Revista Mexicana de Astronomía y Astrofísica, **26**, 83-86 (1993)

THE GEMINI PROJECT

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Gemini Project

RESUMEN

El Proyecto Géminis es una colaboración internacional para construir dos telescopios de 8 metros, uno en Mauna Kea y otro en Cerro Pachón. Los telescopios tendrán muy alta calidad en todas las longitudes observables desde tierra. El proyecto incluye un complemento inicial de instrumentos para imágenes y espectroscópicos. Se ha programado la primera luz para 1998 en Mauna Kea y para 2000 en Cerro Pachón.

ABSTRACT

The Gemini Project is an international collaboration to build two 8-m telescopes, one on Mauna Kea and one on Cerro Pachon. The telescopes will have very high performance at all wavelengths observable from the ground. The project includes an initial complement of imaging and spectroscopic instruments. First light is scheduled for 1998 on Mauna Kea and 2000 on Cerro Pachon.

Key words: **TELESCOPES**

1. INTRODUCTION

The Gemini Project is an international collaboration of Canada, Chile, the U.K., and the U.S. to build two 8-m telescopes, one on Mauna Kea, Hawaii, and one on Cerro Pachon, Chile. The main goal of of the project is to achieve an unprecedented combination of light-gathering power and image quality over the infrared, optical, and ultraviolet spectral regions observable from the ground.

2. STATUS

To date, 95% of the funding has been identified. The U.S. will have a 50% share; the U.K., 25%; Canada, 15%; and Chile, 5%. The remaining 5% is being sought from several possible sources. The U.S. National Science Foundation is the Executive Agency for the Project. AURA manages the project for the NSF.

As of June 1 Sidney Wolff became Acting Director for the Project. Larry Randall is the Project Manager. Patrick Osmer was the Interim Project Scientist until November, 1992. Matt Mountain arrived in October, 1992 to take up the position of Project Scientist. There are Project Scientists in each of the three countries: Roger Davies for the U.K.; Richard Green for the U.S.; and Gordon Walker for Canada.

3. HIGHLIGHTS OF THE SCIENCE REQUIREMENTS

The Gemini Science Requirements are based on efforts in the partner countries, particularly the three national proposals by Canada, the U.K., and the U.S. to build 8-m telescopes, and the U.S. Astronomy and Astrophysics Survey Committee report. The requirements include:

Full sky coverage. The planned sites in the northern and southern hemispheres will enable objects at all declinations to be observed.

Location at excellent sites. Mauna Kea, at 4200m elevation, is regarded as the best site in the world in terms of infrared properties and excellent seeing conditions. A site survey at Cerro Pachon shows that it has

seeing conditions rivaling those of Mauna Kea, excellent IR properties for half the year, and the clear skies for which the Chilean sites are well known.

8-m aperture. An 8-m primary mirror has four times the light gathering power of a 4-m and, at wavelengths where diffraction limits the image quality, twice the angular resolution.

Image quality of 0.1 arcsec. The Gemini telescopes will use active optics and tip-tilt correction in a high-resolution configuration to achieve 0.1 arcsec (FWHM) image quality at a wavelength of 2.2 microns.

Wavelength coverage from 0.3 to 30 microns. The Gemini telescopes are to have high throughput over the ultraviolet, visible, and infrared wavelengths observable from the ground. This will require the capability for different mirror coatings.

Low-emissivity configuration. The Gemini telescopes will have a configuration that yields a telescope emissivity in the range 2 to 4%.

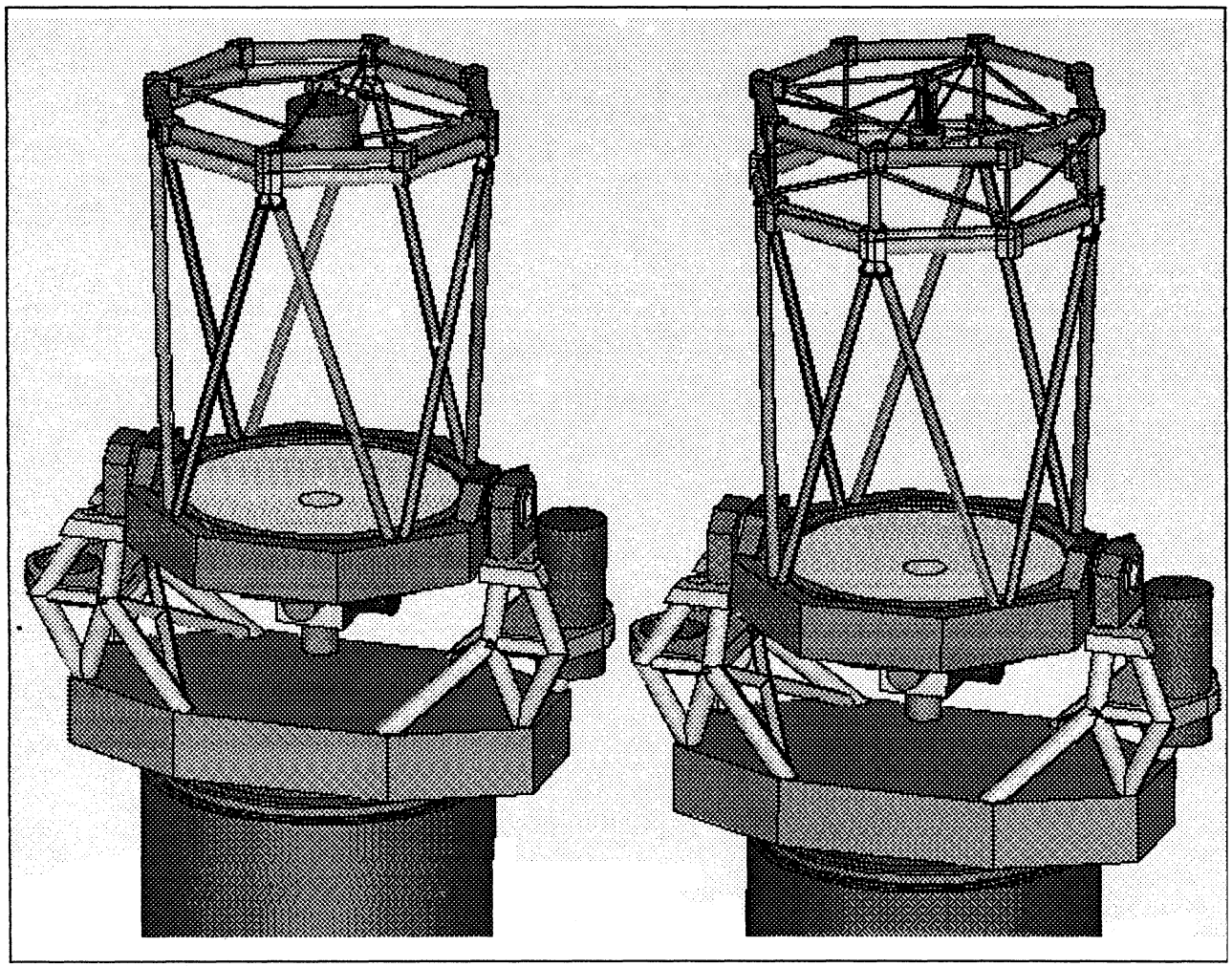

Fig. 1. - Design concepts for the Gemini Telescopes. Left panel - Telescope structure with the f/6 top end mounted. Right panel - Telescope structure with the f/16 top end.

Wide-field configuration. The Gemini telescopes will have a wide-field configuration covering a diameter of 45 arcmin for optical observations.

Flexible observing modes. Gemini will plan to support service observing and remote observing in addition to the traditional mode of having the observer at the telescope.

Cassegrain and Nasmyth focal stations. The telescopes will have Cassegrain and Nasmyth focal stations to accommodate the range of instruments that are planned.

Capability for rapid instrument changes. The telescopes will allow for rapid change between a prime and backup instrument to take advantage of changing weather conditions.

4. TELESCOPE CONFIGURATIONS

The above science requirements lead to three configurations of the telescopes: high angular resolution (IR optimized), wide-field optical, and optical/UV Nasmyth. They are based on the use of a f 1.8 primary with a 1.2-m diameter central bore.

High Angular Resolution (IR-optimized configuration). This configuration is planned to give the highest image quality and the lowesh emissivity. It is to have a final focal ratio of f/16 and a 3.5 arcmin diameter unvignetted field of view. The primary spectral range will be 1 - 30 microns. It will also provide excellent performance at optical wavelengths down to at least 0.4 micron and could also be used at longer wavelengths out to 1 mm. The configuration will have a usable field of at least 10 arcminutes diameter. The focal surface is to be located approximately 4-m behind the vertex of the primary mirror.

Wide-field Optical/UV Configuration. This configuration will have a separate secondary mirror to produce a 45 arcmin diameter field at a final focal ratio of f/6. The primary spectral range is 0.3 to 1.2 microns, also usable out to 2.2 microns. The image quality specification is 0.25 arcsec FWHM, and the focal surface will be approximately 3.5-m behind the primary mirror vertex.

Optical/UV Nasmyth Configuration. A Nasmyth configuration is to be provided for instruments requiring a gravity-stable location. It will have focal ratio of approximately f/20 and a 3 arcmin field of view. The primary spectral range will be 0.3 to 2.2 microns at an image quality of 0.25 arcsec FWHM.

5. INSTRUMENTATION

The Gemini project includes an initial complement of instruments, which are to be procured on a competitive basis from institutions in the partner countries. Initial needs identified for testing and commissioning of the telescopes include:

Acquisition and guiding capability

Wavefront sensing capability

f/16 secondary tip/tilt capability

Space at Cassegrain for higher order adaptive optics correction

High resolution imagers for the 0.4 to 5 micron and 8 to 30 micron regions.

The first instruments for subsequent science programs are now being identified. The long term goals are to provide instruments for:

IR spectroscopy from low to high spectral resolution over the 1 to 5 and 8 to 30 micron regions

Adaptive Optics

Protected Silver Coatings

High Resolution UV/Optical Spectroscopy

High Throughput, Long-slit/Multi-slit Optical Spectroscopy

Fiber-fed Spectroscopy with 45 Arcmin Field Coverage

6. TELESCOPE CONCEPT

The telescopes are to have an altitude over azimuth mount.

The design concept places the primary mirror just below the elevation axis. This has the advantages of reducing the mass of the overall structure, facilitating ventilation, and eliminating the need for a massive steel frame above the primary mirror.

Two interchangeable top ends will provide for the three telescope configuration described above, as shown in Figure 1. The f/6 top end is for the wide-field, optical configuration. The f/16 top end is for the high angular resolution (IR optimized) configuration; it will also serve for the Nasmyth configuration via the interchange of the secondary mirror assembly.

7. SCHEDULE

The Project Schedule calls for first light on the Mauna Kea Telescope in the year 1998 and on the Cerro Pachon Telescope in the year 2000.

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