in astronomy and astrophysics of the last decade and the great technological advances in astronomical instrumentation hold the promise that in the beginning of this new millennium we will take a giant step forward in our understanding of the cosmos. In the last decade we have, for the first time, discovered the existence of numerous planets around stars other than the sun; we have peered at the very edge of the visible universe only a few hundred thousand years after the big bang to study the seeds of galaxy formation; we have found evidence of a new form of energy that might be the largest constituent of the universe. We have found that galaxies and clusters of galaxies were formed much earlier than we had thought and that most galaxies (including our own) harbor massive black holes. The study of black hole physics and of the phenomena occurring in γ ray burst sources has made great advances and holds the promise

to test theories of gravity, including general relativity, under strong field conditions. For the first time we have detected neutrinos from a supernova explosion and extended astrophysical observations of specific phenomena to particle detection.

An ambitious plan of study has emerged for the next twenty or thirty years which combines the study of the extremely large with that of the extremely small. To understand the Universe we need to further advance our knowledge of the fundamental laws of physics and of the elementary constituents of matter. The Universe itself is becoming the laboratory where the very high energies, high densities, and strong fields provide the testing ground for these new laws. This plan anticipates the development of new and more powerful observational facilities in all the wavelengths of the electromagnetic spectrum, as well as particle detectors, through international collaborations on a scale never seen before. ALMA will be at the forefront of these facilities and hopefully will provide a model for such collaborative efforts. ALMA observations will serve to elucidate many of the most important questions in astrophysics today.

ALMA will permit us to study the distant Universe and observe the first seeds of galaxy formation and the subsequent galaxy evolution. It will have the required sensitivity, resolution, and bandwidth to observe the small scale anisotropies in the cosmic microwave background imprinted by the initial fluctuations at $Z \sim 100$ and the distortions due to the Sunyaev-Zeldovich effect in clusters of galaxies. Together with X-ray observation this will permit direct measurement of the size and curvature of the universe.

ALMA will have unsurpassed sensitivity and imaging capabilities for molecular spectroscopic study of external galaxies and will be able to detect the first galaxies formed through their dust emission at $Z > 20$. It will be able to study star formation cores in nearby galaxies and assess the role of morphology and environment in their dynamic and chemical evolution. The setting of ALMA in the southern hemisphere will permit detailed studies of the large and small Magellanic clouds. The study of organic molecules in interstellar space will provide indispensable clues to the origin of life in the universe.
ALMA will offer unique capabilities to study super massive black holes in all galaxies including our own. With the same angular resolution of the Hubble Space Telescope, ALMA can resolve the disks fueling the central black holes in galaxies as far as Virgo and yield geometry, physical conditions and kinematics of the gas. Finally if used as the prime component in a world wide millimeter wave VLBT network, ALMA would allow us to map the structure of active galactic nuclei with a resolution of 10 micro arc seconds, the highest resolution achievable in astronomy. Thus ALMA will contribute to the all wavelength attack on the fundamental problems of the origin of the universe, of development of structures and possibly of organic life.

I would like to conclude with a very brief personal remark. I consider myself extremely fortunate in having lived in this epoch of advances in astronomy not equaled since the time of Copernicus, Galileo, Kepler, Tycho, and Newton. I was privileged in being associate with some of the great enterprises in our field: the start of X-ray astronomy and the development of Chandra, the operation of the Hubble Space Telescope, the development of the Very Large Telescope on Paranal, and now the start of the ALMA Project. In some of my recent papers I found myself using data from Chandra, HST and VLT to clarify, after forty years of work, the mystery of the X-ray background. Still some of the X-ray sources we observe in the deepest survey are so faint that neither HST nor VLT can identify them, and they may well be new types of celestial objects. I hope ALMA will be able to solve this new mystery in my lifetime. I would like to end by thanking our host, Chile, for joining us in this noble voyage of discovery and making this enchanted land the home for some of the most important of these great enterprises.

Me gustaría concluir agradeciendo a nuestro anfitrión, Chile, el haberse unido a nosotros en este noble viaje de descubrimiento, haciendo esta tierra encantada el hogar de algunas de las mas importantes de estas grandes aventuras. Muchas gracias!

ALMA
Groundbreaking Ceremony

A momentous event took place on 6 November, at the site of the ALMA "Operations Support Facility" (OSF), near Chajnantor where the array will be built. About 170 scientists and dignitaries from Europe, North America, Japan and Chile attended the groundbreaking ceremony for this global project. The pictures shown here and two of the speeches that were given (those by the ESO Director General and President of Council) tell the story.

The President of Council, Professor P. van der Kruit, energetically breaks the ground for ALMA along with Dr. W. Van Citters (NSF, Director of the Division of Astronomical sciences) and Prof. M. Tarenghi (ALMA, Director).

ALMA will be the highest-altitude, full-time ground-based observatory in the world, at 5,000 metres altitude. Work at this altitude is difficult.

To help ensure the safety of the scientists and engineers at ALMA, operations will be conducted from the OSF, a compound located at a more comfortable altitude of 2,900 metres, between the cities of Toconao and San Pedro de Atacama, and within relatively easy reach of the array itself. The OSF will also be the base for the construction teams, and the 64 antennas will be assembled here.

A number of containers and other facilities are already located at the OSF, and it is very reminiscent of the early days of the construction of the VLT. Work on the OSF and on the ALMA site itself will now take place at an accelerated pace, paving the way for the arrival of the first elements of the array.

Also, at the Ground breaking ceremony, the new ALMA logo (see facing page) was unveiled.

Directions to everywhere from the site of the OSF, where the groundbreaking took place.

Address by Prof. P. van der Kruit, President of ESO's Council

Mrs. Paulina Saball, Undersecretary of the Bienes Nacionales,

Mr. Jorge Molina, Intendente of the Second Region,

Distinguished Ambassadors,

Esteemed Authorities,

Dear colleagues,

Ladies and Gentlemen,

We are children of the Universe. Actually, we are children of the universe in a very strict sense. Look at our bodies. By weight we are made up for about a quarter or so of hydrogen. The rest is in other chemical elements, of which carbon, nitrogen and oxygen are the major contributors. In contrast, the Universe, when it was about three minutes old and sufficiently cool that atomic nuclei could exist, consisted for three-quarters of hydrogen and one quarter of helium. There was no carbon, no nitrogen, no oxygen or any other chemical element except traces of lithium and boron. We now know that the chemical elements that make up most of our bodies were formed by nuclear reactions in heavy stars that live for a very short while and blow themselves up as supernovae and release the heavy elements into the interstellar gas so that new planets and possibly life can be formed. We are stardust.

Astronomy, astrophysics and nuclear physics have made it possible for us to understand how the chemical elements were formed. I regard this as one of the greatest accomplishments of science in the twentieth century. It is amazing that physical science is so powerful to make it possible for us to appreciate our origin.

Astronomers study our roots and our relation as human beings to the cosmos. But astronomy is an observational science. We will not understand the universe simply by pure thought, but rather we start by looking at it. We presently observe in the optical with giant telescopes, such as the VLT, Gemini, Keck, Magellan, etc., some of which are here in Chile. We use telescopes in space to observe at wavelengths that cannot be observed from the ground, such as in the X-ray region and the far infrared. We have built very large radiotelescopes and we have linked these or have constructed arrays, using the same principle as ALMA will use.

In the last few decades, astronomers have realized the richness of the millimetre and submillimetre spectrum and the potential for observations there to solve the current questions in astrophysics. Therefore millimetre telescopes have been built, again including one on Chilean soil at La Silla, and arrays have been constructed in particular in North-America, Europe and Japan. These already use the spectral lines that can be observed at millimetre wavelengths to study the chemical composition in regions of star formation, especially in the gas and dust in cool regions.

In spite of progress in the twentieth century, such as understanding nucleosynthesis mentioned above, there are still fundamental questions left. Some important ones among these are the following. When and how did galaxies form and in what way did early star formation and chemical enrichment take place? How do planets form around young stars? To completely solve all aspects of these and other problems we absolutely need to be able to observe at millimetre and sub-millimetre wavelengths.

I myself had the privilege as a graduate student in Leiden, the Netherlands, to have professor Jan Oort as my thesis supervisor. This was in the days of completion of the construction of the Westerbork radiotelescope and he always stressed that it was the unexpected to look forward to. So will it also be for ALMA.

In order to build an instrument like ALMA we need a site in a very dry climate, at a high altitude and with a relatively flat area with dimensions of order ten kilometres. We have been fortunate that such a unique site is in existence here in Chile at Chajnantor.

After a number of initiatives in various continents to start a project to construct a millimetre array, eventually collaboration grew out of this between North America (that is, the U.S.A. and Canada) and Europe (the member states of the European Southern Observatory and Spain; ESO states are Belgium, Denmark, France, Germany, Italy, the Netherlands, Portugal, Sweden, Switzerland and the United Kingdom). Unfortunately Japan, which was involved in the definition of the project, is not taking part now and the original plan had to be scaled down to what we call the "baseline ALMA". But we are very hopeful, and actually heard very encouraging news the last few days at the ALMA Board, that Japan will join us soon to build an even more powerful ALMA than we are constructing now.

I would like to express, also on behalf of the ALMA Board, my gratefulness to:

– the visionaries who believed ALMA was the biggest step astronomy could make at the present time and never gave up to try to convince others;

– the scientists and engineers that believed in it and showed that ALMA is possible technically and financially;

– administrators and politicians that also believed in it and convinced ministers and high officials that ALMA should be funded;

– authorities that solved political and legal problems;

– and last but not least everyone at whatever level, in whatever capacity and from whatever country that contributed in whatever way to the fact that today we can formally start the construction of ALMA.

A los Chilenos y particularmente a la gente de la comuna de San Pedro: Muchas gracias por su cooperación en este lugar tan único y para permitir el desarrollo de la astronomía en su territorio hermoso. Estamos agradecidos y les deseamos todo lo mejor.

Address by Catherine Cesarsky, Director General of ESO

THIS IS A GREAT DAY FOR ASTRONOMY. This is indeed a great day for Chile, for the II Region and for San Pedro de Atacama. And this is indeed a great day for all of us, a moment to which we have all been looking forward with great anticipations. This is the real beginning of a joint adventure. We will be reaching towards the stars, searching for the earliest, remotest objects in the Universe, peering beyond current horizons into the deep unknown.

Here, on Chilean soil, in the great emptiness of the Atacama desert and closer to the sky than ground-based astronomers have ever been, we are now embarking upon an ambitious exploration of new and unknown celestial territories. We do so in the service of science and society, ultimately for the benefit of humanity.

There have been astronomers in Chile since long, but it was only in the early 1960s that the true potential for our science of this wonderful country with its pure atmosphere and clear skies was understood by scientists from North America and Europe. Already in those early days, people from ESO and AURA discussed opportunities to collaborate closer in their efforts to establish new and powerful observatories in the IV Region. However, time was not yet ready for such joint ventures and our predecessors in the end decided to set up separate facilities at La Silla and Cerro Tololo.

ESO signed the first agreement with Chile, exactly forty years ago today. Meanwhile, more observatories have been created in Chile, and in parallel Chilean science and technology has developed enormously. We have all benefited from increasingly closer collaboration and many young Chilean astronomers and engineers are now working at these observatories, also at La Silla and Paranal.

ALMA is the pinnacle of this long and steady development in which so many partners have come together to realize what is the first truly global astronomical project. Joining their considerable forces, the power and experience of dedicated specialists on three continents are now striving to open a new, unique window towards the Universe which will allow us to explore vistas which have been completely hidden from view until now. We are convinced that Chajnantor is the best possible site for this new instrument, a unique site which provides the ALMA telescopes with optimal conditions for sensitive, prolonged series of complex observations.

We are together today to celebrate the beginnings of a great project. We are gathering here in a beautiful and, for many of us, very remote region in which unspoiled nature will soon meet the highest technology available on this planet. We have come here to construct a unique instrument in these pristine surroundings, well aware that this vast country has a long historical and cultural tradition of ancient peoples. Peoples who have asked the same fundamental questions about the Universe and man's place in it, as we now do. While the incentives and the search remain the same, we may come closer to the answers with ALMA.

The Chajnantor plateau is a serene site where man can be alone with his thoughts. It is in many ways one of the most extreme places on this planet and nobody who has been up there remains unmoved. Once I thought of the distant past, imagining a small group of ancient, daring travelers crossing that plain in front of me, melting into the stark landscape. They would watch the night fall, the stars appearing in a darkening sky, marveling at the incredible beauty of the majestic panorama above. Would it ever have occurred to them that on this very site, hundreds of years later, a forest of giant structures would be built to collect those cryptic signals from above – messages from the depths of space with information about the beginnings of that mysterious Universe in which they - and we – live? Or would they ever imagine that people from many other societies and from other continents would sometime assemble here, working together in their quest to unravel our distant origins?

ALMA is indeed a unique project, both in terms of science, technology, operation, management. In addition this project possesses a great number of aspects that fascinate young people and it provides a fantastic opportunity to create an inviting path towards modern science, with excitement and learning going hand in hand.

Why is this so? Why has ALMA this great appeal? There is first of all the Chajnantor site itself, its remoteness, the high altitude, the desert, the volcanoes, the population in this area, the ancient peoples with their unique culture, their history. There is the challenge of high technology, the joining of so many antennas and the almost magical possibility to combine the signals so that at the end a radio image of unequalled penetration and sharpness is obtained. And then there is of course the marvelous science which ALMA will do, all the way from nearby stars with exoplanets in the making to complex interstellar molecules and onwards to the earliest and most remote galaxies.

I sense that soon the word ALMA may also become equivalent to excitement, exploration of the unknown and, not least, exemplary international collaboration. People will proudly declare that they are part of this project. Let us rejoice that we have come this far! And let us now together tackle the next crucial phase with determination. Now we begin the construction of this great facility in this exceptional place.

I would like to read to you the message received today from Norio Kaifu, Director of the National Astronomical Observatory of Japan: "Congratulations for the wonderful start of the ALMA construction. Breaking the ground, flying over the Andes, the ALMA will visit a number of marvelous new worlds in the Universe where the humankind could never reach before it. We sincerely wish safe and successful construction on the Atacama site. And, the third condor is ready to fly join you!"

I express my gratitude to all those people, in Europe, in North America and in Chile, who have helped us to reach this crucial milestone. We know that the way ahead is still long and that there will be problems. Together we shall solve them and in not too many years we will then begin to reap the fruits of this hard labour. Muchas gracias.

With the Director General in this photograph, are (left to right) Robert Dickman (NSF), Eduardo Hardy (NRAO), Fred Lo (NRAO), Massimo Tarenghi (ALMA) and Daniel Hofstadt (ESO).

Remarks by Arthur J. Carty, President of the National Research Council of Canada
ALMA Groundbreaking Ceremony
Calama, Chile
6 November 2003

Good afternoon everyone. Bon après-midi. Buenos Tardes.

It is a genuine honour to have been asked to say a few words to you today and I am delighted to be present at what I believe is the launch of one of the most significant scientific initiatives of this decade.

But first of all let me admit that as a chemist, over the last ten years, I have come to appreciate the value of astronomy not only as a fundamental and important scientific discipline, but also as a unique vehicle for encouraging national and international cooperation and for turning our young people on to science and technology.

I am sure that everyone here today is convinced that the world is entering the most extraordinary age of astronomical discovery.

Humanity has been gazing at the stars for millions of years and mapping the heavens for millennia. Certainly we now have a deeper knowledge of the chemistry and physics of the universe, but that in no way diminishes our rapidly expending sense of wonder and excitement as new planets orbiting a sun like our own are discovered and we probe deeper and deeper into the origins of our universe.

Canada is proud of its contributions to this global voyage of discovery and Canadian astronomers and their students have been and will continue to be in the vanguard of this exploration.

More to the point, we are very proud of our track record and role in international collaborations such as Gemini, the Canada France Hawaii Telescope, the James Clerk Maxwell Telescope and others, to help build observatories and innovative astronomical instrumentation.

This brings me to our role as a small, but we believe important contributor to the ALMA project. The Atacama Large Millimetre Array was the top priority for ground based astronomy in Canada's Long Range Plan for Astronomy. The National Research Council and the astronomy community in Canada worked very hard to secure the resources to make a meaningful, long term commitment to ALMA. And through the strategy we worked out for ALMA with NSF and AUI/NRAO which involves intellectual contributions such receivers and software to ALMA itself and the building of a new correlator for the Expanded Very Large

Array, NRC will be able to fulfill the terms of the North American program for radio astronomy.

So I think I speak for all Canadian astronomers in saying that we are very happy indeed to be participating with the host country Chile, with NSF, AUI/NRAO with the European Southern Observatory and other potential partners in this big step forward for radio astronomy.

As Lloyd George once said and I quote “Don’t be afraid to take a big step if one is needed: you can’t cross a chasm in two small jumps.”

Let us hope that this world Observatory ALMA, will not only bridge the gap between the past and the future of millimetre wavelength astronomy but will bring nations together in new and sustained levels of collaboration.

Thank you, merci beaucoup, gracias.