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**Remarks by
Dr. France A. Córdova
Director, National Science Foundation
At the First Stone Ceremony for the
Large Synoptic Survey Telescope
El Penón, Chile
April 14, 2015**

**NOTE: Draft agenda from Victor L. Krabbendam,
LSST Project Manager:**

- 1. General welcome identifying all appropriate dignitaries by a professional Master of Ceremonies**
- 2. (MC Introduction) LSST Director Dr. Kahn with brief LSST Project perspective, comments about Federal Agencies, concluding with intro to Dr. Cordova**
- 3. (Kahn) NSF Director Cordova**
- 4. (MC) CONICYT Representative**
- 5. (MC) US Ambassador Hammer**
- 6. (MC) Chilean President Bachelet**
- 7. (MC guided) All five speakers participate in unveiling and laying of ceremonial stone**

**Thank you, Director Kahn, for that
warm introduction.**



Let me recognize President Bachelet, Ambassador Hammer, and our good friends at CONICYT, and thank them and their staffs for the generous assistance and graciousness they have shown me during my visit here.

I have been the Director of the U.S. National Science Foundation for just over one year now. One of the best aspects of my job is that I am able to re-invigorate our relationships with long-standing partners.

And, let me say that I truly value our partnership with Chile.

I am told there is a revered Chilean proverb that says, “In union there is strength.” The measure of our union is that after more than a half-century of working together, it is stronger than ever and continuing to grow.



As you all know, since the 1960s, NSF has collaborated with the Chilean government and researchers to develop and operate a succession of highly advanced astronomical observatories – several of which are within a few kilometers of us here on El Penón.

This collaboration has been a key contributor to Chile’s reputation as one of the best locations in the world for siting large telescopes, just as the high altitudes; clear, dry air; and absence of light pollution provide unparalleled platforms for the world’s astronomers to explore the southern sky.



NSF was an early partner with Chile in exploring this valuable scientific natural resource.

NSF observatories in Chile are operated in partnership with the Republic of Chile and contribute to various funds for Chilean researchers as well as to scientific education.

Each of the observatories has its own unique international partnership, involving a variety of governments, universities and laboratories.

Critical observations of supernovae explosions observed in the late 1980s and early 1990s were made with the Blanco 4-meter telescope of the Cerro Tololo Inter-American Observatory.



Those observations indirectly led to the 2011 Nobel Prize being awarded to three prominent astronomers for “the discovery of the accelerating expansion of the Universe through observations of distant supernovae” in the words of the Nobel Committee.

CTIO is part of the National Optical Astronomy Observatory – or NOAO.

Incidentally, while I was a graduate student at Caltech in the late 1970s, I spent many nights observing at CTIO.

On Cerro Pachón, there is of course Gemini-South, the 8.1-meter optical/infrared telescope that works in tandem with a twin 8.1-meter telescope in Hawaii.



Gemini's capabilities – full-sky coverage, rapid response to transients, agile scheduling, and specialized optics – will enable Gemini to continue to play a preeminent role in international astronomical communities for many years to come.

These unique assets also mean that Gemini will become a powerful complement to the newest southern astrophysical research telescope – the Large Synoptic Survey Telescope, which we have gathered here today to celebrate -- when it comes online in the 2020s.

Building LSST was ranked as the highest priority large-scale ground-based project by our National Academies' most recent Decadal Survey of Astronomy and Astrophysics.



LSST will produce an unprecedented wide-field astronomical survey of our universe, from the inner solar system to the large scale structure of the universe.

It is designed to image the entire available sky every few nights. Its primary science goals include understanding the physics of dark energy and dark matter and detecting moderate red-shift supernovae.

LSST will provide unprecedented 3-dimensional maps of the mass distribution in the Universe, in addition to the traditional images of luminous stars and galaxies.

These mass maps can be used to better understand the nature of the newly discovered and mysterious Dark Energy that is driving the accelerating expansion of the Universe.



LSST will also provide a comprehensive census of our solar system, including potentially hazardous asteroids as small as 100 meters in size.

Finally, LSST's rapid scans of the sky will expand the opportunities to study distances and motions of nearby stars, measuring the kinematics and structure of the galactic halo, and opening up the time domain.

Repeated deep imaging of the accessible sky will reveal transient and explosive events such as cataclysmic variable stars, supernovae, and the optical counterparts of X-ray transients.



An innovative Citizen Science program will involve people of all ages in LSST discoveries, making discovery opportunities available to K-12 students.

This is just one example of our commitment to engaging the public in the thrill of discovery and increasing public understanding of -- and appreciation for -- scientific research.

Astronomers are also enlisting the help of advanced computers to gather and analyze the estimated six million gigabytes of data that LSST will generate in one year.

That research is part of the growing field of machine learning in which computers learn from large data sets, finding patterns that humans might not otherwise see.



The technique has the potential to gather information on billions of stars in a relatively short time and with less expense.

All in all, the Large Synoptic Survey Telescope will be a “game changer” in astronomy and astrophysics.

LSST is a Public-Private partnership, and the data will be made public immediately to the U.S., Chilean, and operational partner communities.

The National Science Foundation is the lead U.S. Federal agency supporting the central project office, the telescope, site, data management and education and public outreach elements of the project.

The Department of Energy, Office of Science, is providing the funding for LSST’s camera.



Significant private contributors for LSST include the Charles and Lisa Simonyi Fund for Arts and Sciences and Bill Gates.

And there are more than three dozen Institutional Partners that are providing financial contributions, in-kind contributions and/or other forms of participation.

More than 400 scientists and engineers – including many in Chile - - have committed their time, talent and expertise to help maximize the scientific impact of LSST.

Leading the whole conceptual effort to design, fund and build LSST are a handful of visionary scientists, including:



- **Tony Tyson, currently at UC-Davis and formerly of Bell Labs/Lucent Technologies, who was the prime mover of LSST from the very beginning.**
- **Roger Angel of the University of Arizona, who invented the wide field optical design and created the mirror lab that built the M1M3 optics.**
- **Sidney Wolff, former Director of NOAO and former President of the LSST Corporation, was a critical supporter, as was Chuck Claver, also of NOAO.**

Let me close by saying that NSF is very grateful for CONICYT's strong and growing commitment to the many common interests of our two scientific research agencies.



On the occasion of President Barack Obama's visit to Santiago in March 2011, President Obama and President Sebastian Piñera issued a joint statement that included the following words:

“Both Heads of State highlighted the effective collaboration in the fields of astronomy and astro-engineering which will allow the operation of the LSST and ALMA telescopes in northern Chile, involving an investment of \$1.5 billion dollars, with a close collaboration between public and private academic and research institutions in both countries.”

Our two countries share so much – a commitment to exploration and excellence, and a desire to see our partnership continue to expand.



NSF embraces Chile's seeking new opportunities to work together to achieve common goals.

For more than six decades, the U.S. National Science Foundation has empowered discoveries across a broad spectrum of scientific inquiry, and we never lose sight of NSF's desire to explore the unexplored.

More than ever, the future prosperity and well-being of both Chileans and Americans depend on sustained investments in science and engineering, and I am confident CONICYT and NSF will continue to be central to that effort.

Thank you again very much for the opportunity to join you for this important celebration.

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