

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California

El correo de Estados Unidos emite una hoja de seis sellos de tarifa internacional de 60c como parte de las series de los "Logros en la Exploración del Espacio". Esta hoja titulada "Probando la inmensidad del espacio" muestra seis observatorios y/o telescopios del programa espacial Americano.



Sello del Observatorio de Arecibo



Hoja conmemorativa

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California

Probing the Vastness of Space

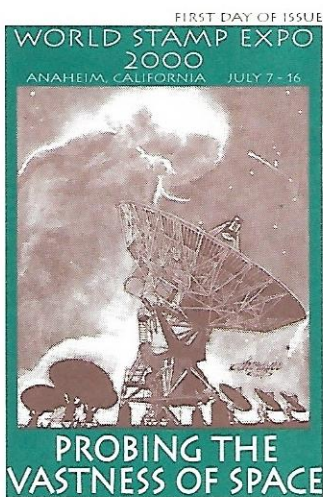


First Day of Issue
Official ASDA "Silk" Cachet by Colorano



FIRST DAY OF ISSUE

Sobre de primer día Colorano con el Observatorio de Arecibo



2000

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Sobre de primer día del World Stam Expo con el Observatorio de Arecibo

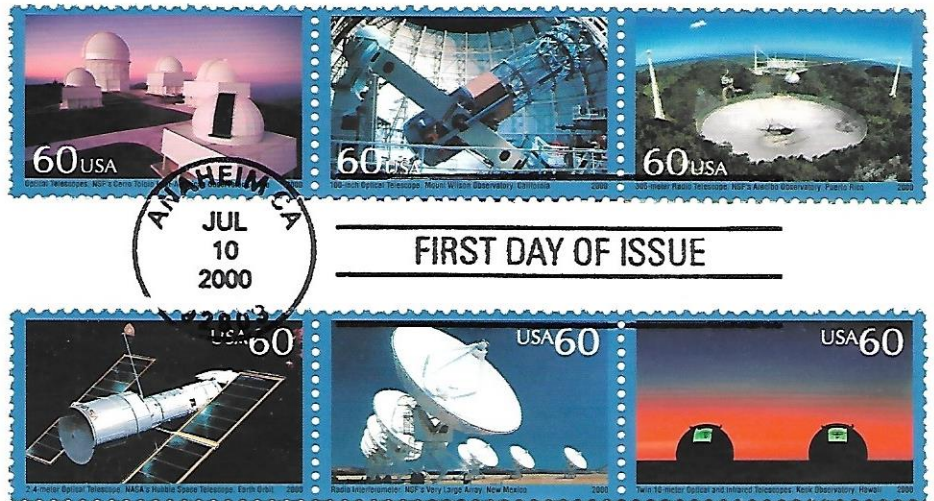
SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000

Anaheim, California

To Honor
The Role of
Observatories
and
Telescopes

*First Day of
Issue*



Probing the Vastness of Space

Sobre de primer día con la serie completa

Arecibo Observatory



FIRST DAY OF ISSUE

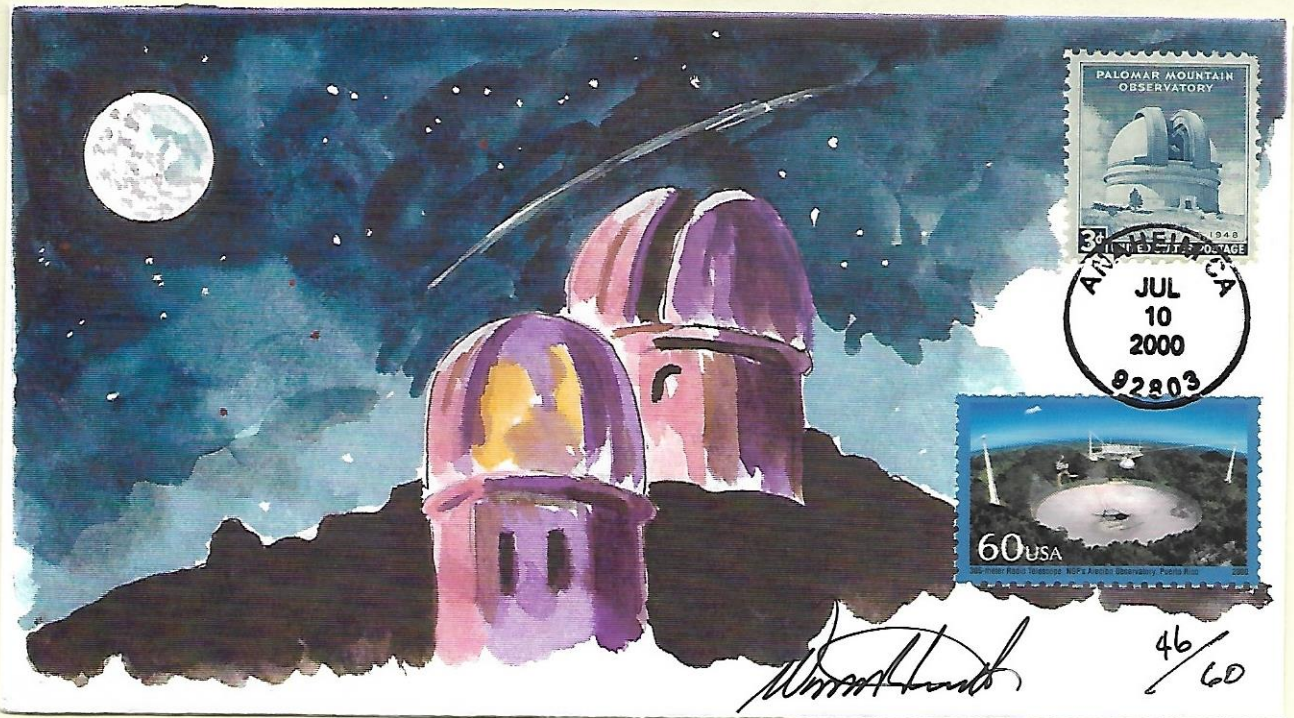
*First Day of Issue
Arecibo, Puerto Rico*



Sobre de primer día con el Observatorio de Arecibo

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California



Sobre de primer día Wild Horse Cachets con el Observatorio de Arcibo

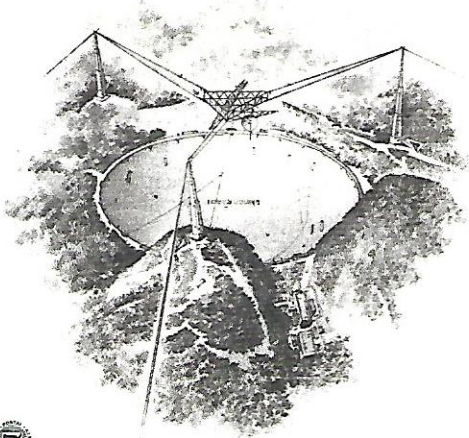


Sobre de primer día Artcraft con el Observatorio de Arcibo

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California

Official First Day Of Issue



FIRST DAY OF ISSUE



PROBING THE VASTNESS OF SPACE

Radio Telescope
Arecibo Observatory, Puerto Rico

Sobre de primer día de la Commemorative Postal Society con el Observatorio de Arecibo

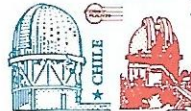
PROBING THE VASTNESS OF SPACE



HUBBLE SPACE TELESCOPE (NASA-ESA)

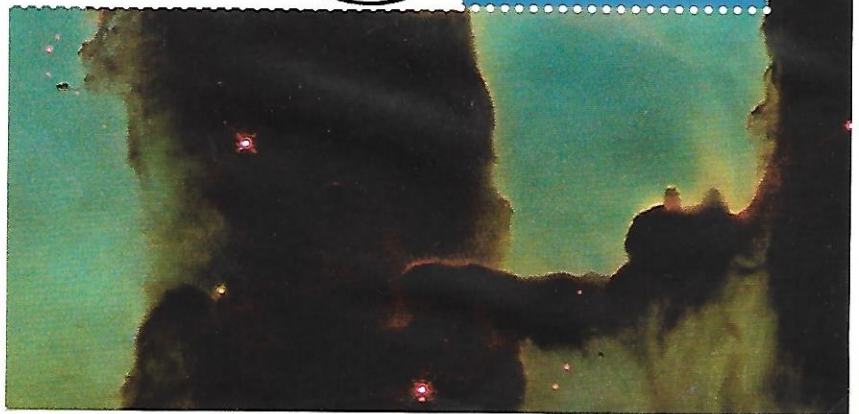
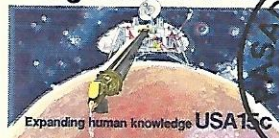
Very Large Array New Mexico

OBSERVATORIES-
Keck, HAWAII
Cerro Tololo Inter-American, CHILE
Mt. Wilson, CA



6-60¢ STAMPS ISSUED JULY 10, 2000

Viking missions to Mars

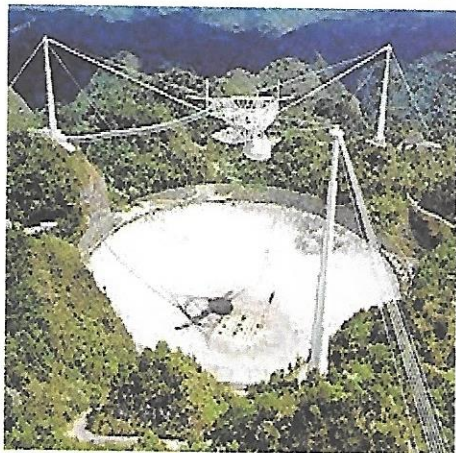


Sobre de primer día con el Observatorio de Arecibo

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California

Arecibo Observatory



First Day of Issue



FIRST DAY OF ISSUE



Sobre de primer día con el Observatorio de Arecibo

Arecibo Observatory



FIRST DAY OF ISSUE

*First Day of Issue
Arecibo, Puerto Rico*



Sobre de primer día con el Observatorio de Arecibo

SERIE EN HONOR A LOS OBSERVATORIOS

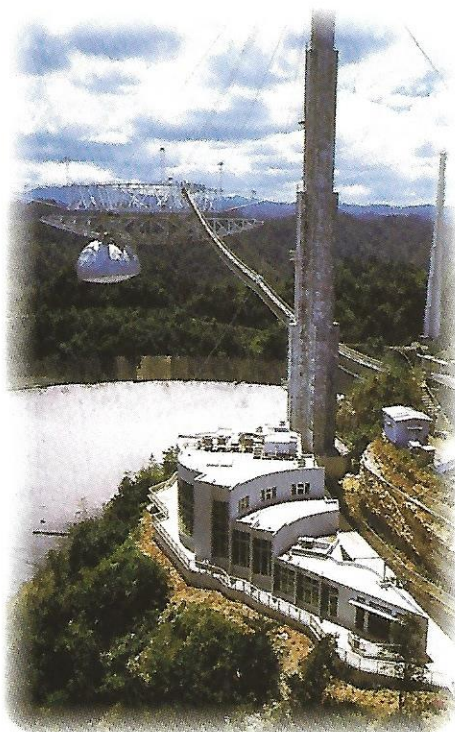
10 de julio del 2000

Anaheim, California

National Astronomy
and Ionosphere Center

Arecibo Observatory

"The largest radio telescope on Earth"



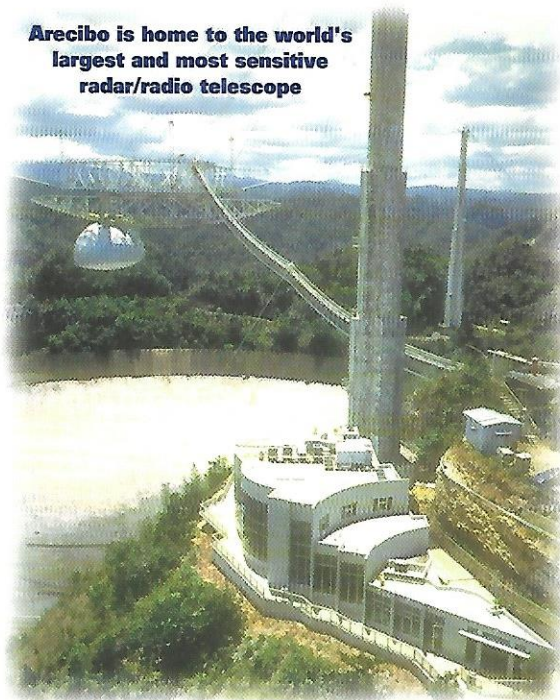
Centro de Visitantes
Fundación Angel Ramos

Angel Ramos Foundation
Visitor Center

THE **ARECIBO** **OBSERVATORY**

Largest radio telescope on earth
Angel Ramos Foundation
Visitor Center

**Arecibo is home to the world's
largest and most sensitive
radar/radio telescope**



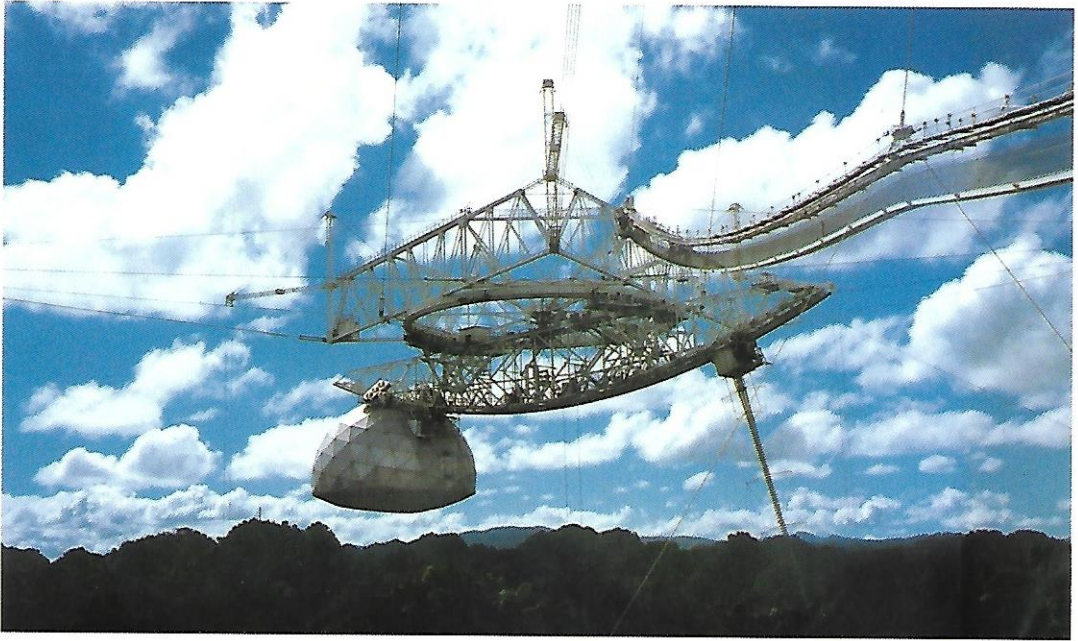
Nestled in the mountains of northern Puerto Rico, about 30 minutes from Arecibo, is the world's largest radar/radio telescope. Here scientists from all over the world use a 20-acre, 1,000 ft. diameter dish to listen to the universe. Visitors view the huge telescope from an observation platform, where its austere metallic symmetry shimmers in dramatic contrast with the dense green tropical landscape.

The Arecibo Observatory is part of the National Astronomy and Ionosphere Center operated by Cornell University under a cooperative agreement with the National Science Foundation

Davis, Parker, 1997 Science Photo Library

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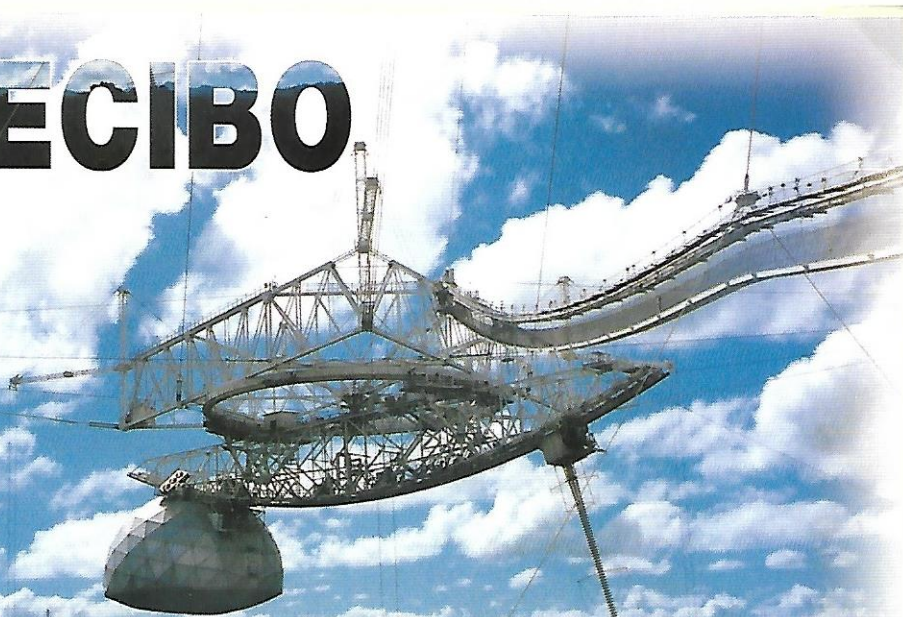
10 de julio del 2000
Anaheim, California



Arecibo, Puerto Rico



ARECIBO

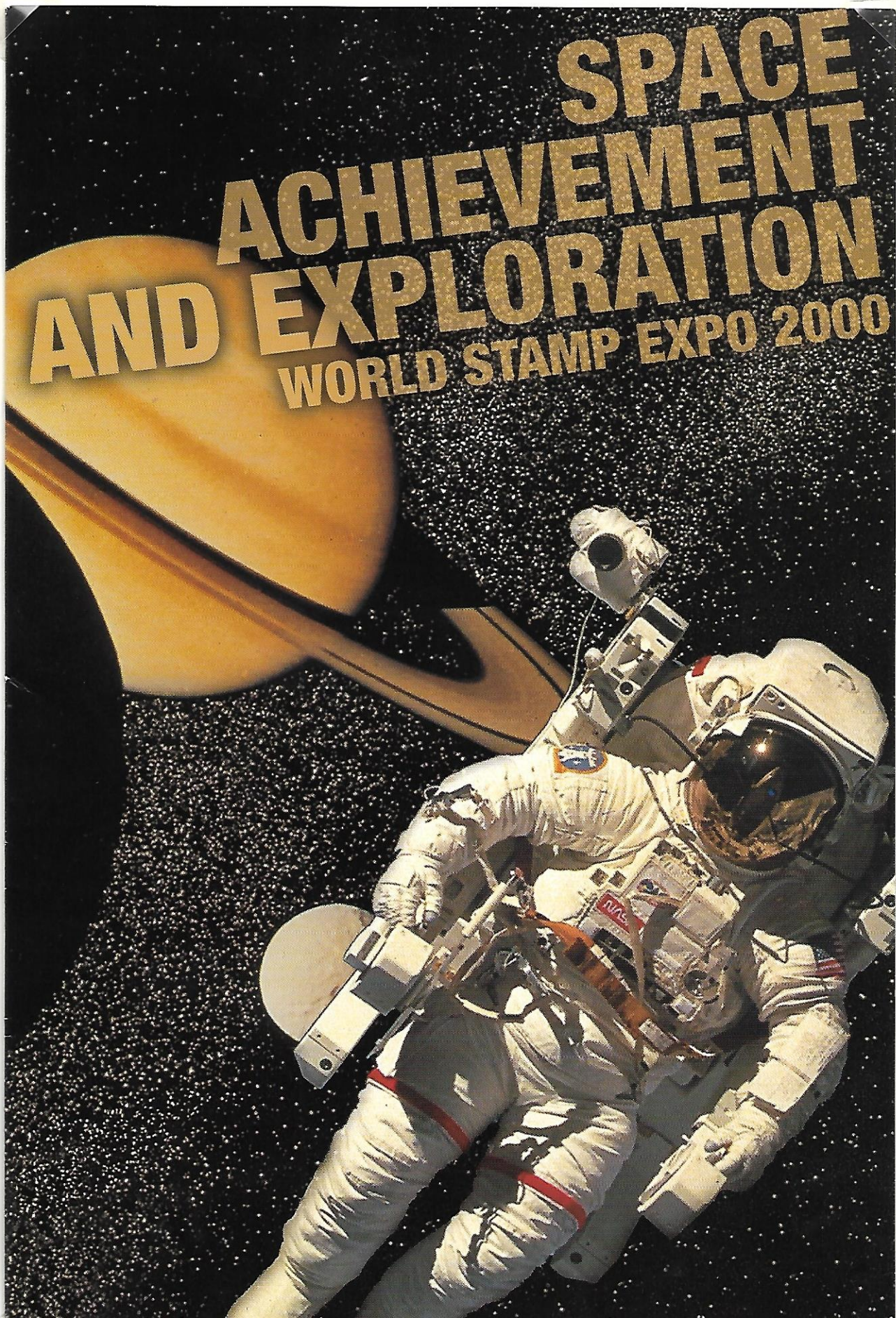


Puerto Rico



SERIE EN HONOR A LOS OBSERVATORIOS

**SPACE
ACHIEVEMENT
AND EXPLORATION
WORLD STAMP EXPO 2000**



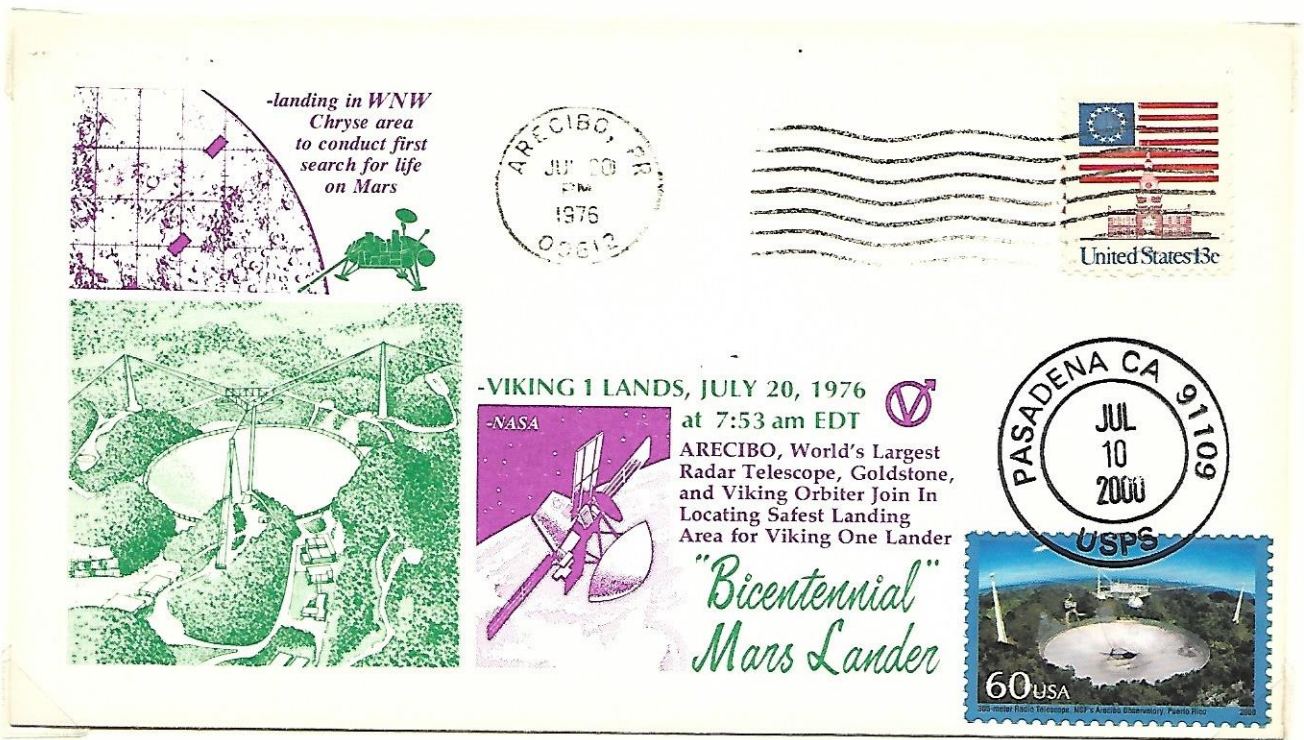
SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000

Anaheim, California



Sobre de primer día BGC con el Observatorio de Arecibo



Sobre de primer día con el Observatorio de Arecibo cancelado también el 20 de julio de 1976 conmemorando el uso del radiotelescopio para el Viking I

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California



FIRST DAY OF ISSUE

Nasa's Hubble
Space Telescope
First Day of Issue

Sobre de primer día con sello del telescopio Hubble de la NASA en órbita

NSF's Very Large Array,
New Mexico



FIRST DAY OF ISSUE

First Day of Issue

Sobre de primer día con sello de la red de antenas en Nuevo México

SERIE EN HONOR A LOS OBSERVATORIOS

10 de julio del 2000
Anaheim, California

Keck Observatory, Hawaii



FIRST DAY OF ISSUE

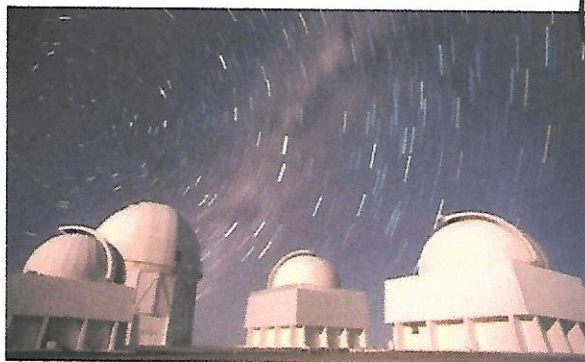
First Day of Issue

W.M.
KECK
OBSERVATORY



Sobre de primer día con sello del Observatorio Keck en Hawaii

NSF's Cerro Tololo Observatory, Chile



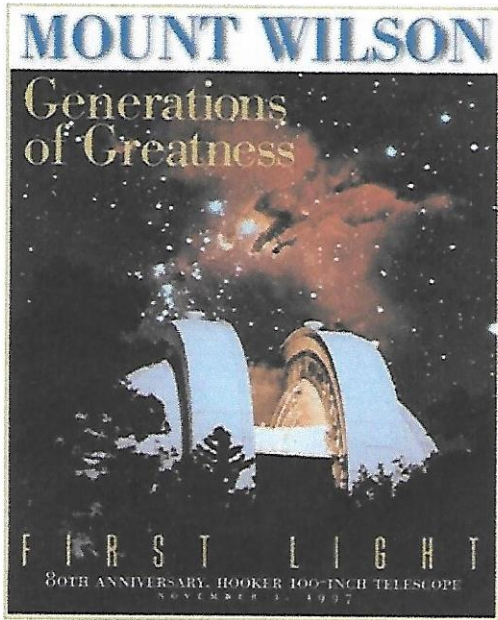
FIRST DAY OF ISSUE

First Day of Issue

Sobre de primer día con sello del Observatorio del Cerro Tololo en Chile

SERIE EN HONOR A LOS OBSERVATORIOS

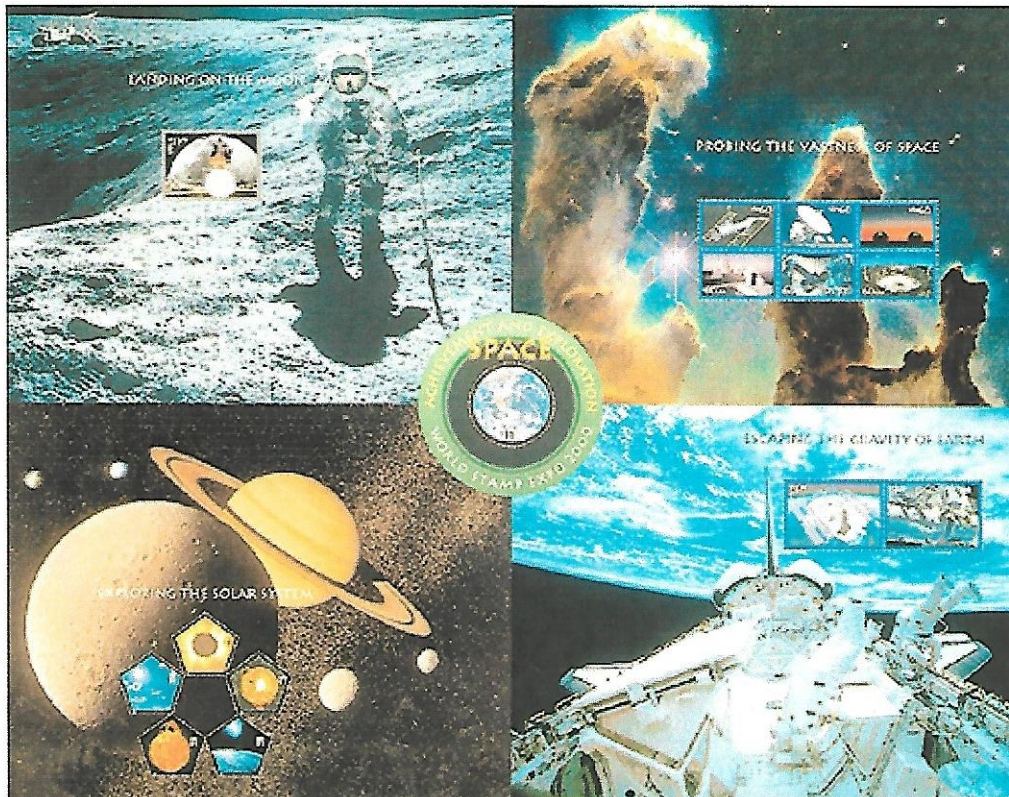
10 de julio del 2000
Anaheim, California



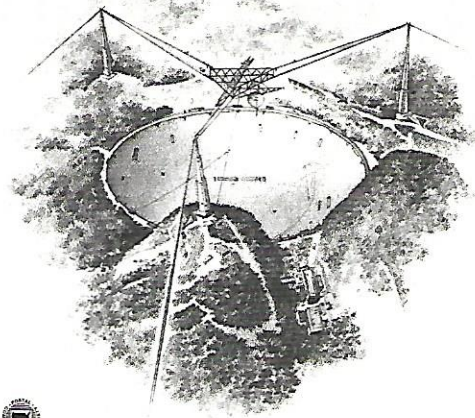
FIRST DAY OF ISSUE

Mount Wilson Observatory
100 inches Telescope
First Day of Issue

Sobre de primer día con sello del telescopio de 100 pulgadas en el observatorio Mount Wilson en California



Official First Day Of Issue



PROBING THE VASTNESS OF SPACE

Radio Telescope
Arecibo Observatory, Puerto Rico



FIRST DAY OF ISSUE



PROBING THE VASTNESS OF SPACE Arecibo Observatory

The Arecibo Observatory near the town of Arecibo in Puerto Rico houses the largest single-dish radio telescope in the world. It consists of a 1,000-foot diameter spherical reflector that is positioned over a large limestone sinkhole. The surface is made up of almost 40,000 aluminum mesh panels.

Moveable antennas suspended approximately 550 feet above the reflector help direct radio waves into the dish. The observatory operates on a continuous basis, 24 hours a day.

The first radio telescopes were built in the 1940s and were used to study radiation emitted from celestial objects. The Arecibo Observatory opened in 1963 and made one of its first major discoveries soon after – observations of Mercury that led to the realization that the planet's rotation rate was 59 days, not 88 days as previously believed.

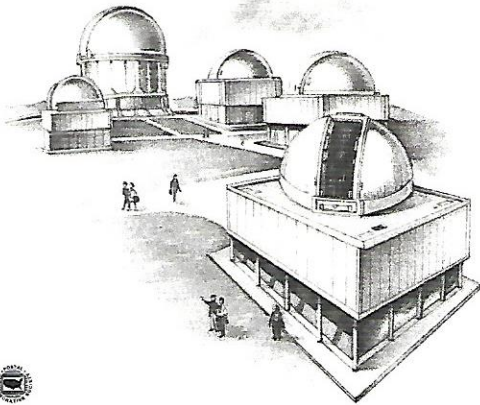
The Arecibo Observatory has been used for many different research projects throughout the years. Among

the greatest accomplishments were the study of pulsars, mapping the surface of Venus, and creating detailed maps of the distribution of galaxies in the universe. It has also bounced radiation off planets in the solar system, thereby providing astronomers with valuable information about their structure and chemistry.

One of the most fascinating functions of the Observatory is the search for extraterrestrial life. The radio telescope focuses on thousands of star systems, trying to pick up signals that might indicate the presence of intelligent life in space. Unlike optical telescopes that can be used only for observation, the Arecibo radio telescope has also been used to send messages into space in an effort to make contact with extraterrestrial life.

The 60¢ Arecibo Observatory U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.

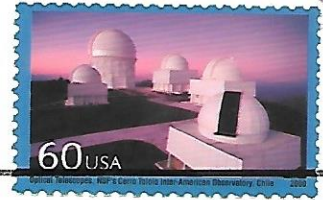
Official First Day Of Issue



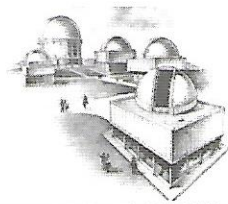
PROBING THE VASTNESS OF SPACE

Optical Telescopes

Cerro Tololo Inter-American Observatory, Chile



FIRST DAY OF ISSUE



PROBING THE VASTNESS OF SPACE Cerro Tololo Inter-American Observatory

The Cerro Tololo Inter-American Observatory (CTIO) in Chile is one of South America's premier astronomical observatories. Built in 1965 atop a 7,200-foot high mountain in the Andes, it is located about 50 miles inland from the coastal city of La Serena. It is one of the National Optical Astronomy Observatories and is operated by the Association of Universities for Research in Astronomy.

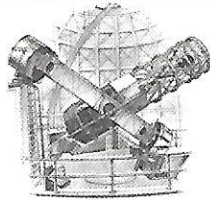
Currently the most significant telescope at CTIO is the Blanco telescope with a 157-inch mirror. When combined with the other powerful telescopes available to astronomers, CTIO has been able to make major advances in research on the central region of the Milky Way galaxy, the Magellanic clouds, and high-energy cosmic radio and X-ray sources.

One of the most ambitious projects at CTIO is Gemini, a multi-national effort to build twin 319-inch astronomical telescopes to be located atop Cerro Pachón, a peak

adjacent to Cerro Tololo, and Mauna Kea volcano in Hawaii. Together, they will provide unobstructed coverage of both the Northern and Southern skies. They are expected to produce some of the sharpest views of the universe ever obtained from earth.

One major problem that CTIO could face in the future is light pollution from nearby cities such as La Serena. Rapid population growth has seen the cities expand ever closer to CTIO and threaten its ability to observe the heavens under the present ideal conditions of an extremely dark sky. CTIO hopes that with successful lighting awareness campaigns, it can continue to be a prime astronomical site far into the future.

The 60¢ Cerro Tololo Observatory U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.



PROBING THE VASTNESS OF SPACE Mt. Wilson Observatory

At the turn of the 20th century, the study of celestial objects was still in its infancy. The founding of Mount Wilson Observatory by George E. Hale was a revolutionary step forward in our understanding of the sun and stars.

The Observatory is located on Mt. Wilson, a 5,710-foot-high peak in the San Gabriel Range near Pasadena, California. It became home to the Snow telescope, the world's first permanently mounted solar telescope, in 1904. Until then, this type of telescope, a coelostat, had only been used for temporary tasks like eclipse expeditions. It took 60 separate trips by mules and horses to transport the instrument and its housing up the mountain.

While the Snow telescope was being installed, work had begun on a 60-inch refracting telescope. When it was finished in 1908, it became the world's largest. It received twice as much light as any previous telescope, allowing astronomers to search deeper into space than ever before. It remains in use today and has been one of the most successful and productive telescopes in history.

A 100-inch Hooker telescope and dome were completed in

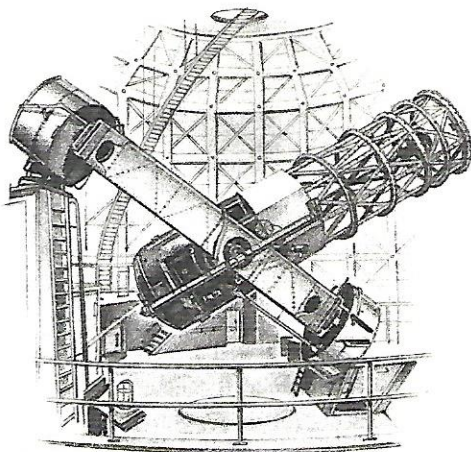
1917 at a cost of \$600,000. This 100-inch telescope gained the title of the world's largest, and it remained the world's largest for 30 years.

Solar tower telescopes of 60 feet and 150 feet were erected in 1907 and 1912, respectively. These tower telescopes improved the view of the sun by, among other things, reducing heat distortion from the earth. Until 1962, the 150-foot solar tower had the longest focal length of any solar telescope in the world.

These telescopes helped solve many fundamental problems in astronomy, including the nature of sunspots, the temperature and composition of stars, and the structure of the universe. The pioneering work in the early history of the Mt. Wilson Observatory was so important that it laid the foundation for almost all solar and stellar research to follow.

The 60¢ Mt. Wilson Observatory U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.

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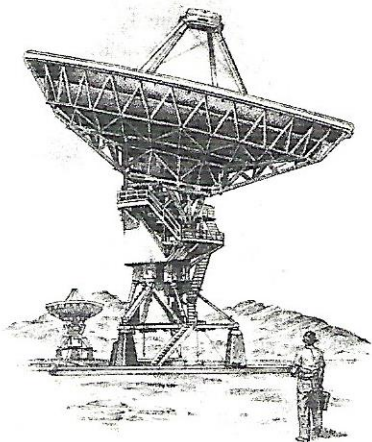
PROBING THE VASTNESS OF SPACE

Optical Telescope
Mt. Wilson Observatory, California



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PROBING THE VASTNESS OF SPACE

Radio Interferometers, New Mexico



FIRST DAY OF ISSUE



PROBING THE VASTNESS OF SPACE Radio Interferometers

The arid plains of San Augustin, west of Socorro, New Mexico, are now home to one of the world's most powerful and most sensitive Radio Interferometers. Known as the Very Large Array (VLA), it consists of 27 large antennae that allow astronomers to conduct unprecedented research to probe the vastness of space. It is operated by the National Radio Astronomy Observatory, which is a facility of the National Science Foundation.

Each antenna is about 82 feet in diameter. They are arranged in a huge "Y" pattern with each arm 21 miles long. The antennae are linked together electronically to multiply the data and give the resolution of a single antenna 22 miles in diameter. This allows the VLA to detect even extremely faint radio signals originating far away in space.

Unlike optical telescopes that gather light to form images, the VLA receives radio waves from stars, planets, galaxies, and other celestial objects. These radio waves are converted to images and have led to significant

advances in nearly every astronomical specialty, including the study of the sun, stars, galaxies, quasars, and black holes, as well as the search for planets within the solar system.

For example, in 1989 the VLA received spectacular images of Neptune and its moons transmitted from nearly three billion miles away by the *Voyager 2* spacecraft. These images revealed the "Great Dark Spot," a giant storm rotating in Neptune's atmosphere.

In addition to being used by astronomers from around the world, the VLA is used for atmospheric and weather studies, satellite tracking, and other projects relating to space study.

The 60¢ Radio Interferometer U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.



PROBING THE VASTNESS OF SPACE Hubble Space Telescope

The Hubble Space Telescope (HST) was launched into space aboard the Space Shuttle *Discovery* on April 24, 1990. The following day, it was released into its own 380-mile high orbit as the most sophisticated telescope ever placed in space.

The HST is the result of a cooperative program between NASA and the European Space Agency. It compares in size to a large tanker truck. It weighs about 12 tons, is about 43 feet long and over 14 feet wide at its widest point. Solar panels on either side generate electricity.

Because it orbits above the visual distortion caused by the earth's atmosphere, it is able to capture higher resolution images than even the most powerful earth-based telescopes. In fact, it is capable of expanding our view of the universe by about 350 times and provides the best views into the vastness of space.

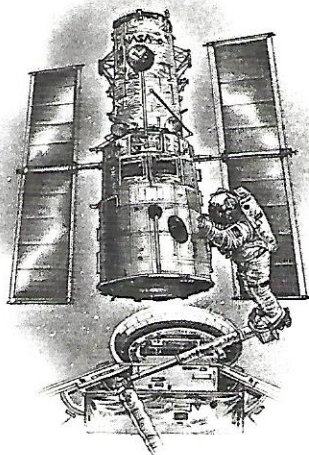
An initial problem with the primary 94-inch diameter mirror caused blurry images to be sent back to earth. Fortunately, the telescope was designed to be serviced in space, and in December 1993, the crew of the Space

Shuttle *Endeavour* installed corrective equipment. Additional servicing in 1997 and 1999 prolonged the life of the telescope. It is estimated to remain functional until at least 2010, with service by Space Shuttle crews scheduled in 2001 and 2003.

In 1994, the Hubble Space Telescope observed fragments of the comet Shoemaker-Levy 9 smash into Jupiter's atmosphere – the first comet impact ever observed. Also in 1994, it provided the first compelling evidence that black holes actually exist. In 1998, astronomers were first able to watch galaxies collide. The telescope has been able to recognize galaxies more than 12 billion light-years away – the oldest light ever observed. Other ongoing experiments provide clues to help scientists calculate the age of the universe.

The 60¢ Hubble Space Telescope U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.

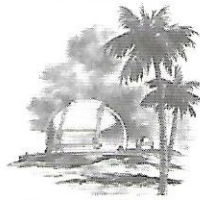
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PROBING THE VASTNESS OF SPACE
Hubble Space Telescope



FIRST DAY OF ISSUE



PROBING THE VASTNESS OF SPACE Keck Observatory

The W.M. Keck Observatory sits just below the summit of the dormant Mauna Kea volcano, the highest peak in Hawaii. The remoteness of the observatory and the resulting lack of atmospheric distortion and light pollution allow astronomers to probe the deepest regions of space with exceptional clarity.

The twin Keck telescopes Keck I and Keck II are two of the world's largest optical and infrared telescopes. Each stands eight stories tall and weighs about 300 tons. Each operates a primary mirror that is comprised of 36 hexagonal segments and is nearly 33 feet in diameter. The light-gathering capacity of each telescope is about four times greater than the Palomar 200-inch telescope.

Despite the enormous size and weight, each Keck telescope can be maneuvered to within a nanometer (one-billionth of a meter, or about 1/25-millionth of an inch).

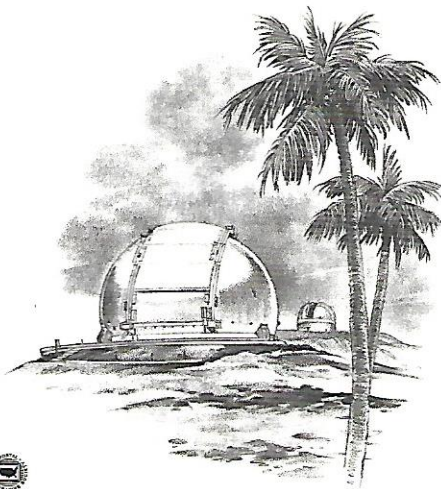
The result, according to astronomer Sandra Faber, is that the Keck telescopes "allow us, like no other telescope in history, to view the evolving universe that gave us birth."

For example, astronomers have been able to view the galaxy NGC 1232, which is located 65 million light-years away in the constellation Eridanus ("The River"). When the light we see today left this galaxy, dinosaurs still roamed the earth.

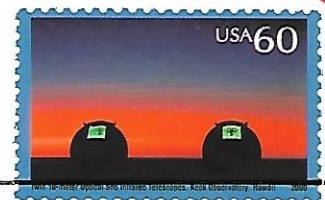
Other spectacular observations include the highest-resolution images ever taken from earth of Neptune's intricate upper cloud layers, orbits of individual stars around a black hole at the center of our Milky Way galaxy, the surface of Saturn's smog-covered moon Titan, and Jupiter's bombardment by the comet Shoemaker-Levy. Questions that astronomers hope to answer by using Keck's technology include how the universe evolved, how and when the galaxies formed, and what the ultimate fate of the universe will be.

The 60¢ Keck Observatory U.S. stamp is part of the Probing the Vastness of Space issue, which is one of five Space Achievement and Exploration issues. It was designed by Richard Sheaff of Scottsdale, Arizona. First Day of Issue was July 10, 2000, in Anaheim, California.

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PROBING THE VASTNESS OF SPACE
Twin Optical & Infrared Telescopes
Keck Observatory, Hawaii



FIRST DAY OF ISSUE

THE ARECIBO OBSERVATORY



CORNELL
UNIVERSITY

THE MISSION OF NAIC

The National Astronomy and Ionosphere Center enables research in the areas of *astronomy*, *planetary studies*, and *space and atmospheric sciences* by providing unique capabilities and state-of-the-art instrumentation for data collection and analysis, together with logistical support to users.

NAIC initiates and supports progress in the above research areas by maintaining a scientific staff whose members develop individual research programs, provide assistance to visiting scientists, and extend available scientific opportunities by developing and implementing plans for future enhancements to NAIC facilities and instrumentation.

NAIC strengthens scientific and engineering research potential by supporting activities which provide undergraduate and graduate students with opportunities to further their education. NAIC contributes to the general understanding and appreciation of science by initiating and participating in public education and outreach programs.

Use of the Arecibo Observatory (AO) operated by NAIC is available on an equal, competitive basis to all scientists from throughout the world to pursue research in astronomy, planetary studies and, space and atmospheric sciences. Observing time is granted on the basis of the most promising research, as ascertained by peer review of proposals by external referees

The Arecibo Observatory is part of the National Astronomy and Ionosphere Center (NAIC), a national research center operated by Cornell University under a cooperative agreement with the National Science Foundation (NSF).



THE 305m RADIOTELESCOPE

Puerto Rico is home of the world's largest single dish radio telescope located about 10 km south of the city of Arecibo, and a comfortable hour and-a-half ride from San Juan International airport. The Arecibo Observatory operates on a continuous basis, 24 hours a day every day, providing observing time, electronics, computer, travel and logistic support to scientists from all over the world.. The huge reflector is 305 m in diameter, with a surface made of almost 40,000 perforated aluminum panels, supported by a network of steel cables strung across the underlying karst sinkhole. It is a spherical (not parabolic) reflector. Suspended 140 meters above the reflector is the 700 ton platform. Just below the triangular frame of the upper platform is a circular track on which the azimuth arm turns. The azimuth arm is a bow shaped structure 93 meters long. The curved part of the arm is another track, on which a carriage house on one side, and the Gregorian dome on the other move. (The dome is named after James Gregory, first professor of mathematics at the University of Edinburgh)



SUBMISSION OF PROPOSALS

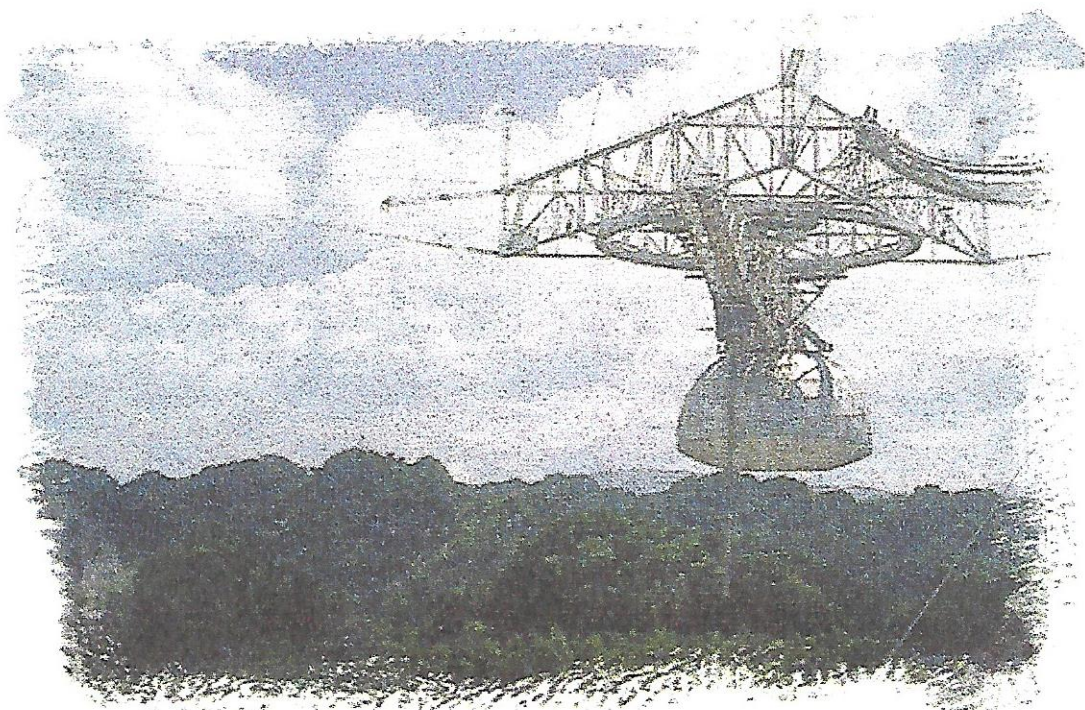
Potential users of the telescope should submit a proposal describing their desired observations and the scientific justification for these. Details of the procedures to be followed are available on our web page <http://www.naic.edu> The deadlines for submission are *February 1*, *June 1*, and *October 1*, although proposals may be submitted at any time.

USER SUPPORT

The Observatory routinely provides transportation on weekdays from (and to) the San Juan airport for visiting observers. One loan-car (VSQ car) is shared, on a sign-out basis, by visitors residing at the Observatory. For visiting scientists without financial support from other sources, and with an approved research program at the Observatory, the NAIC will partially reimburse transportation costs associated with the conduct of the research program, NAIC budget permitting. Reasonable travel costs will be reimbursed, less \$250 per trip, including round-trip air fare at the most economical rate from the home institution to the Observatory. About 140 persons are employed by the Observatory providing everything from food to software in support of the



EXPLORACION Y PROEZAS EN EL ESPACIO



PROBING THE VASTNESS OF SPACE

305-meter Radius Telescope
NSF's Arecibo Observatory, Puerto Rico

Como parte de los Sellos Conmemorativos *Exploración y Proezas en el Espacio* emitidos durante la Exhibición Internacional Filatélica, Expo Mundial de Estampillas 2000 en Anaheim, California del 7 al 11 de julio del 2000, la Hoja Conmemorativa de seis (6) sellos con tarifa internacional de 60¢ *Investigando la Inmensidad del Espacio* incluye una fotografía del telescopio de 305 metros de radio del Observatorio de Arecibo, Puerto Rico.

Estos sellos orientados horizontalmente "lanzados" el 10 de julio del 2000, también incluyen una ilustración del Telescopio Espacial Hubble y fotos por David Nunuk del Radio Interferómetro en Nuevo México, los Telescopios Gemelos Ópticos e Infrarojos en Hawái, los Telescopios Ópticos en Chile y el Telescopio Óptico de 100 pulgadas en Pasadena, California.

Además, los primeros sellos de holograma, circulares y pentagonales nacionales completan esta serie.