NOAO**GEMINI**SCIENCE**CENTER**

TUCSON, ARIZONA • LA SERENA, CHILE

Gemini Observing Opportunities for Semester 2004A

Taft Armandroff

The NOAO Gemini Science Center (NGSC) invites and encourages the US community to submit proposals for Gemini observing opportunities during semester 2004A. Gemini observing proposals are submitted and evaluated via the standard NOAO proposal form and Telescope Allocation Committee (TAC) process. Although the Gemini Call for Proposals for 2004A will not be released until September 1 for the US proposal deadline of September 30, the following are our expectations of what will be offered in semester 2004A. Please watch the NGSC Web page (*www.noao.edu/usgp*) for the Call for Proposals for Gemini observing; this will unambiguously establish the capabilities that one can request. Several important new instrumental capabilities are expected to be offered in semester 2004A, as described below.

Gemini North

- The GMOS-North optical multi-object spectrograph and imager will be offered in 2004A. Multi-object spectroscopy (optionally with nod-and-shuffle mode), long-slit spectroscopy, integral-field unit (IFU) spectroscopy, and imaging modes will be available.
- The NIRI infrared imager/spectrometer will be offered in 2004A. Both imaging mode and grism spectroscopy mode will be available.
- GMOS-North and NIRI will be offered in both Queue and Classical modes. It is expected that Classical will only be offered to programs lasting three nights or longer (see the 2004A Call for Proposals).
- Michelle is a mid-infrared (8–25 micron) imager and spectrograph for shared use between Gemini and the United Kingdom Infra-Red Telescope (UKIRT). Observing modes include direct imaging and long-slit spectroscopy with spectral resolutions of approximately 200, 1000, and 30,000. Michelle was delivered to Gemini Observatory in late 2002. A period of characterization and commissioning of Michelle is presently underway, after which Michelle is expected to be available for scientific use. As of late July, we believe that the imaging mode of Michelle, and possibly the low-resolution spectroscopy modes, will be included in the 2004A Gemini Call for Proposals.
- The Altair adaptive optics (AO) system is undergoing commissioning in its natural guide-star mode. During 2004A, it is expected that Altair will be offered for scientific observations. As of late July, the AO-enhanced infrared imaging mode of Altair using NIRI is expected to be offered in 2004A.

Gemini South

- The Phoenix infrared high-resolution spectrograph will be offered in 2004A.
- The GMOS-South optical multi-object spectrograph and imager will be offered during 2004A. GMOS-South Commissioning and System Verification have been proceeding successfully during semester 2003A. The imaging, long-slit spectroscopy, multi-object spectroscopy, and nod-and-shuffle modes of GMOS-South are expected to be offered in 2004A. GMOS-South will be offered in both Queue and Classical modes. It is expected that Classical will only be offered to programs running three nights or longer (see the 2004A Call for Proposals).
- The T-ReCS mid-infrared imager and spectrometer will be available in semester 2004A. In April 2003, the University of Florida delivered T-ReCS to Gemini South, and first light was achieved on June 2. The imaging mode will definitely be offered in 2004A; please check the Gemini Call for Proposals regarding the availability of T-ReCS spectroscopic modes in 2004A.
- The Acquisition Camera will be available for Quick Response in 2004A.

Detailed information on all of the above instrumental capabilities is available at: *www.us-gemini.noao.edu/sciops/instruments/instrumentIndex.html.*

The percentage of time devoted to observations for science programs is planned to be 70 percent for semester 2004A, both at Gemini North and South. This percentage is up from the 55 percent (Gemini North) and 60 percent (Gemini South) planned for 2003B.

We remind the community that US Gemini proposals can be submitted jointly with collaborators in another Gemini partner; a collaboration simply submits proposals in each relevant partner country, explicitly noting how much time is requested from each Gemini partner. Such multipartner proposals are encouraged because they access a larger fraction of the available Gemini time, thus encouraging larger programs that are likely to have substantial scientific impact. In order to facilitate multipartner proposals, the United States accepts Gemini proposals both with the standard NOAO proposal form and with the Gemini Phase I Tool (PIT).

T-ReCS at Gemini South: First Light and Beyond

Charles M. Telesco, University of Florida

To an astronomy instrument builder, there are few things more exciting than the arrival of the completed instrument at the observatory, and the sight of it attached to the telescope and ready for observations. That excitement is exceeded only by the thrill of seeing the first on-sky images on the acquisition monitor. Starting in April 2003, the University of Florida's Thermal Region Camera and Spectrograph (T-ReCS) development team, working closely with the Gemini Observatory staff, experienced a crescendo of activity and excitement that culminated in our acquiring the first on-telescope/on-sky images and performance numbers. I would like to share briefly my view of some of the early commissioning activities and progress as we approach full science operations.

After extensive acceptance testing at the University of Florida in November 2002 and February 2003, T-ReCS was shipped to Cerro Pachón in April 2003. Lab testing at Gemini South during May then verified pre-ship performance. Finally, at 9:00 P.M. on June 2, T-ReCS made 8.8-micron images of the star γ Cru, thus achieving first light. Although the seeing was unsteady that night (typically about 0.7 arcsec), we could often see diffraction rings in the stellar images. Since then, we have continued to characterize T-ReCS on the telescope and worked to integrate it into the full observatory control system. Since T-ReCS is the first facility instrument to use the full-up chopping secondary-mirror system at Gemini South (our instrument OSCIR was used as a test bed to support Gemini's initial use and shakedown of the chopper in both the north and south), special care must also be taken to implement and test in final form all telescope-system observational modes needed by T-ReCS. I'm pleased to note that this arduous process, which requires close and continuous cooperation between T-ReCS and Gemini personnel, is moving ahead well.

T-ReCS is first and foremost an imager. It uses the Raytheon 320×240-pixel arsenic-doped silicon blocked-impurity-band detector, with peak sensitivity in the 8- to 25-micron wavelength range. With 0.089-arcsec pixels, the point-spread function at 8 microns is Nyquist sampled, and the array field of view is 21×28 arcsec. All lab and telescope tests demonstrate that the T-ReCS image quality is excellent, and meets all requirements for low-distortion and diffraction-limited performance.

The first nonstellar image obtained with T-ReCS was that of Mars in early June at 12.8 microns, which was shown on the Gemini Web page (see also *www.astro.ufl.edu*). A wealth of detail is apparent in the processed image, with a clear correspondence of features, such as Olympus Mons, evident between the T-ReCS infrared image and visible ones made by the Mars Global Surveyor. More recently, on July 13, we obtained the 12.8-micron image of the very bright infrared source η Carinae (see figure 1). The image, obtained while chopping the secondary mirror but not nodding the telescope, is displayed with linearly scaled brightness levels at two different stretches. The left-hand image emphasizes the core structure, while the right-hand image emphasizes outer dust emission that is nearly a thousand times fainter than the core emission. Except for clipping of the faintest structure, the image is essentially raw, and some artifacts are apparent.

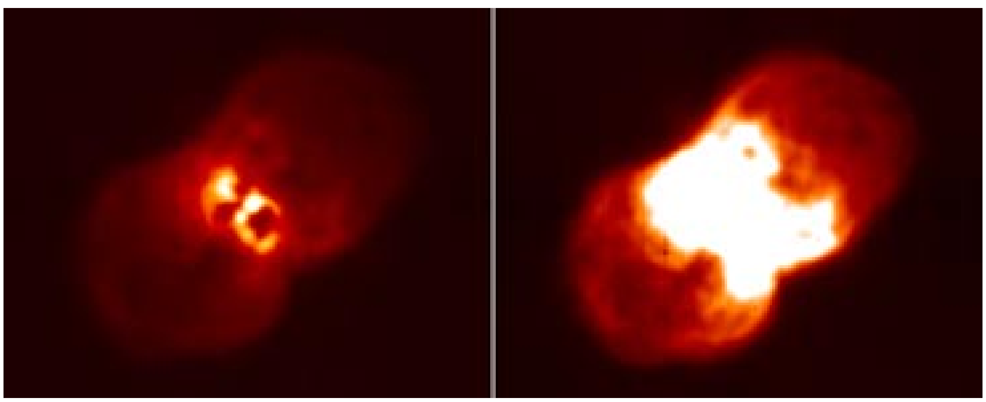

Figure 1. *A raw image of η Carinae obtained with T-ReCS at 12.8 microns. The image was obtained with the Gemini secondary mirror chopping, but without the telescope nodding. The image is displayed linearly at two different stretches and is clipped to eliminate structure below that shown in the source. The left-hand display emphasizes the bright inner structure, whereas the right-hand display shows the outer structure that is nearly three orders of magnitude fainter than the core region.*

continued

T-ReCS at Gemini South continued

Complex, state-of-the-art detector devices invariably have peculiarities, and the T-ReCS detector is no exception. We and other groups who have tested and/or are using this same device see a variety of artifacts, and several techniques have been developed to eliminate or minimize them. (We are grateful to Ulli Kaeufl of ESO, the Subaru COMICS team, and the Michelle team at ROE-ATC for sharing their results and ideas with us.) Some severe field structure is eliminated by referencing the integration ramp voltage to several other on-chip voltages ("correlated sampling"). The disadvantage of using this so-called four-point sampling mode, however, is that it increases the minimum on-chip integration time to roughly 25 milliseconds, whereas with nonreferenced (single) frames, the chip and electronics permit on-chip integration times as short as about 6 milliseconds. Usually, one will use the four-point sampling mode, but under some conditions it may prove useful to observe with the single-read mode. As part of the full commissioning, we are mapping out the complicated phase space of integration times, chop frequencies, and other system parameters that permit optimum operation of T-ReCS under the range of observational conditions encountered at Gemini South.

Another artifact seen by us and others is a line of dark, regularly spaced spots that radiate out from a bright source along one axis of the array. The brightness of these "cross-talk" spots is typically 0.1 to 0.4 percent of the primary source brightness. We believe that, for those observations where it matters, it may be possible to effectively eliminate these spots by appropriately processing the images, an approach that we are beginning to explore at the University of Florida. Finally, we note that the detector device has a somewhat elevated intrinsic noise, which we are still in the process of characterizing and minimizing. Even with this excess detector noise, we are finding that, based on limited initial on-sky tests, the system photometric sensitivity in the imaging mode is within a factor of two of the target sensitivity.

T-ReCS is also a low-resolution grating spectrograph, providing roughly R=100 in the 10- and 20-micron atmospheric windows and R=1000 in the 10-micron window. At the time of this writing we are just beginning to characterize the spectrographic mode on the telescope. Our initial observations have not revealed any surprises, but much work remains before the system is fully characterized on the sky. Among the many issues that we must still address is the accuracy of the flat fielding using real, on-sky observations in this mode. T-ReCS has been designed with an external (ambient temperature) wheel containing a black surface to be used as a reference surface for both imaging and spectroscopic modes, which our experience with OSCIR suggests should make flat-fielding straightforward. A cold internal polystyrene sheet, which has a highly structured absorption spectrum in the mid-infrared, can be inserted into the beam to assist in wavelength calibration. Basic characterization of the spectroscopic mode will continue throughout semester 2003B, even while full science operation progresses using the imaging mode.

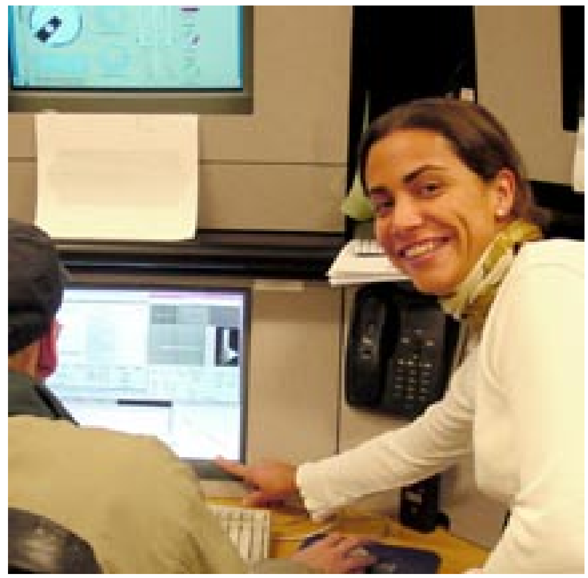

Figure 2. *University of Florida graduate student Cynthia Gómez Martín looks over Gemini astronomer Tom Hayward's shoulder as the first spectrum is obtained with T-ReCS.*

We anticipate that T-ReCS and Gemini will be prepared to carry out the community's scheduled science programs beginning in early 2003B. We are moving rapidly to complete the tasks associated with making T-ReCS the outstanding instrument the Gemini community wants and deserves. I particularly want to emphasize that the successful deployment of a major instrument like T-ReCS depends critically on establishing a harmonious and virtually seamless relationship between the instrument development team and the observatory staff. I am extremely pleased, as I hope Gemini Observatory is, with how effectively the University of Florida and Gemini have worked together to bring this project to completion.

It is a pleasure to acknowledge my T-ReCS colleagues at the University of Florida: Latif Albusairi, Dan Cawlfield, David Ciardi, Richard Corley, Jim French, Kevin Hanna, David Hon, Jeff Julian, Roger Julian, Danny Karrels, Tom Kisko, Naibi Mariñas, Cynthia Gómez Martín, Chris Packham, Robert Piña, James Radomski, Francisco Reyes, and Frank Varosi.

Reminders about Gemini Observing Proposals

Taft Armandroff & Dave Bell

For Gemini observing proposals for semester 2004A, we wish to remind proposers about several important procedural issues. Attention to these issues will help the NOAO time allocation committees (TACs) and the NOAO Gemini Science Center in evaluating and implementing the proposals.

- The Gemini Call for Proposals will specify a right ascension (RA) range for semester 2004A (see the "Instrument Calendar" in the Gemini Call for Proposals). There will be a general RA range, and there may be more restrictive RA ranges for certain instruments (because, for example, certain instruments may not be available until part way through the semester). Please check that all your targets fall within the RA range of the requested instrument.

- Gemini proposals require specification of the observing conditions for cloud cover, image quality, sky brightness, and water vapor. Think carefully about what observing-condition bands should be specified in your proposal. Specifying the conditions too tightly reduces the probability that your program will be approved and executed. Also, please explain your choice of observing-condition bands in your proposal's "Technical Description."

- Include the required overhead time in your request. The rules for calculating overheads are given in the "Performance and Use" sections of Gemini's instrument Web pages.

- For GMOS multi-object spectroscopy, pre-imaging with GMOS is required for mask fabrication. Please be sure to clearly include the observing time needed for this pre-imaging.

- Please list only one "run" per instrument in your proposal. If portions of your program require different instrument configurations or dates, please describe these requirements in the text of the "Technical Description" for the run. For instance, pre-imaging and multi-object spectroscopy with GMOS should be included in a single "run."

- If your observing program is being proposed jointly with another partner country, be sure to enter both the total time requested from all partners and that requested from the US TAC. Also, please specify who is the overall international contact for the multipartner program. Fields are available on the NOAO Web proposal form and Gemini's Phase-I Tool for supplying this information.

- If you plan to use Gemini's Phase-I Tool, be sure to read and follow the guidelines available at *www.noao.edu/noaoprop/help/pit.html*.

NGSC Webcast on 2004A Gemini Observing Proposals

The NOAO Gemini Science Center uses several channels for communicating observing opportunities on the Gemini telescopes to the US community. Starting in September, we plan to experiment with a new tool: Webcasting.

NGSC will hold a Webcast for the US community on September 17 at 10:00 A.M. MST. We will briefly review the Call for Proposals for semester 2004A, highlight new observing capabilities, and then take questions from the community.

In order to connect to the Webcast, or to download the necessary software, visit *www.noao.edu/usgp*.

You are encouraged to send your questions on Gemini observing capabilities and the 2004A proposal process, before or during the Webcast, to *usgemini@noao.edu*, or phone them in to 520-318-8421.

Gemini Next-Generation Instrumentation Planning

Taft Armandroff

Representatives of the Gemini communities at the Aspen meeting on science and instrumentation.

The International Gemini Observatory began a process in early 2002 to identify the key science drivers for Gemini in the period 2008–2010. These key science questions, to be identified by the Gemini partner communities, would lead to a set of required observations that will guide future instrument development at Gemini.

The NOAO Gemini Science Center (NGSC) organized a workshop for the US community, "Future Instrumentation for the Gemini 8-m Telescopes: US Perspective in 2003," on May 30–31 in Tempe, AZ. The goals of this US meeting were to:

- Explore important science questions that will be addressed via Gemini next-generation instrumentation in the period 2008–2010
- Identify, in general terms, the observing capabilities required to address these science questions

The participants in the Tempe meeting worked hard and defined high-impact scientific questions for Gemini to address in 2008–2010. These scientific investigations were justified and placed in context. The participants envisioned Gemini playing a substantial role in the key science questions of the day. The report of the workshop, compiled by Bob Blum, Karl Glazebrook, Michael Meyer, Jeff Valenti, Rosie Wyse, and Taft Armandroff, is available at *www.noao.edu/usgp/Tempe_Report_7-8.pdf.*

Gemini subsequently held an international science and instrumentation planning meeting in Aspen, CO, at the Aspen Meadows Conference Center on June 27–28. Fifty-seven delegates, who were selected by the international organizing committee, participated. Twenty-eight of the delegates were from the United States.

Both the Tempe and Aspen meetings were organized around four science-themed breakout groups:

- Stars, the Solar System, and Extrasolar Planets
- Star Formation Processes and the Interstellar Medium
- Structure and Evolution of the Milky Way and Nearby Galaxies
- Formation and Evolution of Distant Galaxies and the High-Redshift Universe

The Aspen delegates were creative and passionate in their proposed use of Gemini to address key problems in astrophysics. Groundbreaking science programs were proposed to study the evolution of the Universe through the investigation of dark energy and reionization. How dark matter and feedback control the formation and evolution of galaxies was another major theme. Finally, the delegates sought to define programs to understand the physical processes that lead to star and planet formation. Powerful new observing capabilities are needed to achieve these science goals, from a high-contrast adaptive optics system, to an infrared high-resolution spectrograph with unprecedented wavelength coverage, to a wide-field optical spectrograph with very large multiplexing (to list just a few).

The next steps in the process of defining next-generation Gemini instrumentation are now occurring. A report of the science goals endorsed by the Aspen delegates is being written. NGSC and the NOAO Major Instrumentation Program are investigating preliminary specifications and rough costing of the instrumentation required to achieve the Aspen science goals, as are groups at the Herzberg Institute of Astrophysics in Canada, the UK Astronomy Technology Centre, and Gemini. The Gemini Science Committee will discuss the Aspen science case and these instrument specifications at its meeting in October, formulating a recommendation on future Gemini science and instrumentation. Finally, the Gemini Board will consider the Gemini future instrumentation program at its November meeting.

NGSC Instrumentation Program Update

Taft Armandroff & Mark Trueblood

The NGSC Instrumentation Program continues its efforts to provide innovative and capable instrumentation for the Gemini telescopes in support of frontline science programs. This article gives a status update on Gemini instrumentation being developed in the United States, with progress since the June 2003 *NOAO/NSO Newsletter.*

NICI

The Near Infrared Coronagraphic Imager (NICI) will provide a 1- to 5-micron dual-beam coronagraphic imaging capability on the Gemini South telescope. Mauna Kea Infrared (MKIR) in Hilo is building NICI, under the leadership of Doug Toomey.

The NICI Team is well along in the fabrication/procurement phase of the project. Most of the optical and mechanical parts have been fabricated and acceptance tested. Most of the electronics boards are undergoing testing. Overall, 62 percent of the work to NICI final acceptance by Gemini, which is planned for December 2004, has been completed.

Cabinet of small NICI parts awaiting instrument assembly.

Completed parts of the NICI dewar and radiation shields.

FLAMINGOS-2

FLAMINGOS-2 is a near-infrared multi-object spectrograph and imager for the Gemini South telescope. It will cover a 6.1-arcmin-diameter field at Gemini's standard *f*/16 focus in imaging mode, and will provide multi-object spectra over a 6.1×2-arcmin field. It will also provide a multi-object spectroscopic capability for Gemini South's multiconjugate adaptive optics system. FLAMINGOS-2 is being built by the University of Florida under the leadership of Richard Elston (Project Scientist), Steve Eikenberry (Co-Project Scientist), and Roger Julian (Project Manager).

Detailed design work continues on FLAMINGOS-2, with recent progress in the areas of optical and mechanical design. A Critical Design Review for FLAMINGOS-2 will be held on August 20–21 in Gainesville, FL.

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NGSC Instrumentation continued

GNIRS

The Gemini Near-InfraRed Spectrograph (GNIRS) is an infrared spectrograph for the Gemini South telescope that will operate from 1 to 5 microns and will offer two plate scales, a range of dispersions, as well as long-slit, cross-dispersed, and integral-field modes. The project is being carried out at NOAO in Tucson under the leadership of Neil Gaughan (Project Manager), Jay Elias (Project Scientist), and Dick Joyce (Co-Project Scientist).

GNIRS has been undergoing a series of diagnostic cold cycles, followed by adjustments and fixes since December 2002. As of mid-July, GNIRS is in its fifth full cold cycle. The issues that have been addressed during these cold cycles are typical for Gemini instruments, and include light leaks, detector operating temperature, detector alignment, flexure compensation, image quality, and on-instrument wavefront sensor functionality. Gemini and NOAO began GNIRS pre-shipment acceptance testing on August 11. Once Gemini agrees that all of the GNIRS pre-shipment performance tests have been successfully completed, GNIRS will be shipped to Gemini South.

The Gemini Near-InfraRed Spectrograph (GNIRS) shown with NOAO and Gemini staff who played a role in its construction and testing.