GEMINI OBSERVATORY NEWSLETTER

Issue 24

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# Gemini South Dedication Report

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GEMINI OBSERVATORY NEWSLETTER

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# GEMINI SOUTH DEDICATION: COMPLETING THE PICTURE

**Cerro Pachón, Chile, January 18, 2002**

The Gemini South Dedication on January 18, 2002, marked many significant milestones for the Gemini Observatory. Not only did we realize the Gemini vision of completing twin 8-meter optical/infrared telescopes that provide complete sky coverage and operate as one observatory, but it is apparent that we are riding high on the crest of a new wave in ground-based astronomy.

Gemini Director Dr. Matt Mountain said it best in his comments to the dedication crowd, "Welcome to point-and-click astronomy." The technologies that are built into Gemini are going to allow us to do some pretty extraordinary feats. From remote operations, videoconferencing and information transfer capabilities, to the cutting-edge opto-mechanical systems that create Gemini's razor-sharp images, the Gemini South dedication truly delivered us to the dawn of a new age in astronomy.

*Gemini South with Milky Way overhead.* ***Photo by Roger Smith***

This issue of the Gemini Newsletter opens with two articles which make these points abundantly clear. Starting on Page 2, "Gemini South Dedication: A Historian's Perspective" by Patrick McCray presents an historical perspective of Gemini and how our twin telescopes fit into the past, in order to provide a perspective for the future. Next, on Pages 4 - 6, Professor Malcolm Longair provides a written version of his keynote dedication address. In Professor Longair's entertaining and insightful talk, he explores our current understanding of the universe and the promise of Gemini to help unravel many of the current mysteries of the cosmos.

Together, these two articles and the images on the page at left are presented in this issue to document the significance of the Gemini South dedication and help propel us on the exciting ride that Gemini has begun – stay tuned!

***Image Key:*** *The following captions correspond to the numbered images to the left: (1) Chilean President Ricardo Lagos viewing telescope with Matt Mountain and VIP entourage, (2) VIP group during tour of the Gemini South control room by Jim Oschmann (center, right of TV monitor) and Michael Ledlow (right), (3) Assembled crowd during dedication ceremony, (4) Telescope and several flags flying in vents, (5) Matt Mountain (left) and Bill Smith (right) Presenting plaque of appreciation to Dick Malow (center), (6) Cocktail reception prior to dedication dinner, (7) Conversations during dedication reception, (8) Matt Mountain speaking at dedication dinner, (9) Dedication dinner table, (10) Presentation by Professor Malcolm Longair, (11) Dedication dinner table. Dedication ceremony speakers: (12) Monseñor Manuel Donoso, (13) NSF Director Dr. Rita Colwell, (14) AURA President Dr. Bill Smith, (15) Chilean President Ricardo Lagos, (16) Chair, Gemini Board, Professor Roger Davies,University of Durham, UK (17) Canadian NRC President Dr. Arthur McCarty, (18) PPARC Chief Executive Professor Ian Halliday, (19) Gemin Board Member Dr. Gary Da Costa, Australian National University, (20) Dr. Esper Cavalheiro of Brazil, Consejo Nacional de Desenvolvimento Cientifica e Tecnológica, (21) Dr. Esteban Brignole of Argentina, Consejo Nacional de Investigación Cientifica y Tecnológica, (22) Dr. Eric Goles of Chile, President, Comisión Nacional de Investigación Cientifica y Tecnológica.*

# GEMINI SOUTH DEDICATION: A HISTORIAN'S PERSPECTIVE

**W. Patrick McCray**

In his 1962 book *The Shape of Time*, art historian George Kubler said, "Knowing the past is as astonishing a performance as knowing the stars." This reminds one that the historian's goal of interpreting past events is similar to the astronomer's. But astronomers are forever removed from what they study. The historian, in contrast, sometimes has an opportunity to witness events and speak with the people he is studying. On January 18, 2002, I had such occasion when I attended the dedication of Gemini South at Cerro Pachón, Chile.

The Gemini Observatory's roots can be traced back to the mid-1950s. AURA did not yet exist while the NSF was a new agency working to define itself. The dedication of the 200-inch Hale Telescope in 1948 was still fresh in many people's minds. Fifty-four years later scientists and engineers have successfully built a new generation of telescopes, and Gemini's twin telescopes are members of this growing family. The January ceremony offered an opportunity to consider how astronomy has changed between those two eras of telescope design.

> ***"Welcome to point-and-click astronomy."***
>
> *- Matt Mountain*

There are many similarities between the ceremony I saw on Cerro Pachón and the cool summer day in June, 1948, when Caltech's Lee Dubridge announced the 200-inch would be named in honor of George Ellery Hale. Guests sat on folding chairs in the shadow of an amazing new tool for astronomers. After the speeches ended, visitors were treated to the thrilling display of watching the telescope point and slew. At Gemini's dedication, technicians opened the telescope's three-story high thermal vents so guests could see the snow-tipped peaks of the distant Andes. The floor of the dome rotated as the telescope pointed and slewed, giving at least one person a giddy sense of riding the world's most expensive carousel. The sheer immensity of an 8-meter class telescope and the instrument cluster at its Cassegrain focus, so hard to fathom from press photographs, revealed itself as guests milled about taking pictures of Gemini's multi-million dollar mirror.

In 1948, the 200-inch was the largest telescope in the world. It kept this distinction for almost thirty years. Public interest in the telescope was enormous – many can still recall news reports about the mirror's voyage from Corning to Pasadena. The U.S. Postmaster released a new three-cent stamp featuring the telescope's classically-styled dome and articles about the instrument filled the pages of *Life, Colliers* and *Sky & Telescope* for months.

Today the landscape of astronomy is different. Gemini's twin telescopes have joined an amazing array of large telescopes – over a dozen with light collecting areas greater than 6 meters exist. Each sports a glass mirror weighing thousands of pounds whose exquisitely polished surface is covered with about as much metal as an average soda can. The number of telescopes that have been successfully built flies in the face of predictions astronomers made as recently as twenty years ago about what technology and funding agencies could support.

The Gemini Observatory is nonetheless a unique science facility. Gemini's astronomers and engineers paid careful attention to the telescopes' design, for instance, emphasizing infrared optimization and high-resolution imaging. The coupling with new tools, such as larger infrared arrays and adaptive optics, affords Gemini a special "discovery space" which scientists at the 200-inch's dedication could scarcely have imagined and which will set it apart from today's other large telescopes.

The number of large telescopes available to astronomers worldwide speaks to changes in the science community's governance. The 200-inch was built originally to serve the research needs of a handful of fortunate astronomers. Scientists like Edwin Hubble, Walter Baade and Fritz Zwicky had the world's largest telescope at their disposal to pursue personal research programs. In comparison, Gemini's two telescopes will be accessible to hundreds of scientists in seven countries. This suggests a greater degree of democratization compared to when observational astronomy was dominated by a few American institutions blessed with wealthy patrons, big telescopes and good observing conditions.

At Gemini's dedication, Chile's President Ricardo Lagos noted how Gemini's two telescopes enable full-sky observing. Gemini telescopes in Hawai'i and Chile constitute a transoceanic system for scientific research linked together by video conferencing, high-speed data networks and fiber optic cables. In fact, one wonders whether Gemini could have

succeeded as an international construction effort with the telegrams, mimeographs and couriered letters of Hale's day.
All the speakers at Gemini's dedication emphasized how Gemini was an international collaboration between seven different partners, spaced across four continents and over a dozen time zones. More than just geography, of course, separated these countries. Building Gemini and planning its science mission obliged its advocates to transcend their countries' different historical traditions, capabilities and ambitions in astronomy.

Telescopes like Gemini offer scientists from countries like Chile opportunities that did not exist fifty years ago to work at the frontier of scientific research. In 1948, astronomical research was more individualistic and nationalistic. In comparison, late 20th Century astronomy was marked by astronomers' growing acceptance of doing research in groups and international collaborations. With its larger research teams and ever-more expensive machines, one wonders whether ground-based optical astronomy is following the changes experienced by the paradigmatic example of post-1945 science, high-energy physics.

Telescopes exist in popular imagination as more than instruments of science. The 200-inch was dedicated when the horrors of World War II and the nascent atomic age were uncomfortably real. Raymond Fosdick, president of the Rockefeller Foundation, described the telescope his institution had paid for as a tool to heal an ailing world. "This telescope," he said, "is the lengthened shadow of man at his best." Dr. Rita Colwell, the NSF's Director, struck a similar tone at Gemini's dedication: "Now, more than ever," she said, "we need these efforts that transcend national boundaries and cultural divides."

Dr. Colwell also offered an image of doing astronomy (one perhaps at odds with the realities of nighttime observing runs replete with sugary snacks and computer-bleared eyes) that was compellingly evocative. When the discoverer of Champagne, Dom Perignon, first sipped his new elixir, she said, he ran to his fellow monks shouting, "Come quickly, I am tasting the stars!"

Older astronomers at Gemini's dedication could recall long, cold, cramped nights spent in a telescope's prime focus cage and guiding by hand while "tasting the stars." Between 1948 and 2002, powerful technological, social and economic forces changed what it means to be an astronomer. The image of the solitary astronomer sitting in the observer's cage at night is now considered romantic, a sure sign it is anachronistic. The romantic vision of the lone astronomer has been supplanted by a new drama of scale as the size, cost and performance of telescopes has increased.

Albert E. Whitford, Director of Lick Observatory from 1958 to 1968, once remarked that there was "high artistry – doing it yourself. Real mastery of a beautiful and cantankerous instrument, a big telescope." At Gemini's dedication dinner, Matt Mountain showed a picture of the telescope's control room, with its rows of computer screens and digital interfaces, and intoned, "Welcome to point-and-click astronomy." Where once being an astronomer meant adhering to a demanding and uncomfortable nighttime observing schedule, now, as Fred Hapgood said in 1997, "Astronomers keep the same hours...as everyone else: they come to their office in the morning, sit down at a work station, and surf the net." In other words – using a big telescope like Gemini demands a new suite of skills.

For someone familiar with the long history of a mega-project like Gemini, the conversations at the dedication dinner perhaps engendered a feeling of déjà vu. Already astronomers are planning the next suite of big telescopes. Discussion ranged from the future of ALMA – Malcolm Longair even led guests in a supportive cheer for the planned millimeter array – to who would be the first to build a 30-meter class optical/infrared telescope. Overheard were many of the same concerns that occupied center stage in the history of Gemini and its precursors: Would there be cooperation between public and private observatories? Which mirror technology was best? What was the proper role for international collaboration? Can astronomers and engineers break the cost-size paradigm?

Galileo's spyglass once showed the surface of the moon in startling detail and the mysterious movement of Jupiter's moons. Baade's observations of the Andromeda Galaxy with the 200-inch telescope doubled the universe's size. Historians of science have yet to determine how data collected by the new generation of large telescopes such as Gemini will change what we know about the universe and our place in it.

Building large tools for science has been called an act of faith. Millions of dollars are spent, careers are consumed, and expectations may never be met. New telescopes carry the possibility of tremendous rewards and risks for individuals and institutions and, sometimes, even nations. What remains fascinating to historians is why and how men and women make this leap into the dark and how the light, collected slowly and silently by the telescope's mirror, is used by astronomers to tell us something new about the universe.

Gemini's engineers and scientists took this gamble years ago and can now enjoy the initial payoff as nighttime observing runs produce gigabytes of scientific data.

*About the author: W. Patrick McCray is an historian at the Center for History of Physics, American Institute of Physics in College Park, Maryland. His book about the history of recent telescope construction will be published in late 2003 by Harvard University Press. He may be reached at pmccray@aip.org.*

# REFLECTIONS ON GEMINI SOUTH

## Keynote Address by Professor Malcolm Longair at the Dedication of the Gemini South Telescope, January 18, 2002.

The dedication of the Gemini South Telescope represents the culmination of the hopes and aspirations of many astronomers in the partner countries.

*Professor Malcolm Longair addressing the attendees at the Gemini South dedication dinner.* ***Photo by Kirk Pu'uohau-Pummill***

For me, the image for the telescope, showing the whole of the southern sky with the splendor of the Milky Way, sums up why the telescope is so important. The Southern Hemisphere has everything, the plane of our galaxy, the galactic center, the Magellanic Clouds, as well as the extragalactic sky.

*Southern Milky Way above Gemini South.* ***Photo by Roger Smith***

How will Gemini South and the other splendid 8-meter class optical-infrared telescopes contribute to the advance of astronomy in the 21st Century? The key elements are as follows:

• Astrophysical understanding comes from extending observational capabilities and new ways of doing astronomy, supported by excellence in theory and interpretation.
• These capabilities include increases in the spatial and spectral resolution of our telescopes, their sensitivities, their wavelength coverage and the size of data-sets they can obtain.
• Modern astronomy is a partnership between space and ground-based astronomy and technology, including data analysis.
• International collaboration is essential for such ambitious and expensive endeavors.

The Gemini project has all these characteristics. The challenge to the astronomers is to capitalize upon these capabilities.

### Gemini South as an Optical-Infrared Telescope

Astronomy is the Science of Origins – we ask questions about the origins of planets, stars, galaxies, the universe, and even about how life came about. The images showing the earliest phases of formation of these astronomical objects often tend to be infrared, rather than optical images. The reason is that many of the most important regions we need to study are obscured optically by interstellar dust. Fortunately, the dust becomes rapidly transparent as observations are made at longer and longer infrared wavelengths and, indeed, at long enough wavelengths, the dust becomes a stronger emitter, rather than absorber, of light. The dust absorbs optical and ultraviolet light and reradiates this energy at the temperature to which it is heated, which corresponds to emission at far-infrared and millimeter wavelengths. Splendid examples of this process are provided by the COBE images of our own galaxy, which show beautifully the disc and central bulge of our galaxy at infrared wavelengths, to the images at 1 mm, which show the intense dust emission of the interplanetary material in the plane of our galaxy. This is why the Gemini telescopes have been designed to have superb performance in the infrared as well as the optical wavebands.

Let us consider some examples of the astronomical issues which can be addressed by infrared-optimised telescopes. Star formation is one of the most important processes in astrophysics, but it is still rather poorly understood. Part of the problem is that the important physical processes takes place in some of the most obscured regions in the universe. Dust has to be present in these regions to remove the thermal energy of the collapsing protostar by radiation. Already some splendid images have been taken of such regions by Gemini South revealing the typical contents of star forming regions – extremely luminous compact infrared sources and bipolar outflows *(See Figure 1).* The latter seem to play an essential role in star formation, most likely associated with the combined effects of getting rid of the binding energy and rotational energy of the matter which is accreted by the protostar.

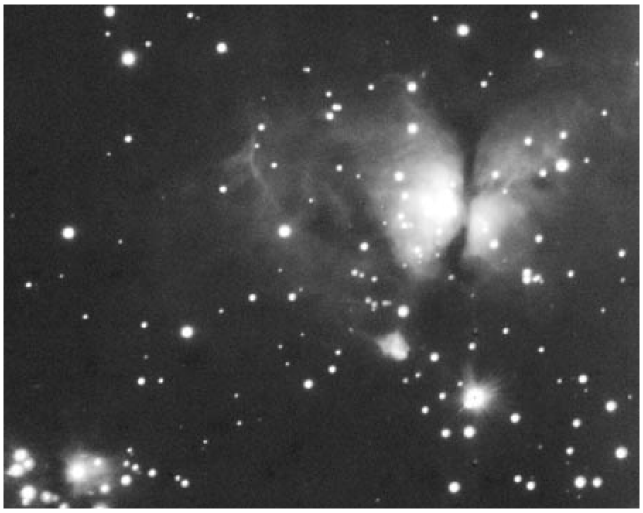


***Figure 1:*** *Star forming region NS14 as imaged by Gemini South. (See details for this image on inside back cover)*

These processes are ubiquitous in galaxies and are also important in understanding how the heavy elements were created. The far infrared luminosities of galaxies are therefore tracers of the cosmic rate of star and element formation. The next crucial international project to advance these studies is the Atacama Large Millimeter Array (ALMA), which will do for sub-millimeter/millimeter astronomy what the HST has done for optical astronomy. The capabilities of ALMA complement those of the 8-meter telescopes and would capitalize upon the superb quality of the Atacama site. We must all get behind the push to build this next generation facility.

**Recent Advances**

As technology advances, projects that were only wishful thinking a few years ago can be brought into reality. One of the most startling recent discoveries has been the detection of planets about nearby stars. When I was young, it was thought that this had already been achieved, but in fact the claimed detections were only fitting sine waves to random noise. Only recently has definite evidence been found for planets about nearby stars, because of the development of extremely stable high resolution optical spectrographs which can measure the tiny motion of the star due to the gravitational influence of an orbiting planet. (As of April, 2002, there were 77 extrasolar planets discovered in 69 planetary systems). Unlike our solar system, many of these Jupiter-sized planets are much closer to the star than the Earth is to the Sun and many have highly elliptical orbits. The result is that theories of the origin of planetary systems are being significantly revised. This type of program is ideally matched to the capabilities of Gemini South, which can also search for their near relatives, the brown dwarfs, by direct imaging with adaptive optics in the infrared waveband. This has already been achieved in observations with Gemini North *(See Hokupa'a/QUIRC science results on Page 8).*

These studies have led to another remarkable discovery, the direct detection of the atmosphere of the extrasolar planet associated with HD209458. This extrasolar planet passes in front of the star. Remarkably, when the planet passed in front of the star, excess sodium absorption in the planetary stellar spectrum was detected in observations with the Hubble Space Telescope.

Another outstanding series of observations has concerned the detection of the motions of stars about the black hole in the center of our galaxy. In a brilliant series of observations with the W. M. Keck Observatory, the motions of infrared stars in the very center of the galaxy have been measured. These provide totally convincing evidence that there is a black hole in the galactic center with mass about two million times the mass of the Sun. This is the type of program which is ideally matched to the capabilities of the Gemini South Telescope. Already outstanding high-resolution images of the central regions of the galaxy have been observed at 4 microns using the NOAO Abu instrument.

**Our Place in the universe**

One of the great challenges is to understand the origins of the large-scale features of our universe. We know what it is we have to explain. The universe looks very irregular on the small scale but, as we progress to larger and larger scales, the universe becomes more and more uniform. There is a hierarchy of structures in the universe which runs from the scale of the typical galaxy, through clusters of galaxies, to superclusters and voids, and finally to the size of the universe itself. This last size is simply the distance light could have travelled from the Big Bang to our galaxy at the present day. It is intriguing that each step in this hierarchy corresponds to roughly a factor of 100 in scale. Thus, it is only a factor of 100 million to scale from the size of our galaxy to that of the observable universe. I always think of our universe as being a somewhat cozy place when looked at in this way.

> ***"We humans are very much average-scale objects in the universe."***
> ***- Malcolm Longair***

Let us be even more provocative. In physics and astronomy, it is best to think of one scale relative to another, rather than think in absolute numbers. In this way, we convert big numbers into small numbers by thinking logarithmically. In the diagram I show the complete range of scales we can potentially access in the universe. *(See Fig. 2)* The scales range from the size of the universe, through

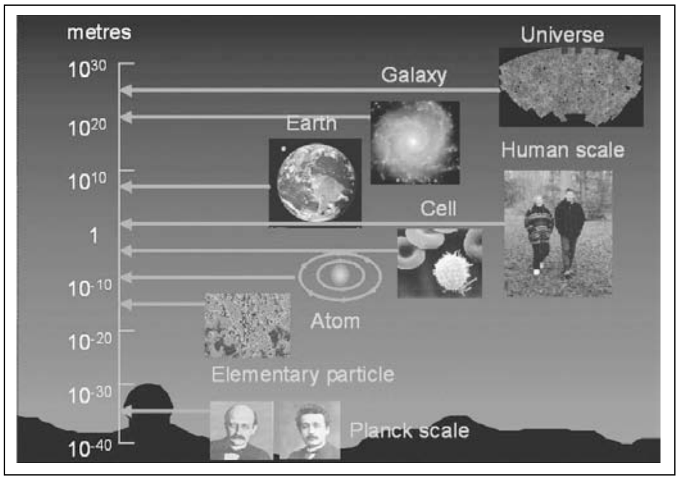



***Figure 2:*** *Scale of objects in the universe.* ***Illustration by Malcolm Longair.***

galaxies, planets, the human scale, a cell, an atom, an elementary particle, and ultimately to the Planck scale, the smallest meaningful physical scale, at which we need to understand quantum gravity. It is intriguing to note that human beings are in the middle of the diagram – logarithmically, we humans are very much average-scale objects in the universe.

What the observations show is that the universe becomes very uniform and simple on the largest scale, and in the same way, on the very smallest scales, the Planck scale, the fundamental theory must be in some sense "simple." All the complexity of our universe occurs on the scales between the very large and the very small, including things like cells, human life and planets. We can think of the process of scientific advance as encroaching upon the complex from the simple, from either very large or very small scales shown in the diagram. The ultimate challenge is to relate the very large and the very small through a detailed understanding of quantum gravity.

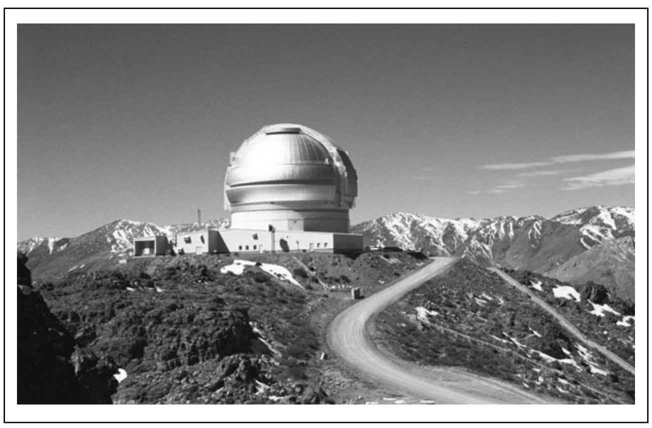
There has been remarkable progress in understanding how to reconcile the extraordinary smoothness of the Cosmic Microwave Background Radiation with the gross irregularity in the large-scale distribution of galaxies. But all these promising developments need to be grounded in reliable observations of the very distant universe, and this is where observations with the 8-meter class telescopes, such as Gemini South, are so important.

Finally, we should never forget that this activity is being carried out within the context of major investments in astronomy by the partner countries. When I am asked to justify these major investments, I make four points:

- The practical application of astronomy and astrophysics research for the benefit of society.
- The development of individuals with the ability to relate phenomena to mathematical structures in a non-trivial way.
- The importance of international collaboration in a troubled world.
- Astronomy for its own sake – insights into the nature of our physical universe.

Many astronomers would regard the fourth bullet as being the whole story, but I am convinced that our mission is much broader than that. Astronomy has a unique ability to bring people together, to stimulate the imaginations of young and old, amateur and professional, and act as a force for good in our troubled world. The dedication of Gemini South is a time to reflect upon the vast potential of astronomy in its broadest cultural and technical context. I am convinced it will make superb contributions in all the four areas listed above.

*Professor Malcolm Longair is head of Cavendish Laboratory at the University of Cambridge, UK.*



*Gemini South late in the Chilean winter.* ***Photo by Peter Michaud***

# RECENT SCIENTIFIC HIGHLIGHTS

**Jean-René Roy & Phil Puxley**

With both Gemini North and South now poised to lead the way into a new era of astronomical research, both telescopes have begun to produce significant science. Our successes are also attracting increased interest from astronomers around the world.

Significant to Gemini's growing popularity is our continued development of instrumentation and technology for observing the universe at many wavelengths, especially in the thermal infrared.

Science Operations at Gemini North and South achieved some remarkable milestones in semesters 2001B and 2002A, and following is a summary of Gemini Science Results since the last newsletter:

The first Gemini Multi-Object Spectrograph (GMOS-N) was commissioned very successfully on Gemini North in late summer and early fall of 2001, and science programs have been executed in the queue mode on a regular basis since November. *(See GMOS Integral Field Unit report on Page 10)*

NIRI, the facility near-infrared imager, was put back on the telescope in the fall after a new steering mirror mechanism was inserted and tested. NIRI acceptance tests and commissioning were continued and some limited science observing was done. The NIRI runs were mostly affected by the exceptionally poor weather we had on Mauna Kea this winter. *(See NIRI report on Page 13)*

We also had a mix of weather conditions for the Hokupa'a/QUIRC runs. However, the February 2002 Hokupa'a/QUIRC queue run was one of our most successful ever.

The first science use of Gemini South was started with the Acquisition Camera, Phoenix and Flamingos-1.

Despite very serious equipment problems with Flamingos-1, including major damage to the optics during transport, 12 nights of observations were obtained for seven 2001B queue programs.

The Phoenix Demo Science program on the measurement of the ratio of O/Fe from infrared stellar spectra was completed successfully in 2002A, and the data - already reduced - are being analyzed. Several Phoenix queue programs have also been started in 2002A.

Gemini South Acquisition Camera data were taken on about 11 nights for four programs, and eight queue OSCIR programs were also observed in 2001B.

More than 15 contributions based on Gemini data were presented in Washington, D.C. at the 199th AAS meeting in January 2002. The science output in terms of papers published, in press and submitted to refereed journals based on Gemini data, is growing fast *(See www.gemini.edu/science/publications/users.html for the most recent list of papers published)*. All the papers published at this stage are based on the use of OSCIR and Hokupa'a/QUIRC on Gemini North.

Although there has been a mix of stellar and extragalactic observing programs executed with Hokupa'a/QUIRC on Gemini North, all papers published to date deal with galactic and extragalactic stellar objects, stellar populations in nearby galaxies, faint companions, brown dwarf binaries, circumstellar disks and asteroids. While many extragalactic programs were executed by Hokupa'a/QUIRC, we are not yet aware of any published papers on AGN, quasar host galaxies or other related topics.

Results from OSCIR observations demonstrate that a small amount of time on the sky with a first-class mid-infrared instrument on Gemini can deliver outstanding science. Considering that the mirror coatings and some other systems are not yet in their final optimal states, this bodes well for future mid-infrared science with the Gemini telescopes.

While a large fraction of the Hokupa'a/QUIRC papers were authored by researchers in the University of Hawaii (UH) "sphere of influence," (members of the UH Adaptive Optics Group and UH astronomers currently or previously at that institution), the OSCIR-based papers are authored by a broad community, most having no connection with the University of Florida group that built OSCIR.

Overall, Gemini science results published to date deal mainly with sub-stellar companions, circumstellar disks, dusty Wolf-Rayet stars, starburst galaxies, stellar populations deep in the galactic center of the Milky Way and nearby galaxies (M32 and M33) and galaxy jets/AGNs.

Highlights of these results are summarized below. *(More details on several of the following topics can be found by going to the publications list at: www.gemini.edu/science/publications/ and* *the press releases at: www.gemini.edu/project/announcements/press.html on the Gemini web page.)*

**Science results with Hokupa'a/QUIRC**

• Following their work on the brown dwarf binary system 2MASS J1426 reported in the previous Gemini Newsletter (Issue 23, Pages 8-9), Laird Close (University of Arizona) and his team have used Hokupa'a/QUIRC to explore 20 very low mass (VLM) stars *(See Figure 1)*. Four were discovered to be binaries. Three of the systems have separations of less than 4.2 AU and similar mass ratios. The authors deduce a binary fraction in the range of 14-24% for M8-M9 binaries with separations > 3 AU, a result consistent with the ~23% measured for more massive (M0-M6) stars over the same separation range. However, VLM binaries appear to have a much smaller semi-major axis distribution peak (~4 AU) compared to more massive M and G type stars (~30 AU).

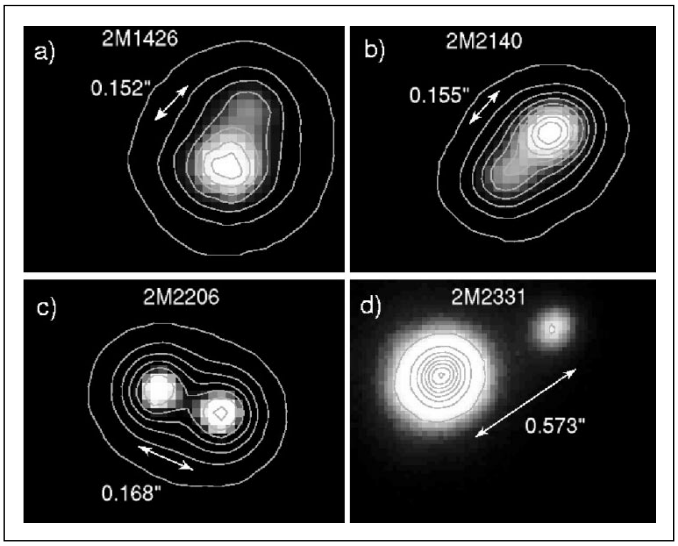



***Figure 1:*** *In (a), we see the K' image of 2MASS J 1426 binary at a resolution of 0.131". In (b-d), we see K' images of the new binaries.*

• Using Hokupa'a/QUIRC on Gemini North, Daniel Potter (University of Hawaii) and his team have discovered two faint ultracool companions to the nearby (d ~ 17.9 pc) young (0.8 Gyr) G2V star HD 130948. The pair is at about 40 AU from the primary. Follow-up near-infrared spectroscopy with NIRSPEC on Keck (fed by adaptive optics) demonstrated that the pair is a brown dwarf binary of dL2 spectral type. This is the first brown dwarf binary system imaged around a G-type star. HD 130948B and C constitute a pair of young contracting brown dwarfs with an orbital period of about 10 years. *(See Figure 2)*

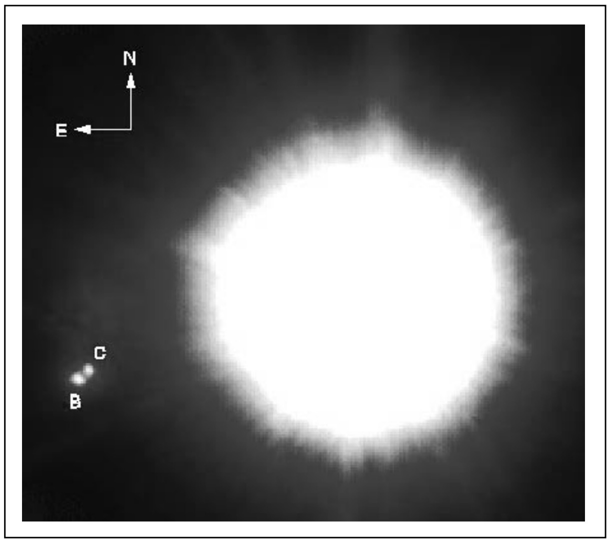



***Figure 2:*** *Discovery Gemini/Hokupa'a image showing the binary companion in HD 130948. The pair is 2.64" from and 8 H-band mag fainter than HD 130948A. The separation between B and C on April 19, 2001, was 0.134".*

• "Crossing the Brown Dwarf Desert Using Adaptive Optics: A very Close L-Dwarf Companion to the Nearby Solar Analog HR 7672" is the title of a recent work published in *The Astrophysical Journal* and theme of a press release and press conference at the January 2002 AAS. Using Gemini/Hokupa'a/QUIRC, Michael Liu (University of Hawaii) and his collaborators discovered a very faint companion to the active solar analog star 15 Sge (HR 7672). This is the closest ultracool companion around a main sequence star found to date by direct imaging. The companion is most likely sub-stellar, with a mass of ~48 $M_{Jup}$ based on models. The companion has an orbital period of 100 years, a semi-major axis of 21 AU, an eccentricity of 0.3 and an inclination of 51 degrees. In contrast to the paucity of brown dwarf companions at < 4 AU around FGK dwarfs, HR7672B implies that brown dwarf companions do exist at separations comparable to those of the giant planets in our solar system. Its presence is at variance with scenarios where brown dwarfs form as ejected stellar embryos. *(See Figure 3)*

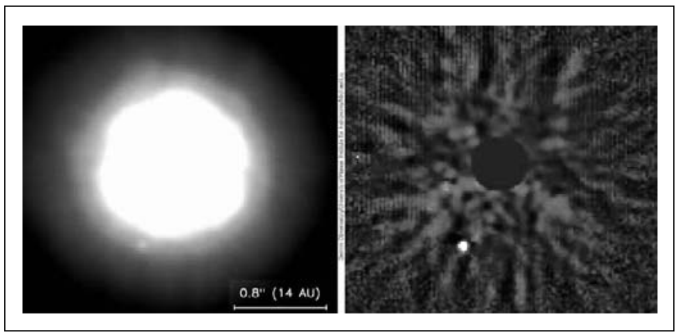



***Figure 3:*** *Left: K' discovery image of HR7672B with Gemini North / Hokupa'a at about the 7:00 position. The companion is seen as a faint object in the halo of the primary. Right: S/N image, of the same data, constructed by unsharp masking the original data and then dividing by a radial profile whose amplitude follows the radial noise profile. The result is an image with uniform noise over the entire field – the companion is well detected.*

• Ray Jayawardhana (UC Berkeley) and Kevin Luhman (Harvard Smithsonian Center for Astronomy) have also pursued the exploration of the environments of several nearby stars in the search of very low mass companions. MBM 12 is one of the few clouds at high Galactic latitude known to harbor young stellar objects. The group of stars it harbors has an age of about 2 Myr. JHK' band imaging with Hokupa'a/QUIRC on Gemini has revealed a clear edge-on disk as part of this quadruple stellar system. MBM 12A 3C has a flaring disk ~150 AU in radius. The inclination of the young stellar disk is 87 degrees and the mass is estimated to be ~0.002 $M_{sun}$. MBM 12A 3C may be the first disk to be clearly resolved around an individual star in a young quadruple system. The fact that the disk of MBM 12A 3C is neither coplanar nor parallel with its orbital plane is a test for models of multiple star formation and early evolution. *(See Figure 4)*

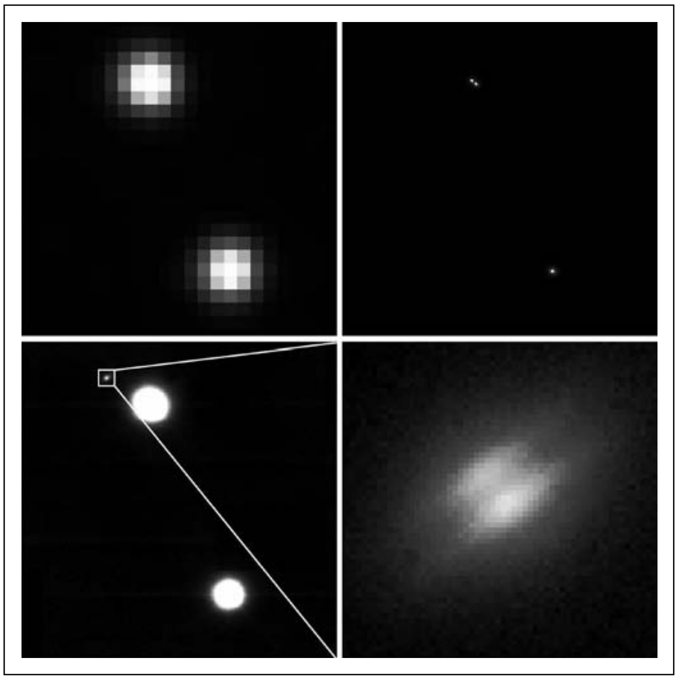


***Figure 4:*** *Upper left: A 24" x 24" image in K', from 2MASS shows the young wide binary MBM12A 2 and MBM 12A 3 (15.5"). Upper right: Short K' exposures with Gemini/Hokupa'a/QUIRC for the same field. MBM 12A 3 is resolved into a close binary (0.42"). Lower left: Deep K' exposures reveal a faint (H=16), nebulous object 4" NE of MBM 12A 3. Lower right: The 1.2" x 1.2" region surrounding MBM 12A 3C in a deep H-band image clearly shows an edge-on disk morphology.*

**Science results with OSCIR**

• Late in the evolutionary stages of some very massive stars, stellar winds become extremely strong and so much dust has been found around these stars that they can be called "smoking stars." A Montreal team led by Sergey Marchenko (now at Western Kentucky University) and Anthony Moffat (Université de Montréal), using OSCIR on Gemini North, has discovered a relatively cool, extended, multi-arc dust envelope around the Wolf-Rayet star WR112, most likely formed by wind-wind collision in a long-period (25 year) binary system. Using OSCIR medium band 7.9, 12.5 and 18.2 micron filters, the team was able to derive the binary orbital parameters, the dust temperature and the dust mass distribution in the envelope. The dust production rate corresponds to ~6% of the total mass-loss rate. They found that amorphous carbon is the main constituent of the dust, and that the characteristic size of the dust grains is ~1 micron, significantly larger than theoretical predictions for this type of environment. The binary will produce on the order of two earth masses of dust over its lifetime. The authors show that at least 20% of the initially formed dust may reach the interstellar medium. *(See Figure 5) (See press release at: www.gemini.edu/project/announcements/press/2002-4.html)*

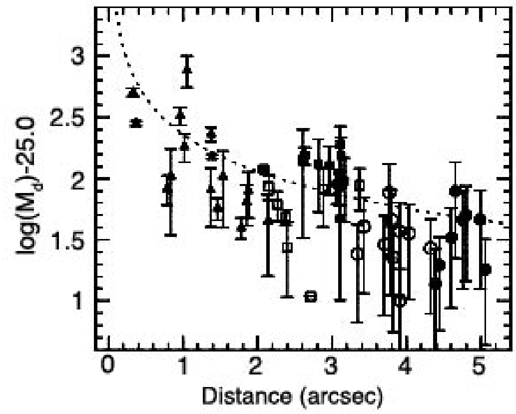



***Figure 5:*** *Dust distribution in the WR112 system, integrated dust mass in grams. Different symbols correspond to different quadrants on the OSCIR images. The dotted line shows the trend expected in the case of mass conservation.*

• Bill Vacca (Max Planck Institute for Extraterrestrial Physics), Kelsey Johnson (University of Colorado) and Peter Conti (University of Colorado) have used OSCIR to study the low-mass, star bursting galaxy Henize 2-10. Obtaining N-band images of this galaxy, the team discovered four bright, compact knots that have no counterparts in the HST UV, HST optical, or ground-based near IR (J, H and K') images. These knots are probably super-stellar clusters containing the equivalent of several hundred thousand solar masses of massive stars. However, the N-band morphology is extremely well correlated with the 2cm VLA radio maps obtained by Kobulnicky & Johnson (1999). The four knots comprise about 60% of the total N-band flux from Henize 2-10. The spectral energy distributions (SEDs) of the knots bear a remarkable resemblance to those of galactic ultracompact (UC) HII regions. The electron densities in the ionized regions surrounding the dust embedded stellar clusters are on the order of $10^3$-$10^4$ $cm^3$, and the radii of the regions are between 2 and 5 pc. The masses of the surrounding dust shells are about $10^6$-$10^7$ $M_{sun}$. For the brightest knot, the radio and IR fluxes allow to derive a mass of $M_{cluster} > 2.5 \times 10^6$ $M_{sun}$, and an age of < 3.6 Myr. The radio/mid-IR knots represent deeply embedded super-stellar clusters (SSCs) and may be the youngest examples yet observed. Ultra-dense (UD) HII regions may be common among starburst galaxies. This suggests that a significant fraction of the star formation in these galaxies is occurring within regions that are completely hidden to the UV, optical and even near-IR observations. *(See Figures 6 & 7)*

**Science results with GMOS**

From moderately deep g', r' and i' GMOS images obtained of the M31 dwarf spheroidal companion And V, Tim Davidge (Herzberg Institute of Astrophysics), Gary Da Costa (Australian National University) and Inger Jørgensen (Gemini Observatory) were able to trace the presence of red giant branch stars out to radius of 126" from the galaxy's center, indicating that And V extends over a diameter of ~1 kpc. Based on the slope of the RGB in the (I', g'-I') CMD,

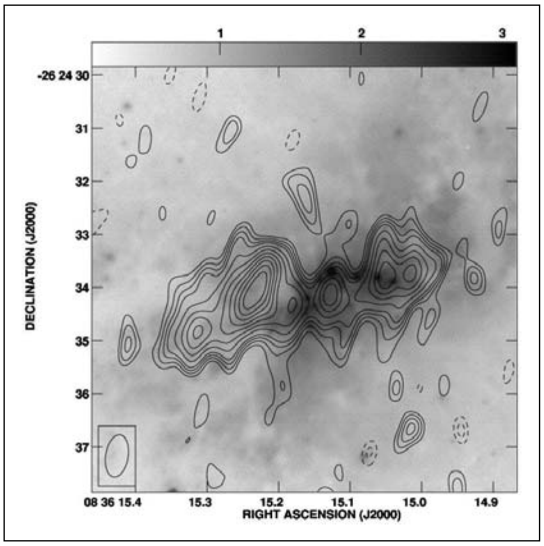



***Figure 6:*** *Optical V-band image from HST of Henize 2-10 (Johnson et al. 2000) with 2cm radio contour overlaid from Kobulnicky & Johnson (1999). As seen in the next figure, the bright mid-IR knots are not correlated with the regions of star formation apparent in the UV and optical bands.*

the authors conclude that the metallicity appears significantly lower than previous estimates, but placing And V squarely aligned with the metallicity and integrated brightness relation defined by other dwarf S and E galaxies. The data used in this study were obtained through the System Verification program of GMOS.

The above results have led to the first round of papers published in refereed journals. We expect at least a dozen

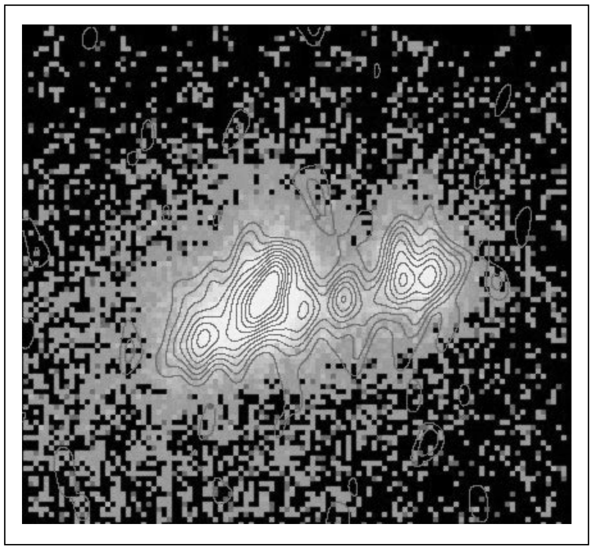


***Figure 7:*** *Gemini/OSCIR N-band image of Henize 2-10 overlaid with the 2 cm radio contours from Kobulnicky & Johnson (1999).*

more papers and the first articles based on data from the facility instrument GMOS to appear before the end of 2002.

As indicated by this summary, Gemini has begun to do what it was designed to do, and based upon these early scientific results, we are off to a great start. Gemini has performed exceptionally well in both the infrared and optical. As more instruments become available at both telescopes, we can expect a significant increase in new and exciting science in the near future.

# GMOS IFU REPORT

**Bryan Miller**

Beginning with the 2002A semester, observers have access to the Integral Field Unit (IFU) of the Gemini Multi-Object Spectrograph *(GMOS; See Gemini Newsletter #23)* on Gemini North. The first such capability on any 8-meter class telescope, this allows spectroscopy over a contiguous two-dimensional region of an object. In complicated environments like galactic centers or star forming regions, changes in kinematics, line ratios and stellar populations can be traced more easily than with longslit or MOS techniques. This has been demonstrated by observations of the active galaxy NGC 1068.

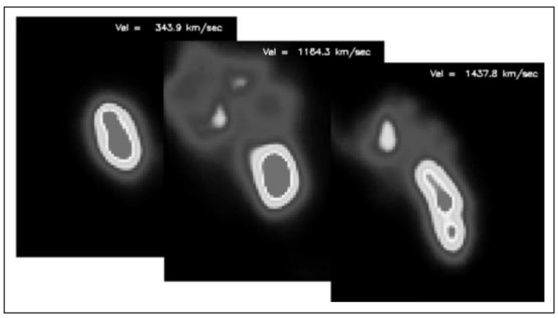



***Figure 1:*** *Three planes from the GMOS IFU datacube of NGC 1068 showing the intensity of [OIII]5007 at three velocities. Each panel is 8"x10" (N up, E left), or 565 pc x 700 pc. The systemic velocity of the galaxy is about 1140 km/sec. The left panel shows blue-shifted light from the bowshock of the approaching radio jet. The middle panel shows gas in the disk NE of the nucleus and gas near the nucleus. The right panel shows emission from gas in the receding, SW, bowshock and gas that may be being pushed into the NE disk by the approaching bowshock. www.gemini.edu/media/IFUImages.html for color images.*

The Gemini telescopes are well-suited for integral field spectroscopy. More collecting area, a smaller diffraction limit, and new technology means that higher signal-to-noise spectra of finer spatial structures can be obtained than with smaller telescopes. Therefore, the first generation of instruments will include optical and near-infrared IFUs on both telescopes: GMOS and NIFS on Gemini North, and GMOS and GNIRS on Gemini South. IFUs are also being commissioned or designed for all the other large telescopes.

The GMOS IFU is inserted into the focal plane like a standard MOS mask so that two mirrors can direct light from regions 1' apart onto a pair of micro-lens arrays. *(Continued Page 25)*

# GEMINI LEADS THE WAY IN INFRARED TECHNOLOGY

**Ed Kennedy with Scott Fisher**

Now that both Gemini North and South are beginning to produce scientific results, the Gemini team is anticipating a far greater impact on leading edge research, especially in the mid-infrared (10-20 microns).

A relatively new field, observing in the thermal IR is currently one of the hottest (please pardon the pun!) research areas in astronomy. Instrument development has always driven the advances in thermal IR astronomy in its 30-year history. With the new research tools now being utilized and developed for Gemini, the field is really coming into its own.

Research tools developed for use in the mid-IR first became available in the late 1970's. These early detectors, called bolometers, were not incredibly complete, but they were extremely sensitive. Camera systems built in the early 80's were almost as sensitive as the arrays that are being used at Gemini 20 years later, but their single pixel design didn't show much detail. They did, however, demonstrate an exciting potential inherent in mid-IR research.

Scientists quickly realized the advantages of having multi-pixel arrays, but had to wait for the technology to catch up. With R&D from the Star Wars defense program, the technology has now caught up through development of focal plane arrays that can be used at these long wavelengths.

By the late 80's the technology had advanced enough to allow astronomers access to arrays with dimensions of 58x32 pixels. The current generation mid-IR cameras that are in use were built in the 90's and have arrays of 128x128 pixels, a relative abundance compared to only 10 years before. OSCIR is one of these cameras. OSCIR has been used extensively in Gemini's opening campaign to view the sky in the mid-IR. OSCIR was scheduled to be used one more time in May to observe the Southern Hemisphere sky from Gemini South.

But what astronomers are really looking forward to are two new imager-spectrometers just about ready to be added to the Gemini arsenal. Gemini's own T-ReCS, developed by the University of Florida; and Michelle, a camera developed by the Astronomy Technology Center at the Royal Observatory of Edinburgh. Each boasts 320x240 pixel detectors with pixel scales of approximately 0.09"/pixel - ideally matched for Gemini's imaging capabilities.

T-ReCS is destined for Gemini South and should be arriving at Cerro Pachón later this year. Michelle will be shared between UKIRT and Gemini North. Michelle has been in Hawai'i for the past six months undergoing its shakedown at the UKIRT facility on Mauna Kea. This fall, it will be moving to Gemini North for a one-year stint.

One obvious advantage of this latest generation of detectors is that with a greater number of pixels, the instruments will have a wider field of view on the sky. These imager-spectrometers are also approximately 50 percent more sensitive than the previous generation, which will basically double their "vision."

"In a very real sense, T-ReCS is the 'son of OSCIR'," says Dr. Scott Fisher, Research Fellow at Gemini North. Fisher, who became involved with OSCIR during the latter part of its development stage at the University of Florida, has helped guide the Gemini team through its commissioning period and early successes in the early IR area.

The main difference between the two cameras is that Michelle has an added mode of very high-resolution (echelle) spectroscopy.

One big advantage for these two new imager-spectrometers is that they will be integrated to an observatory platform developed specifically with thermal IR research in mind. "That's because Gemini was built from the ground up with the idea in mind that it would be used for infrared," says Fisher.

A large part of the credit for the Gemini optimization for thermal IR research can be given to the late Fred Gillett, who from the beginning might be called the driving force behind the Gemini vision.

"Now thanks to the foresight of men like him," says Fisher, "We will be head and shoulders above the competition in mid-IR research. Especially in the Southern Hemisphere,

*(Continued on page 13)*

# ENGINEERING REPORT

**Eric Hansen & Brent Ellerbroek**

Thanks go to all the staff and partners who helped to make the Gemini South dedication a huge success. The dedication on Cerro Pachón was one of the most important milestones in our goal of creating a fully integrated Gemini Observatory. It now joins Gemini North in creating the vision of two telescopes and one observatory.

By any standard we have reason to celebrate results to date in the south. After a rocky start last semester due to a damaged instrument and bad weather, Flamingos (a visitor instrument from the University of Florida) began taking the first science images on Gemini South. Analysis of over 500 frames yielded the superb image quality statistics shown in *Figure 1*.

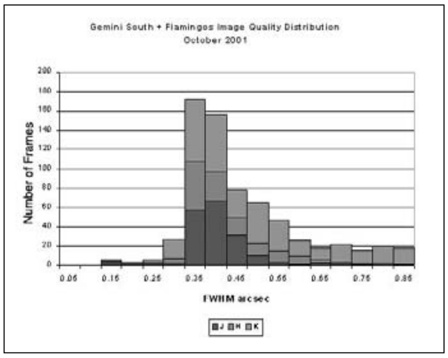



***Figure 1:*** *Flamingos image quality analysis graphic.*

Flamingos used peripheral wave front sensor probe P1 to regularly "tune up" the primary figure and depended on look-up tables to maintain the image quality. This was done because P2 with its smaller obscuration was not yet fully calibrated. Since that time, P2 has been placed in service and early in the 2002A semester, was used regularly with the NOAO visitor instrument Phoenix to produce similar results in terms of image quality.

Further improvement of the closed loop active optics capabilities of both telescopes are among the highest engineering priorities. In addition we are making good progress on implementing adaptive optics capabilities at both sites.

Integration work on the Altair Adaptive Optics (AO) system for Gemini North is now entering its final stages at the Herzberg Institute of Astrophysics in Victoria, Canada. The optical system has been aligned, and the optics bench has been integrated with the instrument's electronics enclosure *(See Figure 2)*. Closed-loop AO testing has now begun to characterize performance parameters such as the control loop bandwidth and the wavefront sensor measurement noise level.

Meanwhile, work at Gemini North is in progress to prepare for Altair's arrival later this year. Scott Roberts (on sabbatical from HIA) and Jacques Sebag have aligned the AO fold mirror in the Gemini A & G system, which insures that Altair will be properly boresighted and focused with respect to the telescope. Corinne Boyer, Chris Meyer, and others are planning the software work needed to upgrade the telescope control systems and observing tools for operation with Altair.

Longer-term work towards the Altair Laser Guide Star (LGS) AO upgrade is proceeding as well. The laser system contract is almost ready for submission to NSF for final approval, and there should be more to report on this topic in the next issue of the newsletter.

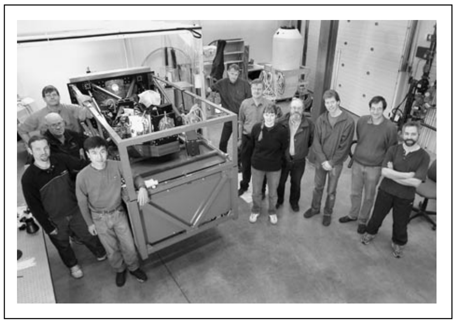


***Figure 2:*** *HIA Altair team during the integration of the electronics enclosure.*

The design of the laser launch telescope is proceeding at EOS Technology in Tucson. A Preliminary Design Review was scheduled for May. Work also continues on the detailed design of the beam transfer optics system, with contributions from the entire Gemini AO team, as well as Don Gavel and Brian Baumann at Lawrence Livermore National Laboratory.

Recent progress on the opto-mechanical layout, electronics, software requirements, and performance estimates was summarized at an internal design review held on April 9. An overview of the Beam Transfere Optics (BTO) design can be found at the Gemini Adaptive Optics (GAO) website. *(See Figure 3 & www.gemini.edu/sciops/instruments/adaptiveOptics/AOIndex.html ).*

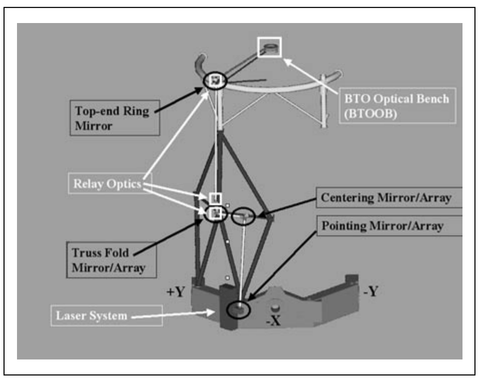



***Figure 3:*** *Beam transfer optics schematic for Gemini North and South LGS AO systems.*

On a related topic, Gemini and Keck Observatory are now fine tuning the implementation of the laser traffic control system (LTCS) that will prevent optical interference between LGS AO operations and other observations at Mauna Kea. Keck propagated their sodium laser at the summit for the first time on December 22, 2001.

The contract documents for the Gemini South AO (GSAO) Real Time Control (RTC) hardware and software are also nearly ready for submission to NSF. Source selection and contract negotiations are continuing for the GSAO optical bench, the deformable mirrors and the natural guide star (NGS) wavefront sensor (WFS) subsystem.

Eric James, Scott Roberts, and our optical design consultant Richard Buchroeder are now developing an opto-mechanical design for an interim LGS WFS for use with a single laser guide star. We currently expect to support several studies later this year to develop a LGS WFS suitable for use with five guide stars. This is the final element of the design needed to fully define an upgrade path to a multi-conjugate AO (MCAO) capability at Gemini South.

Implementing these AO capabilities is intended to allow diffraction limited performance well into the visible. However, image quality is only one of the metrics by which we measure how well we are doing. Performance, efficiency and availability are all critical to maximizing the science return we receive from these telescopes and are used to determine where engineering resources are best applied. Availability as measured by the amount of time the telescopes collect photons for either science or engineering has steadily

| Location | Weather Losses (%) | Telescope Losses (%) | Instrument Losses (%) |
|---|---|---|---|
| **Gemini North** *Semester 2002A through May 5th* | 32.1 | 12.2 | 1.7 |
| **Gemini South** *Semester 2002A through March 25th* | 5.7 | 6.3 | 0.4 |

***Figure 4:*** *Time loss Chart*

increased at both sites since we began taking science data. *Figure 4* shows the time loss statistics at Gemini North and South for much of the 2002A semester. While we are not yet at our goal of 98% availability during clear sky conditions, we are on track to reach that goal soon if current trends continue. In the coming months, many of these metrics, such as image quality statistics and the time loss table, will be available through our public web site.

As a final note, Jim Oschmann Gemini Associate Director of Engineering, began working at the National Solar Observatory (NSO) in early February. Jim has been instrumental in the design, fabrication and commissioning of the Gemini Observatory and his contributions will be greatly missed. *(See story on page 18)*

# NIRI UPDATE

**Joe Jensen**

During the first half of semester 2002A, NIRI has performed well. Several observing runs have now produced some science data for seven queue programs in scientific ranking bands 1 and 2.

Our main frustration has been the weather, which has consistently failed to cooperate since the end of last year. The data we have taken look quite good, although some were taken during poorer weather conditions than we would have liked. NIRI promises to deliver excellent data when we get some good seeing and clear, dry weather.

During times when the weather was too poor to open, NIRI was used to test the facility polarization unit GPOL, which was recently installed on the Gemini North telescope.

Additional commissioning with NIRI on the sky was scheduled to begin during the first week of May.

The NIRI web pages have been updated to include new filters that have arrived, changes in the spectroscopic slit lengths, updated instructions for preparation of Phase II proposals and suggestions for calibrations, among other modifications.

We encourage you to have a look from time to time, and especially when preparing Phase II programs. We are also in the process of developing better data reduction scripts. The NIRI imaging scripts are in fairly good shape and seem to be working reliably. Updated imaging reduction scripts were released with the Gemini iraf package version 1.3 in March.

## *IR Technology story Continued from Page 11*

which remains a relatively uninvestigated region at 10 and 20 μm”.

“IRAS and ISO have done some survey work in the southern sky, but until now the highest resolution mid-IR images taken of the southern skies are from 3-4 meter class telescopes.” This new generation of cameras coupled with the Gemini telescopes will very probably be the most powerful infrared research tool in the world.

# GPOL REPORT

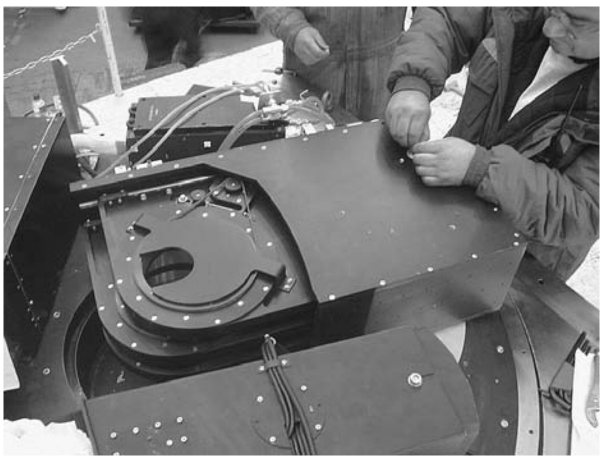
Colin Aspin

Recently, the first of two Gemini Polarimetry (GPOL) units was delivered to Gemini North from the UK Astronomy Technology Center in Edinburgh, Scotland.

The second unit is for Gemini South and will likely be delivered before the end of this year. GPOL is the Gemini facility Polarization module and will, when commissioned, provide polarimetry capabilities for facility instruments such as NIRI, the Near-IR Imager, and GMOS, the optical Imager/Spectrometer.

The Project Scientist for the development of GPOL is Professor Jim Hough of the University of Hertfordshire, England, while I served as Gemini Project Scientis.

The GPOL unit has been designed to mount in the lowest section of the Acquisition and Guide Unit. Hence, the science instrument used in conjunction with GPOL must be mounted on the bottom port of the Instrument Support Structure (ISS).



*GPOL installation at Gemini North.* ***Photo by Jaques Sebag.***

GPOL can be remotely configured to allow linear polarization observations from 0.3 to 4 microns using one of two half waveplates, a super-achromatic waveplate covering 0.3 to 2.5 microns and a thermal IR waveplate for the L pass-band (3 to 4 microns). A circular polarization capability will be added in the near future.

The waveplates are rotatable either to discrete positions (for fully sampling orthogonal polarization states) or continuously. Three calibrator plates, two for the optical (UV and blue-red polaroids) and one for the IR (wire-grid) can also be introduced into the beam prior to the waveplates to allow polarization efficiency calibration.

GPOL is designed to work in conjunction with a polarization analyzer internal to the science instrument itself, in the cases of NIRI and GMOS, this analyzer is a Wollaston prism which splits the incident light into two orthogonal polarization components spatially separated by a fixed amount on the detector. To facilitate this dual-beam polarimetry in the imaging mode, a focal plane mask is introduced into the light path to obstruct sections of the detector. It is in these sections that the deviated polarization state (deviated by the Wollaston prism) is imaged. Dual-beam polarimetry is the preferred method of measuring polarization, since the result is generally considered independent of changes in observing conditions during the observation sequence and hence, more accurate.

However, since the field observed is not complete in one pointing of the telescope, a second pointing is required offset by the width of the focal plane mask slots. At present, spectro-polarimetry observations are only possible in the optical with GMOS, since the near-IR spectroscopy prisms in NIRI are located in the same wheel as the Wollaston prism. For spectro-polarimetry, a dual short slit arrangement will allow the detection of both orthogonal polarization states simultaneously.

GPOL at Gemini North was scheduled for commissioning with NIRI in early May, 2002. During this run, our goal was to characterize the instrument's performance in the near-IR and calibrate its instrumental polarization and limiting polarimetric accuracy. Results from the commissioning run will be presented in the next Gemini Newsletter.

With NIRI, GPOL will have an unvignetted field of view of approximately 90 arc seconds. In addition, around the waveplates themselves are transmissive glass areas to allow use of on-instrument wave-front sensors while taking polarization data.

Commissioning of GPOL with GMOS will likely take place during the fall of 2002 after data obtained during the commissioning with NIRI has been fully analyzed. It is also planned that a Gemini iraf package called "gpol" will be released prior to the availability of the facility for general observing.

We anticipate queue observing with GPOL will be announced before the semester 2003B proposal deadline.

For more information on using GPOL contact Colin Aspin at: *caa@gemini.edu.*

# PUBLIC INFORMATION & OUTREACH REPORT

**Peter Michaud**

As the middle of 2002 approaches, the Gemini Public Information and Outreach Office has marked a number of significant milestones, while our second year of a five-year expansion plan for the department remains on schedule. Highlights include the hiring of several new staff members, formation of the Public Information and Outreach Liaison Network, the establishment of a PIO Office in La Serena and the ramp-up of press release production in support of Gemini's rapidly expanding scientific operations.

### New Staff

Several new staff positions have been filled in the Public Information & Outreach Office and our programming and production capabilities have expanded in proportion to our increased staff resources. **Kirk Pu'uohau-Pummill** has been hired as our Graphic Artist and his skills have resulted in immediate improvements to the look of our publications (such as this Newsletter). In addition to the multitudes of projects that have landed in Kirk's lap, he was responsible for many of the images produced for the Gemini South dedication and is now involved in a major redesign of the Gemini public and media web pages. It is anticipated that many of the design elements that Kirk is creating for the redesign of the PIO pages will also serve as templates for other existing Gemini web pages. Our goal is to create a more uniform and appealing look for all of the Gemini pages and better navigability throughout our site.

In Chile, **Ma. Antonieta (Tonia) Garcia** has been hired as the Public Information and Outreach Assistant in La Serena. She is responsible for the day-to-day operations of the Public Information and Outreach activities at Gemini South. Already, she has contributed to a significant increase in mainstream media coverage on Gemini South and local educational programming for teachers and students. Antonieta also has played a major role in the production and translation of PIO publications, such as a new English/Spanish brochure and a variety of materials in support of the Gemini South dedication. Antonieta is also working closely with Janice Harvey in Hilo to coordinate parallel Gemini North-South programming such as the StarLab portable planetarium education program.

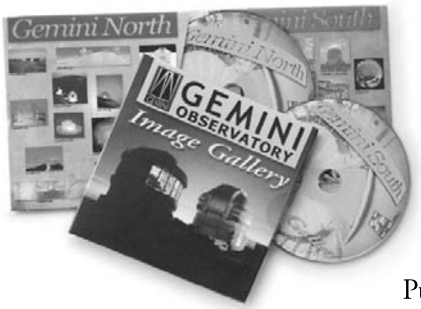
*Tonia Garcia and Janice Harvey visit La Serena school with the StarLab.*

At the start of 2002, Ruth Kneale moved on to a new position with the National Solar Observatory. Ruth has been with Gemini since 1991 and served as Librarian and Webmaster for the past ten years. Ruth's hard work, skills and tremendous knowledge will be greatly missed.

Ruth's position was filled in January by **Virginia Smith**, who eased the transition by working closely with Ruth prior to assuming her new title as Librarian/ Webmaster.

Virginia's time is split 50/50 overseeing the Library and PIO-related activities. Another of Virginia's new responsibilities is to monitor and track Gemini science publication references and citations, as well as mainstream media "hits." Information from these data will be used as metrics to help assess Gemini's success and visibility to scientists and the public. Both Virginia and Kirk are involved in web maintenance and design. Virginia serves as primary webmaster and Kirk as primary designer. However, both Virginia and Kirk are "cross-training" on each other's web duties in order to provide an extra level of depth to assure rapid turnaround for web modifications and updates.

With these new staff members, we have been able to initiate several new initiatives designed to rapidly move the Gemini PIO effort closer to our goal of supporting the needs of the partnership by balancing aggressive local outreach in our host communities with the production of high caliber resources for the media, public and educators.




Examples of this progress include:

• A significant increase in press releases and media resource production.
• Establishment of a fully functioning Public Information and Outreach Office in La Serena.
• Production of various public relations materials in support of Gemini South Dedication, including a CD-ROM which contains a viable prototype version of the Gemini Virtual Tour for both Macintosh/Windows.
• Establishment of PR/Science Imaging Initiative
• Providing teacher workshops with summit tours and educational background information for local elementary through 12th-grade classroom teachers.

*The Gemini PIO Liaison Network during a tour of Gemini South during first group meeting, from left to right: Antonieta Garcia (Gemini South PIO), Guillermo Bosch (Argentina), Consuelo Pacheco (Chile), Doug Isbell (USA), Eleanor Geer (UK/ROE), Helen Simm (Australia), Peter Michaud (Gemini PIO Manager), Janice Harvey (Gemini North PIO), Dennis Crabtree (Canada), Amber Jones (NSF), Mariangela Oliveira-Abans (Brazil), (Missing: Peter Barratt UK/PPARC).*

**PIO Liaison Network**

The first annual Gemini PIO Liaison Network meeting was held in La Serena Chile, in February. This meeting brought together representatives from each of the Gemini partner countries in order to discuss Pubic Information and Outreach issues and better understand the possibilities and constraints of each partner country. As a result of the meeting, an extensive list of action items was generated that will provide a framework for future Gemini PIO interaction among partner offices. Some key action items included:

• Resolving the distribution method and timing for coordinated multi-partner releases.
• Establishing proactive science monitoring throughout the partnership.
• Identifying an appropriate slogan for Gemini and exploration of a new logo design.

The second meeting of the PIO Liaison Network has been tentatively scheduled for June or July of 2003 and will either be held in Hawai'i or Australia to possibly coincide with the IAU meeting in Sydney.

**Science Press Releases**

With the rapid increase in published scientific results from Gemini, a corresponding increase in press releases to support these results has begun. During the first four months of 2002, six press releases were developed and distributed. These releases covered four scientific results, the Gemini South Dedication and one outreach programming event. To support many of these releases, additional artwork and illustrations were produced that have been used extensively by the media and scientific community. *(See Figure 1)* A web page is under development that highlights some of the media coverage that Gemini has received and can be viewed at: *www.gemini.edu/media/media_archives.html*

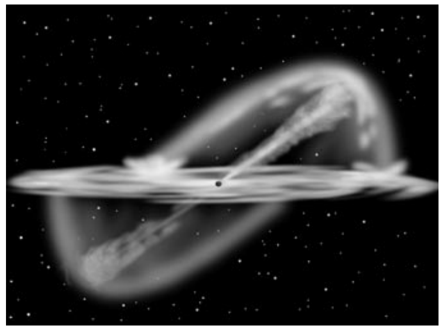


***Figure 1:*** *Illustration by Jon Lomberg of the central black hole region of NGC1068.* *(See story on Page 10)*

**Other Highlights**

Several other events and initiatives have helped to define the progress of the Public Information and Outreach Office. Among these is the PR Imaging Initiative that will result in the acquisition of publication quality images of astronomical objects in support of scientific results and future press releases. In order to help accomplish this, an astronomical imaging workshop was held in Hilo in late March in order to share ideas and techniques on producing aesthetically pleasing astronomical images. Special thanks are due to Zolt Levay (STScI) and Dr. Travis Rector (NRAO/NOAO) for sharing their expertise and time with our staff.

Finally, with the foundation laid over the past year, the entire PIO team is anxious to continue with the aggressive development of our programs and initiatives. Before the end of this year, we will begin the selection process for a full-time Press Officer who will complete the Gemini PIO team.

OUTREACH

# RELATIVELY SPEAKING

**Ed Kennedy**

*"Einstein" captures the imagination of a full house at the University of Hawai'i Hilo Theatre.* ***Photo by Kirk Pu'uohau-Pummill***

"Maybe we nudge a few neurons tonight." With these words, Albert Einstein was brought to life for a series of Hawai'i presentations of science and fun, with a little help from Gemini Observatory.

Arden Bercovitz presented his unique, one-man show, "Einstein (Relatively Speaking)" before a baker's dozen of general and school audiences around Hawai'i in April. The tour was sponsored by Gemini.

Bercovitz's tour was part of the ongoing program by Gemini's Public Information & Outreach Office to introduce the observatory to the public and help educate and inform our host communities.

Bercovitz, who holds a PhD in Reproductive Endocrinology, was "discovered" by Peter Michaud, Gemini's Public Information & Outreach Manager, when he saw him give the keynote address at a planetarium directors' conference 10 years ago. Janice Harvey, who heads up the Gemini North Outreach Office, coordinated the appearances.

"Now all you astronomers and Gemini people in the crowd do not listen," Bercovitz, in his persona of Einstein, told one such capacity crowd of more than 600 at the University of Hawaii, Hilo. "I'm talking to these other people." And talk he did, as he brought Einstein to life, lecturing, joking and answering a slew of remarkably erudite questions from the audience.

Sporting the Nobel Prize winner's famously disheveled hair and droopy moustache, Bercovitz was so successful in his Einstein persona that before the night was out, children and adults alike were addressing him as if he actually were Einstein.

"What happens to matter when it falls into a black hole?" one audience member asked in the question-and-answer portion. "Einstein" responded by giving a brief, credible summary on the subject. "Black holes literally curve space," he said. But then with a twinkle in his eye, he concluded, "It's like a very big person and a very lousy mattress."

"What are worm holes?" a youngster who could not have been more than 10 asked the professor. "Something in the garden," he shot back, and then went on to give a short synopsis behind the concept.

Which somehow leads us to his definitive explanation of relativity. Relating a story about Einstein once encountering Jack Warner in a movie studio commissary, Berkovitz told the audience the two were introduced to each other.

"Relativity, huh?" cracked the legendary producer. "I got my own explanation of how relativity works. You wanna hear it?" Einstein indicated that he did.

"Never hire 'em."

Bon Voyage

# JIM OSCHMANN

**Matt Mountain**

I first met Jim over the Christmas holiday in 1992, and it was an inauspicious start to our Gemini careers. We were both new to AURA, and hadn't earned any vacation yet, so we were both sitting virtually alone in the Tucson Gemini Project Offices, where we had just been told that Congress had asked the NSF to set up a major review of the Project and its choice of mirror technology. By the new year of `93, things weren't getting any better: the NSF Independent Review had not gone well, and we had until the fall of that year to recover the credibility of a fledgling Project that had a new and untried Project Scientist (me), and a new Systems Engineer, Jim Oschmann. Jim had the additional handicap that most of our community at that time (and I suspect a significant fraction of the Project Team) weren't exactly sure what a System Engineer was, or why they needed one. It was against this backdrop as "the big telescope underdogs" that I had the privilege to start working with, and really get to know Jim Oschmann, both as a long-time friend and trusted colleague, and realize just what a unique individual he is.

*From left, Jim Oschmann, Doug Simons & Phil Puxley during a lighter moment at the Gemini South Dedication.*

For as long as I have known Jim, he was able to carry the entire Gemini system, budget and schedule in his head, which gave him the extraordinary and unique capability to navigate the Gemini Project through the technical and program management complexities of a construction project spanning two hemispheres funded by a diverse partnership of seven nations. Jim was relentless in his inquiry of how to "get things done," and move on to the next problem: how many of our engineers (or even our scientists for that matter) have found themselves in the uncomfortable position of having to explain to Jim why they had spent so much effort exceeding their requirements, rather than just meeting them. Whether it's been in the office, at our sites, sitting through our hundreds of meetings and reviews, on our all too numerous plane flights, or in a restaurant after another long day away from home, it has been an exhilarating and transforming experience working and debating with Jim over these "Gemini years."

When Jim, now Associate Director of Engineering (and formally Gemini Project Manager after Dick Kurz), finally decided to leave Gemini in February of this year (2002), Gemini could not have been more transformed from those early "underdog days." Both Gemini telescopes has been constructed on schedule and within our $184M budget, a top ranked engineering and support team is in place at the Gemini Observatory which now delivers world-class science to its communities, and our adaptive optics program is poised to revolutionize the way we undertake astronomy from the ground. All of these successes are testaments to Jim's tenacious focus and peerless intellectual leadership of the engineering and technical team that made the Gemini Observatory happen.

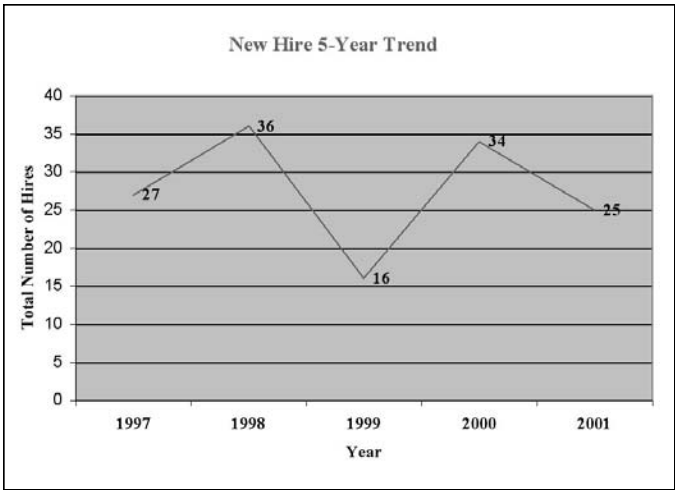
# HUMAN RESOURCES REPORT

**Melissa F. Welborn**

Scientists like to take data and make measurements. Then they apply their knowledge and skill to analyzing their data to come to some conclusions. And, like scientists, we in Human Resources do the same. The measurement and subsequent analysis part of our work tell us where we have been and where we want to go.

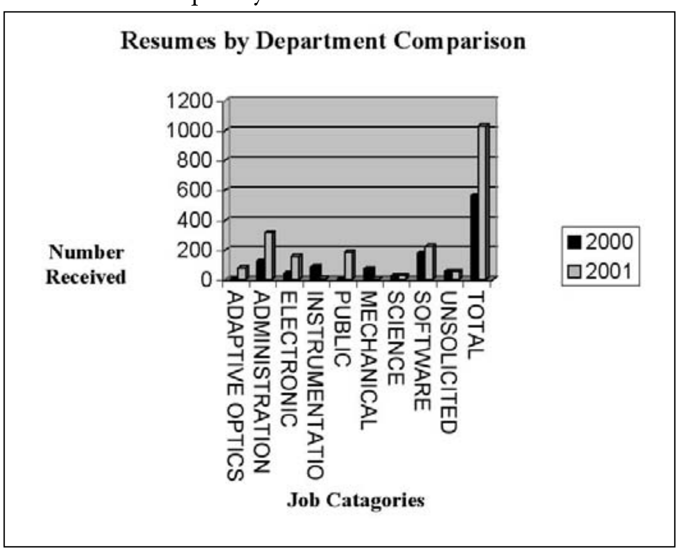
The Human Resources Department considers itself a strategic partner with all the departments at Gemini Observatory, working closely with managers and employees to bring to fruition the full capabilities of Gemini Observatory. We have recently undertaken the task of taking our multiple measurements and developing a number of reports from them. This allows us to develop plans that integrate ongoing initiatives and the Observatory's strategic vision.

One of our major activities has been, and continues to be, recruiting staff with the requisite skills to make Gemini Observatory a success. Because we are young and fast growing, our emphasis has been to respond as quickly as possible when new openings occur. Our goal is to provide the recruiting manager with qualified candidates so that his or her operational objectives can be achieved.

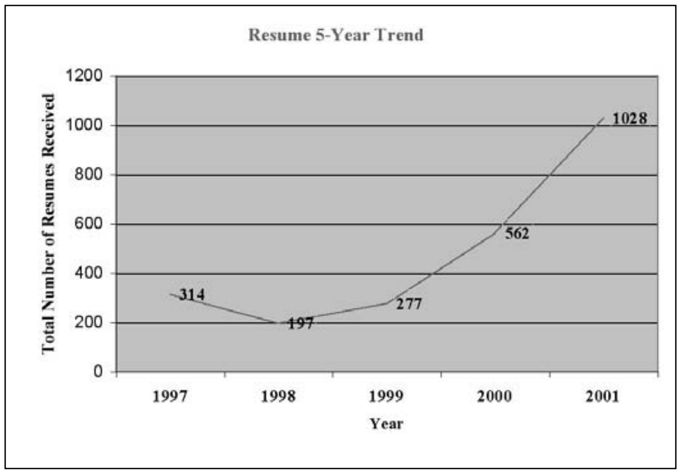



On the face of things, one might conclude that recruiting activities slowed in 2001 compared to 2000. However, what is not evident is that nine recruitments started in 2001 were either completed in early 2002 or have not been filled as of press time. Another factor in our recruiting activities involves resume handling. When one looks at the number of resumes we handled in 2001, a different picture emerges.

Like the little boat in the children's story, floating down the river and having quite an adventure, each resume has a journey to take. When we receive a resume, we go through a process to ensure that we are meeting our legal obligations as well as our internal requirements. We date-stamp each resume that comes into the HR Department, for both legal and internal reasons. Then the resume is catalogued in several reports for both legal and internal purposes. We maintain a database of all resumes for efficient retrieval, to calculate the efficiency and effectiveness of the recruitment and in order to determine the value of our advertising efforts. Then the resume is copied and forwarded to the Interview Panel and a file is started in the Human Resources Department for each position and this is where the original resume is kept. Other managers may request resumes for a variety of purposes and our system makes it possible to locate a resume quickly.




The true value of a measurement system is that it gives us a chance to discover in great detail just where we have been effective and where we can improve. We are excited and enthused to be able to contribute to the success of the Gemini Observatory, as we continue to strive to do better.




**SPECIAL AWARDS and RECOGNITION**

There are many outstanding employees at Gemini. It is our pleasure to recognize the valuable and meaningful achievements of our employees of the last several months.

**Brent Ellerbroek** was elected a fellow of the Optical Society of America in the fall of 2001, and in January, 2002, he became a topical editor for the Journal of the Optical Society of America.

**Virginia Smith** received her Masters Degree in Library Information Science from the University of Hawaii at Manoa in December 2001.

**Larry Stepp** recently received the AURA Technology and Innovation Award 2001.

**AURA Years of Service Awards**

The following employees have been recognized for their years of service:
**Gustavo Arriagada**, 15 years; **Chas Cavedoni**, 5 years; **Paul Gillett**, 10 years; **Kim Gillies**, 20 years; **Eric Hansen**, 10 years; **Steve Hardash**, 10 years; **Mark Hunten**, 5 years; **Jim Kennedy**, 15 years; **Ruth Kneale**, 10 years; **Pedro Ojeda**, 20 years; **Jennifer Purcell**, 5 years; **Mike Sheehan**, 10 years; **Wendy Shook**, 5 years; **Kent Tsutsui**, 5 years.

***Congratulations to all!***

STAFF PROFILE

# GEMINI SOUTH'S GUSTAVO ARRIAGADA

**Ed Kennedy**

Gustavo Arriagada is a man of many friends. This could be taken as a rather surprising statement, considering the fact that as Gemini South's Senior Systems Engineer, he is responsible for coordinating the systems and personnel that enable astronomers to do successful science. Such a job is susceptible to frayed nerves and angry ultimatums, and not particularly designed to make you the most popular guy on the block. So why is it, when you mention "Gus" (pronounced like "goose") to almost anyone who knows him, you always elicit a smile?

*Gustavo Arriagada, Senior Systems Engineer for Gemini South.*

"He's just a good man," says Claudia Sanhueza, an administrative assistant at Gemini South. With an easy going manner mixed with hardheaded engineering, Arriagada has managed to put his stamp on Gemini South. And if you talk to Arriagada's associates, you'll find he's achieved this with humor, patience and the ability to listen.

"Oh, I don't know about that," says Arriagada, 43, from his home in Coquimbo, Chile. "It's just that I enjoy talking to people." And then he laughs. "This listening thing is sort of a joke in my family," he says. "Wherever we go, I always seem to end up talking to strangers. And then my family has to wait around for me. They say I'm like a priest hearing 'confession.' By now they should be used to me, don't you think?" he laughs.

It's difficult to get Arriagada to talk about himself. But his friends are eager to discuss him. "He's one of the most professional men I know," says Gemini South Site Manager Diego Maltes, and his best friend. "And he never worries."

"He's also very good at trouble shooting," says John White, Electronics Technician at Gemini North. White worked closely with Arriagada when he came to Hawai'i in 1997 and became involved with commissioning Gemini North.

"Not only that," says Claudia Winge, a Gemini Science Fellow based in Chile. "He's easy to work with. Very focused and efficient." Winge first met Arriagada as a graduate student when he was working at Cerro Tololo Inter-American Observatory (CTIO) in the early 90's.

"What I like about him is the way he can always keep the level of stress down when we're on the mountain observing. If things begin to get tense, you can always count on Gustavo to step in and lighten the atmosphere with a joke and a smile. He's always calm.

"But what I'd really like to know," says Winge, "is how did he take that picture of that *vizcacha*?" Winge was referring to a photo of a native Chilean animal, similar to a rabbit, that hangs in the corridor of the observatory atop Cerro Pachón. It's a closeup shot of the shy little animal. Photography is one of Arriagada's passions.

"I don't know," replies Arriagada when asked about how he came to be such an artist with the camera (his favorite photographer is Ansel Adams). "Sometimes there is beauty where others don't see it. If I can capture this beauty, for me that's magic."

Arriagada has become so good at photography that his work has been featured in public exhibits, including one sponsored by the National Science Foundation in Washington D.C. Another of his interests is music. He enjoys music so much that he uses it as a metaphor for his job. "For me, what I do is like the director of an orchestra," he says with a flourish.

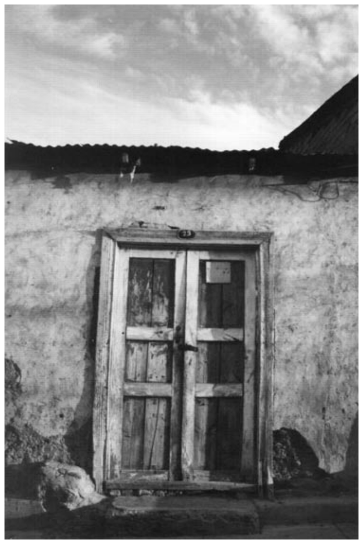
As Senior Systems Engineer, Arriagada is responsible for the coordination of all telescope systems and maintaining parity between both telescopes. His job involves a great deal of interaction, coordination, and trouble shooting with a variety of problems and personalities. So when things are running smoothly it's like music to his ears. But if he detects a sour note, then he jumps.

"He works much too hard," says Helena Vincke, administrative assistant for Maltes. "I'll tell you how dedicated he is," Maltes says. "One time on the weekend we had a heavy snow on the mountain and the call went out for a crew to come clear the roads. Gustavo, with so many worries as Senior Systems Engineer, was the first one to show up with a shovel. He didn't have to do that. He was just worried about the telescope."

Maltes and Arriagada work hand-in-hand to see that the telescope runs smoothly. "I handle days and he handles the nights," says Maltes. "Gustavo is always available 24 hours a day," he adds.

"He gets things done," says Vincke. "And I like the way he does it. When there is work to be done, and he wants to push things, he just jokes, and says, 'I'll bet you a *queque* (Chilean cake) you cannot get it done on time." And does he always win? "No," says Gemini Fellow Winge. "I think he's running about half and half."

"He's always thinking about food," laughs Maltes. It turns out food is another of Arriagada's passions. On weekends you can often find him cooking in the kitchen, trying out new recipes. "You ought to try his *empanadas*," says Maltes.



*"Portalandacollo2" by Gustavo Arriagada.*

"Gus is from what I like to call the CTIO School," says his friend and long-time associate Rolando Rogers. Rogers, Gemini Systems Manager, first encountered Arriagada at Cerro Tololo when Arriagada joined AURA in 1987. "We had good training there," says Rogers. "We learned it's good not to pay too much attention to what kind of work is asked of you, just pitch in and do it. Gustavo is a very smart guy," he adds. "He's very easy going, very technically prepared and he doesn't look for trouble. He's a nice person."

Arriagada demonstrated this type of attitude when Gemini brought him and his family to Hawai'i in 1997. "When I showed up, I found out the first thing they asked of me was to assemble all these benches in a warehouse by the airport. So I did my best."

"It turned out we had a good time with that," says Clayton Ah Hee, a Gemini North Optics Technician who worked with Arriagada in the warehouse. "Gus and his family came to my son's baby luau. He even brought his mother."

Arriagada had already had so much experience with telescopes, however, that soon he became involved with the Gemini Interlock System (GIS). By the time Gemini North was commissioned, he had informally become the engineer responsible for the GIS hardware. "That was a great time," he says of Hawai'i. "I'd like to go back."

But after the commissioning it was time for him to return to Chile. "And I was basically out of work," he says. He looked around for something to do. And with typical good cheer, ended up involved with Gemini South's Acquisition & Guidance System. "Then I started working pretty closely with Eric Hansen, the Systems Group Manager, in commissioning Gemini South."

"Gus stepped in and started directing traffic," says Hansen, who presently is also serving as Gemini Acting Chief Engineer. "He was pretty much our 'stoplight'," says Hansen. "He kept us out of gridlock. He's done an exceptional job." After the commissioning, Hansen moved on to Arizona and Arriagada was promoted to his present position.

"I really like my job because it gives me an opportunity to interact with everybody in the observatory," Arriagada says. "And I get to learn a little bit about all the systems."

In 1981, Arriagada graduated with an Electronics Field Engineer degree from the Universidad Tecnica Federico Santa Maria in Valparaiso. Within less than two weeks he was hired as an Electronics Engineer for "El Mercurio," one of Chile's largest newspapers.

In 1982 Arriagada was married to his wife, Ivonne. The couple have three children. Nineteen-year-old Ignacio, his oldest son, is attending Arriagada's alma mater studying to be a physicist. His daughter Pamela, 17, has always been at the top of her class (even when she was attending school in Hawai'i), and wants to become an astronomer. Gustavo Jr., 14, has aspirations of becoming an architect.

"Without the support of my wife Ivonne and my family, I would not be where I am now," he says. "They are my refuge when things go wrong. They are my energy when I'm tired and they are my happiness when I'm sad."

Arriagada was fairly content at "El Mercurio." ("I probably would have stayed if the money had been better.") But then one day a fellow employee showed him an advertisement which was about to run in the paper. It was for AURA. They were looking for electronics engineers. He applied. He was hired as an Assistant Electronics Engineer. "It was incredible," he says. "Everything was different there, starting with the coffee cups. I did everything you can imagine," he says. "Computers, telescope, systems, cameras, electronics, everything. It was a 24-hour job."

In 1997 Arriagada happened to see an e-mail which said a man named Jim Oschmann was coming to Cerro Tololo and was interested in talking to engineers who would like to work for Gemini. "I talked to him. It was nice. Two months later I was hired."

Since then he hasn't looked back.

STAFF PROFILE

# GEMINI NORTH'S CHRIS CARTER

**Ed Kennedy**

It's a quiet afternoon in the Gemini North Operations Center atop Mauna Kea, and Chris Carter is enjoying himself as he leans casually on the desk in front of the M2TS console.

Carter pays close attention to that M2TS console, which monitors the Secondary Mirror (M2) Tip/Tilt System. It's his baby. He's the Senior Control Engineer for Gemini North, and he's been baby-sitting the secondary mirror ever since he helped uncrate it back in 1998.

*Chris Carter, Senior Control Engineer for Gemini North, standing in front of Secondary Mirror.*

In a Cassegain optical system such as the Gemini Observatory, the M2, along with the SCS (Secondary Control System), is at the heart of Gemini's leading edge technology for Tip/Tilt control and infrared chopping. Both Gemini North and Gemini South are equipped with one of the most sophisticated Tip/Tilt and chopping systems of any observatory in the world. *(See related background story on Page 24)*

But being the leader in such technology hasn't necessarily come easy. The problem has been that nobody had ever dealt with a system this sophisticated before. After all, there are only two of these M2/SCS designs in existence – one on Mauna Kea and the other at Cerro Pachón. "I must say it was all quite interesting," Carter says with typical British understatement. "It was an enormous challenge to fully understand how that system interacts with the rest of the telescope," says Dr. Scott Fisher, a Research Fellow and specialist in Gemini's ground-breaking infrared capabilities.

Fortunately, Carter was in on it from the early stages. First, at the Royal Greenwich Observatory in Britain working on the MCS (Mount Control System), and later with the Gemini team in Hawai'i. "It was all new territory for us," says Carter. "When something came up, there was no one we could call to ask them how to fix it," he says. "We simply had to make it up as we went." But they managed.

Already Carter and the rest of Gemini North team have brought the chopping duty cycle performance to 87% for Gemini North. That's only 3% shy of the design maximum. But Carter says, "We're not done yet." "That's incredible progress," says one Gemini team member, evaluating Carter's performance to date. Carter, far more critical of his own achievements, is fully aware of the critical role the M2 hardware and the SCS plays in doing successful science on Mauna Kea. "This is where the rubber meets the road," he says – only half jokingly.

Presently at Gemini South, the engineering team is busy ironing out its own M2/SCS problems, especially with its chopping performance. And Carter has overall responsibility for these concerns. But because of experience the engineering team gained in integrating Gemini North's system, at least Gemini South is not working without a net. "At least they can call us," Carter laughs.

This day Carter is dressed in his usual workaday outfit: jeans, scruffy tennis shoes, pullover and the omnipresent hat pulled down over ponytailed hair. With a bow to the 4,000 meter chill at the observatory, he's traded his habitual baseball cap for a knitted stocking one that reads, "Mauna Kea Observatories - Simply the Best." And today he's in a good mood. No major problems with the SCS, the M2 performance is fine, and he's just come in from doing a little photography for an upcoming report. He enjoys photography. It's one of his favorite hobbies.

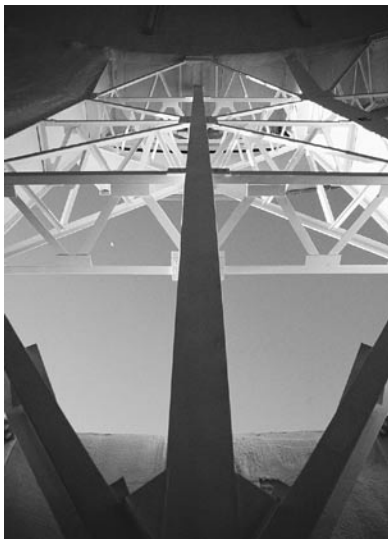
As he talks about his job, Carter gives the impression that he's a little surprised to be standing where he is. "This is a long way from Cornwall," says the British native. But people who know Carter say he's paid his dues. And through experience, education and sheer hard work, he's come to be a respected and valuable asset on the Gemini team. "I think his greatest asset is his unequivocal dedication to the job," says Fisher. "He's driven to do the job. And do it right. And to really push the limits of the system."

As Carter sips his tea ("You know us Brits") in the afternoon quietness of the Control Center and munches on a Pop Tart ("Great American cuisine"), he trades a few friendly barbs with Chas Cavedoni, the only other person in the spacious room. Between jokes, Cavedoni, Gemini North's Senior Mechanical Engineer, sits in a far corner, buried beneath a pile of blueprints.

As Carter contentedly eyes the M2TS console and jokes with Cavedoni, he's humming along with the upbeat, happy music that's filling the room. "That song is from Monsters Inc.," he explains. He likes that Disney movie. Another one of Carter's interests is animation (He has his own website on *Beauty and the Beast*). "It's gotten us through a few hairy moments up here," he laughs. From his corner, Cavedoni just snorts.

Now 37, Carter's life revolves around the SCS. "This is my life right now," he says. (Recently he was heard complaining about having to take a vacation). "I'd really like to see what this system could do. I like to push its limits." "Pushing limits" with something as sophisticated as Gemini's SCS comes naturally to him. "I guess it's in my blood," he says.

This is obvious once you get a look into his office back at Gemini North's headquarters at University Park next to the University of Hawaii campus in Hilo. His office is stuffed to overflowing with computers, cameras, disassembled electronic gear, things that tick and clack and hum, dog-eared books, toys, clothes and gear for the mountain, paper on every conceivable flat surface stacked inches high, reports and folders spread across the floor (what little you can see of it), more paper, printouts, files, pictures, boxes, and the hundred-and-one other pieces of paraphernalia characteristic of an educated man who works with both his head and his hands. In fact, his office is so stuffed, he usually has to go to some trouble just to find a place for a visitor to sit. "I'm a bachelor," he explains sheepishly.



*"Cathedral of the Stars" by Chris Carter.*

Sitting in the darkened little room, listening to him talk about his life, it's tempting to call Chris Carter The Hard Luck Kid. "I didn't do anything the right way," he laughs. It's tempting. But it isn't true. Because Carter is proof that sometimes the overall plan, the path, the destiny, may not look so hot at the moment. But you never know what might turn up. Tough turns have served him well.

Born in Exeter, a university town in southwest England, Carter spent most of his growing years in and around the counties of Devon and Cornwall. As a teenager he lived in the village of Budock Water, just outside Falmouth, where his mother still lives. Carter's "backward" entrance into the cutting edge of astronomy began upon graduation from secondary school back in 1980. For one thing, he had trouble with math.

"Well," he says, "I'd always been fascinated by electronics." He remembers building his own digital clock when he was about 14 years old. "It's still running, too," he says. "Mum's got it.

"My friends were all going off and getting jobs at British Telecom as electronics trainees. So of course, I applied, too. I failed miserably," he laughs.

This was his first piece of "bad luck" that ever so slightly turned Carter towards Hawai'i. Having nothing better to do, he decided to go back to school. Soon he was enrolled at Cornwall College in Camborne. "I didn't do real great, especially in math and physics," he said. "But I was hanging in there."

Then his second big turning occurred in the guise of a major traffic accident while headed home from classes on a motorbike one day in 1982. "That knocked me out of just about everything for a couple of years," he said. With a badly injured leg, he was forced to spend a lot time at home. "But the interesting part is that's when I first started to get really interested in computers. The first PC's were beginning to appear on the market. I didn't have much else to do, so I started playing with all this gear. Writing programs. Taking things apart."

By the time he had recovered, he already knew his way around a circuit board and computers. He was offered a job as a technician at an electronics firm. "I got a lot of 'hands on' training that still serves me well," he says, "but eventually I realized that job was going nowhere. I was at another dead end." Trying to find a way out, Carter took a long shot and asked permission of his employer to go back to school. To his surprise, everyone agreed. "This time I really took off," he said. "It was exciting. I realized I'd found what I really wanted to do."

By 1991, he'd earned an honors degree in Electrical and Electronic Engineering from the University of Plymouth. Then in 1993 he got his Masters in advanced control system theory from Imperial College in London. By 1995 he'd signed on at the Royal Greenwich Observatory as a junior engineer. "I thought I was going to the Canary Islands," he said. "Instead, they came to me one day and asked me if I'd like to work on this international project the RGO was participating in. I'd never heard of it. It was called Gemini." It turned out the RGO had the responsibility of helping develop the MCS for the proposed Gemini telescopes. Though the most junior engineer of the MCS team, Carter was in on it from the early stages of development. But in

1998, more bad luck. The RGO was in danger of losing its government funding. Carter's job suddenly was in jeopardy. And so he bailed. "I went to Gemini and asked if they needed someone like me to work full time. They hired me. They warned me I'd have to move to Hawai'i. I didn't see that as much of a hardship." And so Carter came to Hilo.

It happened that about the same time he arrived, Lockheed Martin was delivering its newest state-of-the-art M2TS to the Gemini team on Mauna Kea. Since control systems were his specialty, Carter was assigned to the team in charge of integrating this one-of-a-kind M2TS to the telescope. "We worked like the devil," he said. While learning, Carter gradually became the point man for the M2/SCS. "And so in spite of everything, here I am," he says happily. But he still seems a bit surprised that everything turned out so well.

Since the big humps are over for Gemini North, these days Carter is busy refining M2TS performance. Carter is currently working with the Software Group to implement a data logging system on Gemini North (a prototype is already running on Gemini South where it was developed). "The big idea is to allow us to monitor the many performance parameters of the system at a high rate and for relatively long periods of time," he says. "So we can see how the system is doing, and correct any problems in a quick and effective manner."

Other goals he's looking at are to increase the stability and accurateness of the telescope's chopping performance and to work closely with the software developers to improve its reliability and ease of use. "What we're really looking at is to increase the robustness of the overall system," he says. And why would he like to do this?

"Well," he says, "What I'd really like to see is Gemini to fundamentally out-perform any ground-based telescope in the world." And then, realizing the scope of what he has just said, he leans back, adjusts the brim of his ball cap, and breaks out into a self-conscious smile.

"Anyway," he says, "I'm glad I'm here."

COSMIC BACKGROUND

# STEERING STARLIGHT

**Chris Carter**

For a state-of-the-art ground-based telescope facility such as Gemini, a huge primary mirror is not everything – an equally significant contributor to the ability of the telescope to produce the highest quality scientific images is the far smaller secondary mirror, known as M2. M2 is 105 cm (41.3 inches) in diameter and made of Zerodur – a glass-ceramic which is highly temperature-stable.

M2 steers the light from the telescope's primary mirror, known as M1, back to the ultrasensitive detectors in Gemini's science instruments, all of which are located near the Cassegrain focus – just behind the central hole in the Primary Mirror. As a result, if M2 is even slightly out of position the quality of the science image degrades and potentially great data can become worthless. Maintaining the desired position of M2 to within tiny fractions of a degree – which requires positioning the mirror to accuracies of fractions of a micron for hour after hour during an observation – is the task of the Secondary Mirror Tip/Tilt System (M2TS).

Designed and built for Gemini by Lockheed Martin, the M2TS is a sophisticated mechanism that controls M2 by constantly adjusting the position of three supports attached to the back of the mirror. The positions of these mirror supports is precisely controlled by powerful digital microprocessors – they allow the mirror to be held at a desired position to better than a tenth of an arcsecond – and kept there as the telescope moves around the sky, is buffeted by wind, or repositioned for a new observation. (A tenth of an arcsecond is 1/36000 of one degree; there are 1,296,000 arcseconds in a full circle of 360 degrees).

Keeping the 55 kg secondary mirror precisely in place, yet able to be moved with incredible precision under all these circumstances, is a considerable technical challenge. A lighter mirror would help, and it was originally intended that M2 be made of silicon carbide, which would have made it approximately 18% lighter than at present. However, large SiC mirrors like M2 are challenging to manufacture, and after several attempts by the contractor, it was found to be too expensive and difficult to achieve at that time. Once it was decided to go with the easier-to-manufacture Zerodur mirror, ways had to be found to keep the mass as low as possible. This involved a procedure known as lightweighting – acid-etching and drilling out of excess material from the back, leaving just enough to keep the strength and stiffness needed, while lowering the overall mass and hence the inertia of the moving mirror. Lower inertia is beneficial – it means less force is required to control the mirror movements. This in turn means less power is needed. It also means that less vibration - generated as the mirror moves – gets coupled back into the telescope structure, which could subtly disturb the observations if allowed to get out of hand.

Fast computers, ultra-sensitive position sensors and electrical actuators that are a close cousin of the hi-fi loudspeaker are the key to keeping the mirror in place. The mirror control computers, mounted at the top end of the telescope, read the mirror position, calculate corrections and issue new demands to the actuators 3,800 times a second – that's once every 263 microseconds. Because the mirror can't keep itself in position without these commands, the control loops are never idle. They are running 24 hours a day, even when the telescope is not observing.

For the control engineer, the challenge is to make the system a reliable and accurate performer. We want to consistently exceed the performance requirements. In other words, we want to accurately maintain the position of the mirror while not being badly affected by things like wind, telescope motion and other influences. This means we must have a robust and stable system.

The Gemini telescopes are intended to make outstanding observations in the infrared part of the electromagnetic spectrum – invisible to our eyes but sensed by us as heat. In order to make measurements of incredibly distant objects in the infrared, we need to employ another feature of the M2TS – its ability to "chop." Chopping is the capability of the system to rapidly move M2 from one position to another and back again. This is like looking to the left and then the right, back and forth several times every second. It allows the telescope to switch very quickly between looking at one part of the sky and then another. Chopping is far quicker than repointing the massive telescope to a different location, but the two regions of the sky it looks at in this mode are very close together, separated by only a few tens or hundreds of arcseconds.

Chopping with M2 allows an infrared-sensitive science instrument to "subtract out" the heat radiation that exists all over the sky, and see only the difference between the tiny patch of sky containing your science target (the star) and a nearby patch with no star. The difference left is the incredibly faint infrared signature of the object – just what scientists want to collect as data.

This technique is common on infrared-capable telescopes. It is used on Keck, for example. But Gemini employs a second-generation chopping system that is capable of greater accuracy in its positioning of the mirror, faster chop rates (up to ten times a second) and more flexibility in how it can be used with different instruments. All these capabilities help make the Gemini system a strong contender to lead the ground-based infrared observing field – especially in the Southern Hemisphere where such capability is currently nonexistent on 8-meter telescopes.

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## *GMOS IFU story Continued from Page 10*

The lenslets, subtending 0.2", transfer the light to optical fibers which reformat the image into two, one-dimensional slits at the entrance of the spectrograph. One lenslet array covers a contiguous area of 5"x7" while the second array has half that field. The result is that up to 1500 spectra are collected simultaneouly on the GMOS CCD mosaic.

Once extracted using tasks soon to be released in the Gemini iraf package, the spectra form a "datacube" with two spatial dimensions and one spectral dimension. Spectral features can then be mapped at the highest spatial resolutions that Gemini can deliver. An additional advantage to full area coverage is the high spectral resolution of a narrow slit (0.3" effective width) without the associated loss of the light outside the slit.

Commissioning of GMOS IFU for Gemini North began in September, 2001. In all tests the performance of the IFU has met or exceeded expectations. Currently only three of the 1500 spectra cannot be extracted, but two of these may be recoverable with more sophisticated techniques. The profiles of the spectra are narrower than expected, making the spectra easier to distinguish. Also, the throughput of the IFU alone has been measured on the telescope to be between 60% and 65%, in agreement with theoretical expectations and laboratory measurements.

The power of the IFU is demonstrated by commissioning observations of the active galaxy NGC 1068 *(See Figure 1 on Page 10)*. The reconstructed image has 0.4" image quality, showing that the IFU can deliver the same high image quality as direct imaging. The spectra reveal high velocity gas that is believed to be accelerated and shocked by jets emitted from a supermassive black hole. Part of the approaching bowshock may be accelerating material back down into the plane of the galaxy, producing a redshifted velocity component. The picture is consistent with recently published results by Gerald Cecil and collaborators who used the Hubble Space Telescope.

Gemini is grateful to the Astronomical Instrumentation Group at the University of Durham (UK), especially Jeremy Allington-Smith, Robert Content, and Graham Murray, who designed and constructed the IFU.

TRIBUTE

# BOB SCHOMMER

## Nicholas Suntzeff

*It is with deep sorrow that we publish this tribute to the late Dr. Robert Schommer. Dr. Nicholas Suntzeff was a close personal friend and colleague.*

Dr. Robert A. Schommer, 55, Project Scientist for the United States Gemini Project Office and an Astronomer/Tenure at Cerro Tololo Inter-American Observatory and National Optical Astronomy Observatory, died in La Serena, Chile, on December 12, 2001. Bob was born in Chicago on December 9, 1946.

*Bob Schommer, circa 1981.*

Bob was an internationally recognized observational cosmologist with unusually wide-ranging interests. He was widely regarded as an authority in the field of resolved stellar populations and in the kinematics of the local universe. His work on the star clusters in the Magellanic Clouds and M33 forms a basis for our understanding of the formation histories, both chemical and dynamical, of these galaxies.

His early work with Aaronson and Olszewski on the distance to the Large Magellanic Cloud which is perhaps still the key step in the measurement of the Hubble constant, clearly set the stage for debate which rages on today, on the different distance scales as measured by the old and younger populations. He did fundamental work on clusters of galaxies and their use in establishing the distance scale, especially in the application of the Tully-Fisher relationship and its sensitivity to the detailed properties of the spiral galaxy population.

To advance the application of the T-F method independent of the declination limits of the Arecibo telescope, Ted Williams and Bob while still at Rutgers, built a Fabret-Perot imager which was used for many years at the Cerro Tololo Inter-American Observatory (CTIO) to measure galaxy rotation curves. Finally, he was also a pioneer in the study of dark matter in dwarf galaxies.

Over the last six years, Bob was an active member of the High-Z Supernovae Search Team, which announced in 1998 the discovery of an acceleration in the local universe. His knowledge of the properties of galaxies and precision photometry greatly helped the team find and limit systematics of this result. In honor of this work, he was awarded the AURA Science Achievement Award in 1999.

In his last year at CTIO, Bob took over the management of the U.S. Gemini Project Office as Project Scientist. Bob was an advocate for a strong national observatory which would allow all U.S. astronomers access to world-class, ground-based facilities. At the time of his death he was in the process of moving his operation to Tucson, to establish a U.S. Gemini Science Center and a remote observing facility.

In writing these words, I realize what a void has been left with his death. He has been a professional colleague of mine for over 20 years, and more importantly, a very close personal friend. He was an outstanding scientist and a very honest and moral person. As one colleague wrote of Bob, "There are few individuals ... who better personify the combination of internationally recognized research, unselfish service to NOAO and its user community, and professional leadership that defines the ideal in what one seeks in a staff member of a national observatory."

Bob received his BA in Physics at the University of Chicago in 1970, an M.S. in Physics at the University of Washington in 1972, and a PhD in Astronomy at the University of Washington in 1977. Prior to his position at NOAO, Bob had held postdoctoral positions at Caltech (Chaim Weizmann Fellow), the Hale Observatories, the University of Chicago, and the Institute for Astronomy in Cambridge, England (NATO Postdoctoral Fellow). From there he went to the Department of Physics at Rutgers University where he advanced to Professor of Physics. In 1990, he joined the NOAO staff as an Associate Astronomer at where he advanced to Astronomer/Tenure.

He is survived by his wife Iris Labra and his children Paulina, Andrea, and Robert.

**Schommer Education Fund**

AURA/NOAO/CTIO has suggested a fitting memorial to Bob Schommer is a fund to ensure his three children will be able to have the education Bob would have wanted for them. Please send your contributions to:

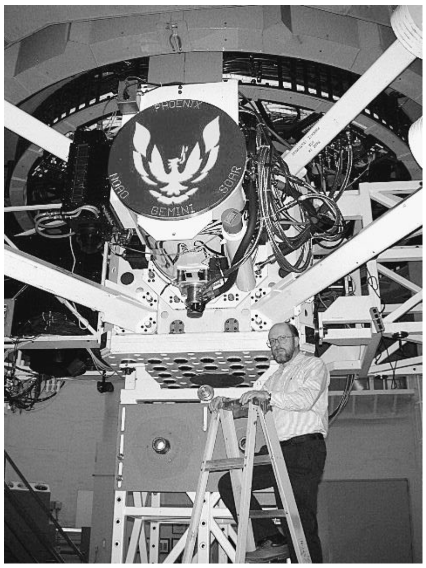
*Schommer Children's Fund*
*c/o Wendy S. Goffe, Esq.*
*Graham & Dunn P.C.*
*1420 Fifth Avenue, 33rd Floor*
*Seattle, WA 98101*

# UNITED STATES

Taft Armandroff

The U.S. Gemini Program (USGP) has experienced a strong community response to the Gemini call for 2002B proposals and is moving along with the development of several important instruments.

There was a total of 103 U.S. Gemini proposals for 2002B. On Gemini North, 57 proposals were received. These were 36 for GMOS and 22 for NIRI. There were 46 U.S. proposals requesting Gemini South. These break down into 21 for Phoenix, 18 for T-ReCS, 6 for Flamingos, and 4 for the Acquisition Camera U.S. Gemini proposals sought 181 nights on the two Gemini telescopes. The resulting oversubscription factors were 3.0 for Gemini North and 4.0 for Gemini South. The discrepency in totals is due to requests for more than one instrument in certain proposals.




*Phoenix mounted to Gemini South, with Ken Hinkle standing on ladder under the telescope. The four "legs" are balance weights, required to bring the mass and center of gravity to within the Gemini specifications.*

**The following is an update on instrumentation:**

• NOAO's high-resolution infrared spectrograph Phoenix was installed November 28, 2001 on Gemini South. The nights of December 15 -23 were assigned for Phoenix commissioning. Several Gemini scientific staff, plus Ken Hinkle, Nicole van der Bliek, Bob Blum, and Patrice Bouchet from the USGP scientific staff participated in the commissioning. The commissioning time was divided between tests related to the use of the instrument with the telescope, such as alignment, acquisition and guiding, and measurements of the instrument's sensitivity.

Phoenix was the most requested instrument at Gemini South in 2002A. The first scientific observing block for Phoenix took place February 1-15. USGP staff participated in the service observing on every night of the block. A number of approved programs and the demonstration science program "Determining the Oxygen-to-Iron Abundance Ratio in the Large Magellanic Cloud" were executed.

Another Phoenix block was sceduled for May, again with USGP support. An exposure time calculator for Phoenix, an FAQ page, a list of available order sorting filters and other documentation are provided at: *www.noao.edu/usgp/phoenix/phoenix.html*.

• NOAO has been selected as one of two teams to develop a conceptual design for the Gemini South Adaptive Optics Imager (GSAOI). The instrument is to be designed for use with the multi-conjugate adaptive optics (MCAO) system being built by Gemini for use on the southern 8-m telescope. A review committee convened by Gemini Observatory has evaluated the proposals from NOAO and other groups.

The imager will cover wavelengths between 1 and 2.5 microns, and will be based on a 4K x 4K HgCdTe mosaic. This is sufficient to cover the well-corrected field of view of the MCAO system (about 80 x 80 arcsec) with a pixel scale matched to diffraction-limited images.

The two teams, from NOAO and the Australian National University will complete their respective studies in August, at which point Gemini expects to select one of the teams to complete the instrument. Jay Elias and Bob Blum lead the NOAO GSAOI Scientific Team. Neil Gaughan is serving as Project Manager. Technical personnel from Tucson and La Serena are also participating in the GSAOI effort.

• T-ReCS, the Thermal Region Camera and Spectrograph, is a mid-infrared imager and spectrograph for the Gemini South telescope, under construction at the University of Florida by Charlie Telesco and his team. T-ReCS has been completely assembled and tested. The team has been performing a series of flexure tests interspersed with mechanical enhancements in order to meet the stringent flexure requirements for this instrument. A program of minor electronics upgrades to minimize noise, in parallel with detector optimization, is also in progress. The team is working hard to complete these two efforts, which will then allow T-ReCS to undergo its Pre-Ship Acceptance Test.

• The Gemini Near-Infrared Spectrograph (GNIRS) is a long-slit spectrograph for the Gemini South telescope that will operate from 1 to 5 microns and will offer two plate scales and a range of dispersions. The project is being carried out at NOAO in Tucson under the leadership of Project Scientist Jay Elias and Project Manager Neil Gaughan.

*NOAO Senior Engineer Gary Muller is shown with the fully assembled GNIRS bulkheads and dewar shells, which were delivered to NOAO in December, 2001.*

Cold mechanism testing is under way, as are optical subsystem tests. The GNIRS bulkheads, dewar shells, and related parts have been completed and assembled for a fit check *(See photo)*. Warm imaging tests with the assembled instrument are expected to be under way soon. Overall, 90% of the work to delivery has been completed. The GNIRS Team plans delivery for autumn of 2002.

• The Near Infrared Coronagraphic Imager (NICI) will provide a 1-5 micron dual-beam coronagraphic imaging capability on the Gemini South telescope. NICI is being built by Mauna Kea Infrared in Hilo, under the leadership of Doug Toomey. The NICI team has made good progress in the areas of optical design, mechanical design, electronics design, systems engineering and software. The NICI Team passed its Preliminary Design Review in Hilo on April 2-3.

In other news, the U.S. Gemini Scientific Advisory Committee discussed the current state of Gemini observing capabilities at a meeting held at Carnegie Observatories on March 22-23. Gemini Board member Gus Oemler hosted the meeting.

A discussion was also held concerning how the priorities of the U.S. Gemini community should be enunciated at the Gemini Science Committee meeting held in Vancouver on April 8-9.

One final personal note. I became Acting Head of the U.S. Gemini Program in late December, following the death of Bob Schommer. *(See Page 26)* Please feel encouraged to contact me (tarmandroff@noao.edu) with your questions, comments, and suggestions on U.S. Gemini issues.

## Alencar new U.S. Gemini Fellow

**Sylvia Alencar**, a post-doctoral Research Fellow at the Universidad de Sao Paulo, Brazil, has been named the 2002-2003 recipient of the U.S. Gemini Fellowship.

Alencar, 29, will use her Fellowship to study at the Harvard-Smithsonian Center for Astrophysics, where she intends to do research on the formation and early evolution of solar-type stars via studies of T Tauri stars. Alencar plans to use Gemini Observatory in her research.

U.S. Gemini Fellowships provide students and educators from Argentina, Brazil and Chile the opportunity to study, conduct independent research, work and teach in their choice of U.S. universities and similar research institutions.

The U.S. Gemini Fellowship program is conducted in partnership with USGP and the Association of Universities for Research in Astronomy (AURA), with funding from the National Science Foundation. It provides research support for up to two years.

She says of her studies: “I’ve been working on stellar formation and evolution since college. I initially studied eclipsing binary systems in order to determine absolute parameters and test evolutionary models. In the beginning of my PhD I worked on stellar atmosphere models and later on T Tauri stars.”

“Nowadays I am a postdoc at the Astronomy Department of the University of Sao Paulo working on star formation with Professor Jane Gregorio-Hetem. I keep collaborations with my former advisors, Luiz Paulo Vaz at Belo Horizonte (Brazil) and Gibor Basri at Berkeley (U.S.). I am currently also working on various projects related to the variability of young stellar objects with Dr. Celso Batalha from the National Observatory in Rio de Janeiro and Drs. Jerome Bouvier and Catherine Dougados from the Grenoble Observatory (France).”

Born in Belo Horizonte, Brazil, she obtained a BS in physics, and her master’s and PhD in astrophysics from the Universidade Federal de Minas Gerais. She is fluent in Portuguese, English and French, and is interested in music, art, film and literature.

# UNITED KINGDOM

**Pat Roche**

This year will see the completion of almost all the current United Kingdom contributions to Gemini instrumentation, representing an enormous amount of hard work and determination by many dedicated scientists, engineers and technicians. The fruits of this endeavor will be in the form of scientific results obtained by astronomers throughout the Gemini community over the coming years. But for now, here is an update on progress on the UK contribution to instrumentation.

Now that GMOS-N, the optical multi-object spectrograph, is fully commissioned and producing excellent scientific data in Hawai'i, the GMOS team is focused on the second GMOS now being integrated in Edinburgh before being shipped to Chile later this year. The GMOS instruments have been built in a collaboration between the UK and Canada.

The demand for observations with GMOS-N has remained very high for the 2002B semester, with applications for observations with GMOS accounting for over half the total UK time requested. We expect this to increase further next semester when both GMOS instruments should be available.

At University College London, the HROS modules for the R=150,000 bench spectrograph are being assembled on the optical bench. Depending on when the CCD head is received in London, the first test data with the full spectrograph should be collected before this summer. The design of the fiber pick-off from the GMOS focal plane is being finalized, and delivery of the entire instrument to Chile is expected before the end of the year.

The first polarization modulator unit, GPOL, has been installed in the Gemini North A&G and was ready for commissioning with NIRI in early May. The second GPOL will be shipped to Chile later this year. GPOL units for both Gemini telescopes were built by the ATC, Edinburgh, and the University of Hertfordshire, and will house optical and near-infrared half-wave plates together with calibration polarizers to allow high precision linear polarization measurements on the upward-looking instrument ports. Initial commissioning will be conducted with NIRI, which already has a Wollaston prism analyzer installed. Optical polarization measurement will be conducted with GMOS, once the large magnesium fluoride Wollaston prism is included in the filter wheel.

Michelle, the mid-infrared imager-spectrometer built in Edinburgh, which will be shared between UKIRT and Gemini North, has been in use at UKIRT for the last six months. Despite rather poor weather on Mauna Kea over much of the winter, it has conducted a large number of innovative science programs. Michelle will be transferred to Gemini around the end of Quarter 3 2002, where it will be available for approximately one year before returning to UKIRT.

Michelle's detector array will be upgraded with a higher quality device that will have fewer cosmetic defects and probably slightly higher quantum efficiency. Already Michelle has proved to be reliable at UKIRT with a sensitivity that is close to the predictions of the integration time calculator.

The large sensitivity increase offered for mid-infrared observations of compact objects on Gemini opens up many new areas of astronomy.

The final UK component of Gemini instrumentation is the image-slicer Integral Field Unit for GNIRS under construction at Durham University. The IFU module is currently under construction, and will be integrated into the instrument at NOAO before it is shipped to Gemini.

UK astronomers are now starting to receive piles of CDs containing Gemini data regularly, and the next challenge is to ensure that they are able to reduce the data efficiently. We eagerly await the fully operational Gemini Observatory with facility instruments on both telescopes, and the data flow that will follow.

We expect that the UK will join ESO in the middle of 2002, gaining access to the VLT the following year. This presents new opportunities for UK astronomers to develop projects using the Gemini and ESO 8-meter telescopes, but also new challenges in ensuring that projects are conducted on the most suitable facility.

# CANADA

## Dennis Crabtree

The Gemini Science Archive (GSA) has come one step closer to becoming an effective community resource following a successful Conceptual Design Review teleconference hosted by the Canadian Astronomy Data Centre (CADC) at Herzberg Institute of Astrophysics in Victoria on Nov. 1-2, 2001.

The review committee not only looked at the Conceptual Design but also evaluated the CADC's Phase II Proposal for developing and operating the GSA. The format of the review was an experiment whereby the majority of the reviewers participated via video conferencing.

The review committee made several recommendations motivated by the desire for the GSA to be up and running in its most basic form as soon as possible. The advanced capabilities identified at the GSA workshop will be re-evaluated once a basic archive is available. The review committee report is available at *www.hia.nrc.ca/pub/Gemini_HIA/GSA/CoDR/GSArev_report.pdf*.

In response to the November GSA review, the CADC released a set of documents on March 13, 2002. These include a GSA response to the review, an updated Conceptual Design document incorporating recommended changes, and a significantly revised Phase II Proposal document. All these documents are available by following the appropriate links at *www.hia.nrc.ca/pub/Gemini_HIA/GSA/*.

The CADC also announced the appointment of David Bohlender as the GSA Project Scientist for the Phase II work.

Review committee members and the GSA team participated in the successful teleconference meeting over the two-day period from three widely divergent locations: Victoria, Canada; Hilo, Hawaii; and La Serena, Chile.

The Gemini review committee consisted of Jean-René Roy and Colin Aspin in Victoria; Inger Jørgensen, Jacques Peysson and Doug Simons in Hilo; and Phil Puxley in La Serena. The external reviewer was Remo Tilanus from the Joint Astronomy Center in Hilo.

The GSA team, consisting of CADC members participating from HIA in Victoria, were Severin Gaudet, Norman Hill, David Schade, David Bohlender, Daniel Durand and Patrick Dowler. Felipe Barrientos, a representative from CONICYT, also participated from La Serena.

This effectively concludes the Gemini Science Archive Conceptual Design Study Work Scope No. 9414257-GEM02012. Congratulations to all who participated in this project including those from the CADC, from CONICYT and from Gemini. The CADC now looks forward to Phase II and to the day the Gemini Science Archive is available to the community.

As for instrumentation, Altair, the facility adaptive optics system for Gemini North, will be shipped to the Hilo base facility this summer. Science verification is planned to start in September. Altair is on schedule and the team in Victoria is very busy ensuring that the system is fully operational upon arrival in Hawai'i.

We can all look forward to hearing about the successful commissioning of Altair, complete with a picture or two, in the December 2002 Gemini Newsletter.

# AUSTRALIA

## Warrick Couch

Gemini activity is moving ahead in Australia with construction progressing well on our first Australian-built Gemini instrument and a strong proposal response from the country's astronomy community.

As for proposals, although the numbers remained steady compared to last semester, demand for time has increased significantly. This upturn was particularly obvious for Gemini South. Total hours requested were 93 hours for Gemini North and 58 hours for Gemini South. This represents an oversubscription factor of 2.6 and 2.8, respectively.

On Gemini North, there continues to be a strong demand for GMOS, with eight of the 11 proposals requesting time on this instrument.

The Flamingos-1 instrument on Gemini South is also particularly popular, although there were also requests for AcqCam, T-ReCS and Phoenix. Half of the proposals involve multi-partner collaborations with proposed projects going to two or more of the NTACs across the Gemini partnership.

Australia's first instrument for Gemini is the Near-infrared Integral-Field Spectrograph (NIFS), which is being built by the Research School of Astronomy and Astrophysics (RSAA) at the Australian National University. With the detailed design of all its mechanisms complete, construction is now under way.

The grating turret has now been completed, assembled and operated using the Instrument Control System. The on-instrument wave-front sensor's filter/aperture wheel and gimbal mechanism, which was manufactured by the University of Hawaii, has already been delivered to Mount Stromlo Observatory. Also, the focal plane mask wheel is nearing completion. All these mechanisms were to be tested cold in the cryostat in late May. Delivery of the finished metal mirror optics was also expected at that time as well.

The HAWAII-2 detector's bare MUX has also been operated successfully at room temperature, under the control of the RSAA's CICADA software. The CICADA software will be ported to the Gemini EPICS environment after initial testing.

The RSAA team, headed by Peter MacGregor, is also working on one of the two Concept Design Studies commissioned by Gemini for the Gemini South Adaptive Optics Imager. Proposal review and selection will take place in Hilo in August.

Finally, Dr. Matthew Whiting from Melbourne University has just returned from Chile after a very rewarding and enjoyable three-month period spent at Gemini South assisting with instrument commissioning and the Quick Start Science programs. Dr. Whiting took up a postdoctoral position at the University of New South Wales this April, where some of his time will be spent in a support capacity in the National Office, particularly in imparting the experience and knowledge he gained while in Chile.

# ARGENTINA

**Nidia Morrell**

As a result of the 2002B semester call for proposals, the Argentine Gemini Office has received 10 requests for observing time with the Gemini telescopes.

These proposals include five each for Gemini North and South.

The Gemini North proposals are two for GMOS and three for NIRI.The Gemini South proposals are four for Flamingos and one for Phoenix.

The total requested time is 39.32 hours. This amount of requested time represents an oversubscription factor of 1.35 for the upcoming semester.

Guillermo Bosch, a member of the Argentinian NGO, has agreed to take a further responsibility serving as our Public Information and Outreach (PIO) contact person.

Serving in his new capacity, he joined a very fruitful PIO liaison meeting in La Serena, Chile, where participants were able to benefit by exchanging ideas and perspectives with other PIO staff members from various participating Gemini countries. The meeting included admiring a beautiful sunset atop Cerro Pachón.

# BRAZIL

**Albert Bruch**

To accommodate the Brazilian astronomical community's continuing need for wide-range spectral coverage, astronomers here are currently undertaking the first steps towards the construction of a "low" resolution module for the Gemini bHROS (benchmounted High Resolution Optical Spectrograph).

Whereas the original HROS was designed for a resolution of R=50,000, the bHROS has a much higher resolution of about R=150,000. Obviously, the higher resolution will also reduce bHROS' spectral range.

The scientific projects of many Brazilian astronomers, however, still require the larger spectral coverage of the original design. In order to alleviate this problem, a consortium of Brazilian institutions has initiated studies to build a camera for the bHROS which will approximately meet the original HROS spectral range specifications.

As a first step towards this goal, an optical design study has been initiated. These efforts are being funded by the Brazilian Ministry of Science and Technology. The funding comes under the auspices of an "Instituto de Millênio," which is aimed at strengthening Brazilian astronomical research utilizing large telescopes. Funding for the actual construction of the camera is still being sought.

In other news, the most recent Call for Proposals for semester 2002B resulted in considerably fewer applications than was expected. The number of proposals was only half of what it was last semester.

Currently the Brazilian NGO is investigating the possible reasons behind the drop in requests so that appropriate action may be taken to address this slowdown.

# CHILE

**Luis Campusano & Sebastian Lópes**

The big news from Chile this past semester was of course the dedication of the Gemini South Telescope on January 18, 2002, which was attended by Chilean President Ricardo Lagos.

President Lagos emphasized the important role of a "small country" such as Chile in such a major scientific undertaking as the Gemini Observatory. President Lagos also pointed out to the gathering that Gemini is the only astrophysical observatory located in Chile in which our country is a partner. *(See stories on Pages 1 - 6)*

Another notable event this past semester is that the first paper based on Gemini data obtained during Chilean time has been submitted to the *Astrophysical Journal* by Courbin et al. (astro-ph/0202026). This is encouraging given the still-small number of Chilean programs that have been completed.

For the 2002A semester, Chilean astronomers applied for a total of 92 hours of Gemini South time. This amount of time is a factor of 1.5 higher than the allocation assigned to the Chilean astronomy community.

The Chilean TAC approved five Flamingos and one Phoenix proposal. A similar oversubscription of requests for time is expected for the 2002B semester.

Also new, the web site for the Chilean project office has recently been renewed and is now more focused on the local proposal submission process *(See: www.conicyt.cl/Gemini)*.

In personnel news, our Executive Assistant, Jane Shuttleworth, left CONICYT in December. Maria Elena Diaz has joined the Gemini team as her replacement and is now our new Executive Secretary.

The Chilean office, in collaboration with the University of Chile Astronomy Department and Gemini Observatory, made possible the stay of Sebastian López at the La Serena Base Facility and Cerro Pachón during November, 2001, to help out with the preparation and execution of OSCIR observations.

*The first of two major winter storms this year brought snow down to the 8,000 foot level on Mauna Kea.* ***Photo by Kirk Pu'uohau-Pummill***


## Early Science Images from Gemini South

The infrared images above show a sample of the science images that were obtained in late 2001 during commissioning of Gemini South. From star-forming regions, to the cores of active galaxies, Gemini South has already begun helping scientists to explore the universe in unprecedented detail.

All of the images above are infrared observations obtained with either the University of Florida's "Flamingos-I" near-infrared imager/spectrograph (images 1&5) or "Abu", a thermal-infrared camera built by the National Optical Astronomy Observatory (images 2, 3, 4). Following are details on each image:

1) NGC 6357 - Star forming region in Scorpius, Nidia Morrell P.I. (UNLP-CONICET/Argentina). Made from J,H and K-short band images with a mean image quality of 0.56 arcsec. (FWHM)
2) NGC 6369 - Planetary nebula produced by a star that was once like our Sun. Made from J, H2 and K band images K-band image has an image quality of 0.35 arcsec. (FWHM)
3) NGC 1097 - A Seyfert galaxy revealing its bright and active nucleus. Made from a J-band image with a FWHM of 0.5 arcsec.
4) Galactic Center - The center of our Milky Way Galaxy showing emission from hot gas that will either form stars or feed the supermassive black hole at the center of our galaxy. The image quality for this Brackett-alpha (hydrogen) line image is 0.35 arcsec. (FWHM)
5) NS14 - A bi-polar nebula at a distance of 7,500 light years. The nebula is excited by four stars in the center and a dense dust lane or torus bisects the nebula. This color composite J, H, K-short band image has a mean image quality of 0.41 arcsec.

# GEMINI OBSERVATORY NEWSLETTER

*THE GEMINI OBSERVATORY*
*is an international partnership managed by the*
*Association of Universities for Research in Astronomy*
*under a cooperative agreement with the National Science Foundation.*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*Background photo: Gemini North with Leonid meteor (right), Nov. 2002 Photo by: Kirk Pu'uohau-Pummill and Peter Michaud*

*Gemini South Base Facility construction late April, 2002. Photo by: Antonieta Garcia*

*On the cover: Close-up of region near the Trapezium in Orion. Gemini Observatory / University of Florida - Flamingos-1 / Phil Lucas, P.I., United Kingdom. Inset top: Dr. Rita Colwell, Director NSF , Gemini South dedication. Inset bottom: Chilean President Sr. Ricardo Lagos (left), Matt Mountain (center), and Gabriel Perez (right) at dedication. Photos by Kirk Pu'uohau-Pummill*